Contributions to Hermeneutics 4

Dimitri Ginev

Hermeneutic Realism

Reality Within Scientific Inquiry

Springer

Contributions to Hermeneutics

Volume 4

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To all who sacrifice their lives to end any form of animals' abuse

Preface

Recent developments in the realism debate are by and large characterized by a shift from the subject-object model of thinking to a paradigm informed by the primacy of the interpretive constitution of meaning. Putting the constitution of meaning first seriously revises standard realism but does not imply antirealism. This book is grounded on the premise that the facticity of scientific inquiry is that kind of interpretive constitution of meaning which enables one to develop the position of hermeneutic realism. Actually, the book defends a stronger thesis: It is difficult to imagine a successful version of realism that does not include an interpretive theory of scientific inquiry. The facticity of scientific inquiry brings to the fore that mode of reality's being which affords the formulation and the advocacy of hermeneutic realism. I have organized *Hermeneutic Realism: Reality Within Scientific Inquiry* in four chapters. Each chapter is based on properly specified tenets of hermeneutic phenomenology. The Introductory Chapter discusses the unity of meaningful articulation and objectification in the scientific disclosing of reality. In encroaching on a historical excursus, chapter "The Production of Objectified Factuality Within the Facticity of Scientific Inquiry" resumes the Fleckian strategy of asking about the genealogy of scientific facts. My focus here is on a hermeneutic recasting of principal issues in the realism debate. Chapter "Meaningful Articulation and Objectification of Reality in Scientific Inquiry" addresses the interpretive fore-structuring of objectified factuality within the facticity of inquiry, thereby adumbrating a program for a philosophy of science pertinent to hermeneutic realism. The whole study is guided by the claim that the articulation of meaning and the procedural objectification within the facticity of inquiry manage to "textualize" the domains of reality disclosed by scientific practices. The prominent role that the concepts of "textualizing" and "text" play in the study is summarized and additionally analyzed in the Concluding Chapter.

In the name of honest advertising, I should state my location on the map of the complicated area abandoned by both philosophy of science and philosophical hermeneutics. I feel most at home in the tradition of the hermeneutics of scientific research as it is typically represented by the studies of Joseph Kockelmans and Patrick Heelan. Belonging to this tradition, I am dissatisfied with the objectivist

portrayal of science depicted both in philosophical hermeneutics and the analytical tradition. At the same time, my roots are in a kind of strongly internalist philosophy of science, and I would identify myself as a convinced opponent of any form of external criticism of science. It is my contention that only a kind of hermeneutic philosophy can abolish the wrong metaphysical identification of science with epistemological objectivism, thereby developing a consistent advocacy for science's intrinsic interpretivism. This philosophy effects an internal criticism that differs on principle from the reconstructive-explicative-normative criticism put forward by the analytic tradition. The interpretive philosopher of science tries to reactualize forgotten or ignored possibilities for doing research. Her internal criticism should take the form of "dialogical participation" in an ongoing process of inquiry – a participation that resembles the activity of the art critic as an irreplaceable figure of artistic life at large. This kind of criticism is intimately related to an essential aspect of Gadamer's philosophical hermeneutics, scrutinized in *Truth and Method* under the heading of application. "Applying the text to be understood" unveils new possibilities in the interpreter's present situation. Application as the third element – along with understanding and interpretation – is the source of a possible criticism in one's hermeneutic situation. Application is critical because it creatively transforms the meaning understood and interpreted. For Gadamer, understanding and interpreting the meaning of a text in a new and different way in every concrete situation is application. The demand of "redefining the hermeneutics of the human sciences in terms of legal and theological hermeneutics" is subjected to the aim of integrating application in human-scientific interpretation (Gadamer 1989, 309). From the perspective of hermeneutic realism, application is a re-contextualization in the process of inquiry. In stating this, I would like to embark on some further parallels with philosophical hermeneutics that will be exploited in the subsequent chapters.

The interrelatedness of discursive and non-discursive practices builds a medium where agents and entities ready-to-hand manifest their original belonging together. This medium does not preexist what is disclosed and constituted within it. The interrelatedness of practices has the character of a medium to the extent to which it discloses reality and constitutes meaning. The medium is part of the meaningful reality disclosed within it. For Gadamer, the linguistic medium presents itself (*sich darstellt*) as a finite process (*endliches Geschehen*). Being interested in "the coming into language of a totality of meaning," he contrasts the finitude of this process to the infinite mediation of concepts (Gadamer 1989, 469). In this study, I will argue that the medium of interrelated practices is characterized by horizonal-processual infinity and contextual finitude. The medium is constantly open to new contextual disclosures of reality and always relatively enclosed in particular contexts. Thus, the horizon of contextual disclosures is infinite, but each of them is accomplished within a relatively enclosed (finite) context. Gadamer makes the case that – by taking into consideration the finiteness of human life – the coming into meaning points to a "universal ontological structure." The ubiquity of understanding generated within the linguistic medium reveals this structure, which makes language "Being that can be understood." This is Gadamer's formula for "the universal aspect of hermeneutics."

In light of the finite-infinite character of the interrelatedness of practices as a medium, I will claim that the disclosing of reality and the constitution of meaning

within this medium point to a continuous fore-structuring of the cognitive structures necessary for having objectification. The interrelatedness of practices projects its own potentiality-for-being upon the possibilities for contextual constitution of meaning. This posit does not contradict the linguistic accent of philosophical hermeneutics. Gadamer tells us that language as being that can be understood also includes the "language of nature." He is aware that this claim resonates with the early modern understanding of scientific inquiry as a way of reading the Book of Nature – the book written in the language of mathematics and readable through experiments. One is not far from this understanding if one goes on to assume that the interrelatedness of scientific practices points to a synergy of readable technologies. What is read by means of these technologies is the "language of nature." Yet – in contrast to legal, theological, and philological hermeneutics – there is no written book and grammatically structured language in scientific inquiry before deploying readable technologies. (There are written texts in scientific education and scientific communication that are always available before one starts teaching a class or writing a paper. But the educational and the communicational hermeneutics of science are – if not completely, at least essentially – irrelevant to this study). Reading experiments, calibrated instruments, measurements, data models, computer simulations, concepts, theoretical models, etc., within the contextually finite and horizonally infinite medium of interrelated practices is tantamount to writing or better to "textualizing." Furthermore, it is a reading process that not only constitutes meaning but also constantly disseminates and deconstructs what is constituted. Textualizing through scientific practices qua readable technologies is an interpretive process that cannot be covered by Gadamer's philosophical hermeneutics.

The position of hermeneutic realism I am going to develop in this study is congruent with Gadamer's accent on language in another respect. According to him, to "come into language does not mean that a second being is acquired" (Gadamer 1989, 470). Insisting on language as self-interpretive being does not imply a duplication of meaningful reality. By the same token, the hermeneutic realist argues that what becomes disclosed and "textualized" through readable technologies is not detached or extracted from reality. The very process of reading, articulating, and objectifying – as well as the hermeneutic situation in which the process is set up – belongs to reality. That which comes into the medium of scientific practices is not something that is pre-given before this medium. The way in which Gadamer's philosophical hermeneutics universalizes the intrinsic interpretativity of language crucially depends on the thesis that the hermeneutic experience is available only to a "finite mind," for it is not able to develop out of itself the totality of meaning. In other words, this experience is available to a mind that cannot be conceived in "the perfect contemplation of itself." The present study extends this thesis as follows: The hermeneutic experience of scientific inquiry presupposes the finiteness of existence in the sense that both the absolute meaning of reality and the objectivity of reality are available only to an "infinite mind" or to God's eye point of view. The finite mind is doomed to investigate reality by being involved in the way in which the meaningful articulation within interrelated scientific practices fore-structures the objectification of reality. Practical fore-structuring of the cognitive structures of objectification is the distinctive feature of the hermeneutic experience in scientific inquiry.

Gadamer operates with the concept of play when analyzing what is "self-presented in the hermeneutic experience." The present study makes use of a similar concept of interplay when analyzing what is disclosed, articulated, and objectified by means of the phronēsis of inquiry. I attach much importance to this concept as well as to the concept of entanglement when the hermeneutic truth of what is achieved in the facticity of inquiry is at issue. Paraphrasing a postulate of *Truth and Method*, the participants in the process of inquiry who understand what is contextually articulated in their practices are "drawn into events" through which meaning asserts itself. However, again, philosophical hermeneutics deals with forms of play that take place in understanding texts already created. Indeed, the effective-historical existence of such texts in the traditions in which they are constituted (and reconstituted through their interpretive receptions) is an inextricable dimension of Gadamer's doctrine of hermeneutic truth. I am not saying that philosophical hermeneutics could be reduced to a kind of cognitive hermeneutics devoted to the "procedures of understanding." Gadamer's criticisms of conceptions suggested by authors like Emilio Betti and Eric Donald Hirsch provide sufficient arguments against such a reduction. Nonetheless, because he excludes the experience of objectifying inquiry from the scope of hermeneutic experience, there is no room for treating (what I will call) "textualizing" in his philosophical hermeneutics. Without addressing the forms of textualizing through readable technologies – so the basic argument of this book goes – it would be impossible to have a hermeneutic phenomenology of what scientific practices meaningfully constitute.

My personal road to hermeneutic realism has abounded in incidents and accidents. Many years ago, when I started my career in pharmacobiochemistry, I became a junior fellow of a research team conducting experimental studies on the antiarrhythmic effects of alkaloid sparteine. Initially, my activities were related only to pharmacognosy – extracting this alkaloid from shrubs which are endogenous to the Balkan Peninsula. But later I had to participate in pharmacological experiments with animals. I quit this job immediately. It was clear to me that as a strong vegetarian and ardent follower of Arne Næss's deep ecology, I would not have a future in research activities related to clinical experiments with animals. Unfortunately, I did not find another opportunity to continue my carrier in biochemistry – the discipline I loved so much. I left the laboratory forever to become a philosopher. Yet this reorientation turned out to be initially unsuccessful. I met unsurmountable difficulties in accepting the views that prevailed at that time. It was the time of a pursuit of realism after the image of the "mirror of nature" was definitely discredited. It was also a period of the growing disappointment, on the part of philosophers of science, over the doctrine that scientific theories are linguistic entities formalizable in predicate logic and that they contain (along with the vocabulary of logic) primitive theoretical terms whose meanings are to be gained by means of implicit definitions. According to this doctrine, the fixed logical structure of a scientific theory is to be supplied by a set of "correspondence rules" that enable a partial empirical interpretation of theoretical terms.

Philosophers of science were prone to embrace structural views about scientific theorizing. Models, symmetries, and invariances became magic words.

Representation in the formal sense (and as associated with formal reduction) gained the status of a central issue. Reality became more or less a prisoner of formal semantics. Many philosophers of science of my generation – inspired also by the easy passage from formal theories of measurement to formal semantics – believed that there is no scientific representation of reality without the isomorphism of models, the assumption being that reality is given to us through the models of a theory, and any model is isomorphic to a group of transformations under which theory's equations are invariant. I sincerely tried to make sense of these "structural representations." But I was convinced that what scientific inquiry discloses cannot be represented/reduced by means of representation theorems stipulating the relations among the semantic models of a theory. It was my teacher and friend, Azarya Polikarov (1921–2000), who drew my attention to the loss of reality within the holist-semantic approaches to scientific theorizing. For him, the "question of reality" was a question which cannot be posed and answered through logical and/or semantic analysis. Reality shows itself when one is employing heuristic practices and devices in scientific inquiry. (Polikarov was one of the pioneers of applying heuristic methods of AI to the theory of scientific inquiry.) His "heuristic realism" is still a great achievement of the nonanalytical philosophy of science.

My first reorientation – from science to analysis of science in terms of discrete models – ended up in a mistrust toward the analytical philosophy of science. I was at peace with myself only after my second reorientation – this time from normatively codified "rational reconstruction" to linguistic hermeneutics. In the early 1980s, I came upon the two classical versions of this hermeneutics, suggested respectively by Georg Misch and Hans Lipps. Two lessons I took from these philosophers paved my way to hermeneutic realism: First, hermeneutics has an essential ontological dimension, but it ought not to be regarded as post-philosophical thinking of the meaning of being, and second, hermeneutics is not to be disentangled from the existential situations of choosing possibilities. Both classical versions of linguistic hermeneutics were developed (in the 1920s) at once under the influence of Heidegger's branch of phenomenology and in opposition to the radical ontological turn in hermeneutics. My orientation to a theory of interpretation that deals more with practices and meaningful articulation than with the meaning of being has convinced me that the very idea for a philosophy of science external to science-in-the-making is wrong. In a quasi-Quinean manner, I began to look for a hermeneutic philosophy continuous with science's interpretive internalism. What follows is the outcome of this long-standing quest.

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Introductory Chapter: On the Very Idea of Hermeneutic Realism

1 The Kind of Hermeneutics in Hermeneutic Realism

Is it possible to have a philosophical position of realism without essentialist assumptions and residual metaphysics of presence? In this book I develop the position of hermeneutic realism as an affirmative answer to that question. In breaking in a radical manner with the "myth of the given", the hermeneutic realist holds that there is but a meaningful reality. The articulation of meaning within practices is not imposed upon a pre-meaningful (amorphous) reality. This articulation is inextricable from reality. (Hereafter I will also use the expression "meaningful articulation".) In the remainder the profile of hermeneutic realism will often be specified via formulating disclaimers. Here is the first disclaimer: The intrinsic meaningfulness of reality does not need an epistemic subject who intentionally produces meanings embodied in her beliefs, actions, and activities. The meaningfulness of reality preexists and conditions the formation of any kind of epistemic subject. This meaningfulness is neither subjective nor intersubjective. It is trans-subjective. The next disclaimer is that advocating the meaningfulness of reality by stressing the primacy of practices does not imply a form of constructivism. Reality is not constructed by (scientific) practices. Any form of constructivism presupposes the dualism of constructor and constructed qua a version of Cartesian dualism. (Approaches such as actor-network theory and the "empirical ontologies" in the sociology of scientific knowledge SSK are controversial attempts at deconstructing the dualist assumptions of classical social constructivism.)

For those who subscribe to a certain version of hermeneutic philosophy, it is a commonplace view that (1) the world is not out there, and (2) the mind is always within the world. In this study I defend the view that hermeneutic realism is opposed above all to metaphysical realism—as related to the claim that what is existing independently of "our minds" has a single order—and, by implication, to scientific realism. Metaphysical realism will be criticized for taking for granted that the mind is exempt from the "work-world" of practices, thereby confronting a mind-independent objective reality. The hermeneutic realist raises the critical

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question of whether the mind does not belong to reality as disclosed and articulated within practices. Since most of the metaphysical realists are inclined to argue that the mind is a part of objective reality, the hermeneutic realist focuses in her criticism on the predicament arising from the attempts at reconciliating the following two doctrines which circulate in various forms in the realism debate: (a) objective reality is independent of the mind (as something opposed to reality); and (b) the mind represents and conceptualizes reality, but this does not imply that it is not a part of objective reality. Doctrine (b) is obligatory for naturalizing all functions and properties of the mind.

Any kind of ontological naturalism—that supposedly supplements metaphysical realism with arguments about the reducibility of all spatiotemporal entities to objects endowed with physical effects—uncritically combines (a) and (b). The present study considers ontological naturalism as an inconsistent position. Donald Davidson's "deflationary realism" (cum its form of naturalism) perhaps avoids the clash between the doctrines (a) and (b), but at the expense of holding a too scanty concept of reality (if any). It is hard to believe that an approach based on the assumptions that (1) every mental event is identical to a particular physical event, and (2) mental properties supervene on physical properties can dispel the ambiguities caused by combining (a) and (b). More sophisticated versions of naturalizing the work of mind—like Francisco Varela's conception—that counter objectivist (reductionist) naturalism with excellent arguments take their cues from the phenomenological tradition. Yet again it is hard to believe that a phenomenologically reformulated cognitive science and/or neuroscience (like Varela's "neurophenomenology") could provide resources for a new philosophical view of reality. In trying to overcome the ambiguities generated by the relations of (a) and (b), the hermeneutic realist makes the difference between facticity (of the modes of existence) and factuality (produced by contextualizing and contextualized practices within facticity) a central theme of discussion. In a tenet of hermeneutic realism, reality is not something that can be reconstructed through an analysis of epistemic attitudes and science's theoretical achievements. All epistemic attitudes and forms of theorizing are shaped within reality-as-facticity.[1] The hermeneutic realist consistently tries to do justice to the ontological primacy of reality-as-facticity. She denies the possibility of having a foundational body of empirical knowledge about "firm" objective factuality, i.e., factuality independent of facticity.

[1] Hereafter I use the term "facticity" in connection with the original program of the "hermeneutics of facticity". In the basic cases in which the term will be used in the study, this connection will be commented on and specified. The various connotations of the term depend on its relatedness to the everydayness of routine practices, the nexus of finitude and situated transcendence, the potentiality-for-being, and so on. Yet the main connotation refers to the mode of being characterized by a production of objectified factuality within practices of objectification that project their interrelatedness upon horizons of possibilities. Generally, the way in which the concept of facticity is used in hermeneutic realism is in line with Heidegger's triple differentiation between fall, existence, and facticity. But the formulations in which the concept is used are not corollaries to the doctrine of this differentiation.

Reality-as-facticity is (1) the (existentially) organized totality of meaning-constituting practices and (2) the ongoing meaningful articulation of a domain of reality disclosed in a characteristic hermeneutic situation. Approaching facticity allows one to reflect upon the factual manifestations of the ontologically relevant hermeneutic circularity of existence. The attempt at conceptualizing facticity without essentializing it (i.e., without deriving it from an underlying essence) sounds like a vicious circle: The conceptualization ought to be achieved through a kind of phenomenological analysis of facticity's manifestations while these manifestations can only be made analyzable through analyzing the ways in which they are ontologically fore-structured within facticity. On closer inspection, however, there is no vicious circularity, and the interpretive attempt at conceptualizing facticity by avoiding presupposed essences launches a tentative formulation of the famous task of entering the hermeneutic circle of facticity in the right way—a task of prime importance for the whole program of *Being and Time*. In hermeneutic realism, entering this circle amounts to unfolding a version of double hermeneutics for conceptualizing facticity in its multiplicity of existential phenomena.

In the coming chapters I will argue on various occasions that the empirical as related to (and dependent on) the finitude of human existence is facticity.[2] Assuming that there is a factual reality (organized into "natural kinds") before having a meaningful reality (or a factual-reality-within-facticity) is admissible if and only if one would postulate that the "ultimate factuality" is given to a creature without finite existence. To be sure, there is no program of naturalist objectivism that is explicitly committed to such an assumption. But all kinds of objectivism simply ignore (the epistemological significance of) the issue of existential finitude, which implicitly makes them committed to the assumption. Ignoring the finitude of existence leads to images of an eternal factual presence that imply a God's eye view of reality. The empirical is never a mere presence that resides "out there". It is never given to the practitioners involved in the interplay of practices and possibilities as an order of facts that is imported in this interplay from without. The empirical is not—or rather, does not amount to—a layout of firm facts ready to be procedurally established or discovered. The view of the empirical as a "spatial actuality beyond the temporalizing of temporality" is the exact opposite of hermeneutic realism. The empirical does not exist independently of the horizons upon which interrelated practices project both their interrelatedness as a potentiality-for-being and the factuality-toward-possibilities they may produce. Within these horizons the empirical is always in the making, granted that "the making" does not refer to social construction but to meaningful constitution. The non-conceptualized and non-objectified factuality, i.e., the contingent factuality before (and independent of) scientific inquiry, is meaningfully constituted within the horizons of production and reproduction of cultural life forms. The empirical is meaningful since it is always culturally expressed (Fehér 1999; Babich 2011, 2014). In its state of being-bound-to-horizon before

[2] Thus, "naturalizing" the philosophy of science in a non-objectivist manner by having recourse to the empirical-as-facticity is a completely feasible program from the viewpoint of hermeneutic realism.

being-objectified-within-horizon, the empirical manifests forms of meaningful articulation in their routine everydayness.

Starting out from the modes of being in the "work-world" of practices prevents one from an initial hypostatization of the opposition between the epistemic subject and the objective world (and the schematism of conceptual framework and empirical content). The observation that reality has a being in the interrelatedness of practices is—from the viewpoint of hermeneutic realism—tantamount to the assertion that the meaningful articulation of reality takes place within the horizon projected by interrelated practices. (This is a horizon of temporality that becomes temporalized in what becomes meaningfully articulated. The "temporalizing of temporality" implies that kind of continuity of the meaningful articulation which is at stake in the phenomenological-constitutional analysis.) Furthermore, the being of reality is always projected upon possibilities. Humans are interpreting themselves in accordance with the possibilities they can appropriate and actualize in playing their roles in the meaningful articulation of reality. In so doing, they reflexively participate in the interpretive circularity between the horizon of possibilities and the constitution of meaningful units as actualizations of possibilities. Yet their reflexivity (and accountability) is not to be equated with practices' immanent reflexivity.

The realism debate in the philosophy of science has given the impression that the realist positions are obligatorily subjected to a tacit rule: The kinds of realism should carry with them a commitment to a certain range of entities that must be regarded as real (i.e., existing in physical reality) (Sankey and Ginev 2011). Stated otherwise, for the participants in this debate the word "realism" in philosophy usually suggests a commitment to a certain range of entities which is appropriately specified. Thus, the scientific realist insists on the reality of unobservable theoretical objects; the (ontic) structural realist takes the structures that remain mathematically invariant in fundamental physical theories to be in a sense real entities; and the entity realist commits to the reality of those objects of experimentation which can produce manipulative effects in the laboratory work. In all of these cases, the defense of a realist position implies a reification of something that is presupposed in the defending arguments. Even the positions which are most radically freed from essentialist assumptions—like Putnam's "internal realism" or the pragmatist kinds of realism—cannot avoid the pitfall of reification, when asserting the existence of an "external reality out there".

The hermeneutic realist does not try to single out a particular class of entities (objects and/or structures) as having (privileged) existence in physical reality. Her task is to address the existence of entities—regardless of whether they are empirically identifiable or not—as meaningfully articulated (and procedurally objectified in the process of scientific inquiry), provided that the meaningful articulation interpretively fore-structures the objectification. Both the articulation of meaning and the interpretive fore-structuring of what becomes objectified take place within practices that project their interrelatedness upon possibilities. The hermeneutic realist is preoccupied with the constitution of all possible entities—be they physical or idealized or even only fictional (virtually real)—as they are situated in the meaningful articulation of reality. The hermeneutic realist is also engaged in overcoming the

hypostatization of codices of scientific rationality, epistemological standards of scientific method, and non-contextual criteria for scientific truth (Ginev 2003). Despite this anti-essentialist engagement, hermeneutic realism, as I will argue throughout the study, puts forward a radical and comprehensive anti-relativist strategy.

Hermeneutic realism is a position that fights any kind of reification. Notoriously, the struggle against reification has gained currency afresh in recent years. In the tradition of critical social theory the reanimated critique of reification is inspired by a particular meta-epistemological doctrine: The best way to combat reification consists in demonstrating that the fundamental experience of dialogical recognition is prior to objectifying cognition. Axel Honneth (2008, 42–57) believes that this experience may serve as a source of normative standards for structuring cognition. Following this line of argument, and admitting that overcoming reification needs reflexivity, he comes to the conclusion that reification results from the forgetfulness of the experience of dialogical recognition. I agree with this conclusion. But thus formulated, it has only a restricted validity. In the perspective of hermeneutic realism, the term of recognition has to be understood in a broader sense that goes beyond the framework of intersubjective dialogue as implied by Honneth's view. It means not only a recognition of the Other—as a prerequisite for a genuine intersubjectivity—but also a recognition of endogenous reflexivity operating in the practices of the procedural objectification of reality. Recognizing that reality becomes revealed and articulated within the reflexive practices of scientific objectification amounts to acknowledging that the objectifying inquiry has, in a sense, a dialogical character as well.[3]

Underscoring this character does not entail that there is a dialogue between inquirers and objects of inquiry such as histones, enzymes, and neutrinos. The dialogical facet of scientific inquiry is entirely informed by the capacity of scientific practices to form changing contexts. Each context is constituted by a configuration of scientific practices. I will claim in this study that contextualization within the interrelatedness of practices is indispensable for having a meaningful articulation of a domain of inquiry. There is a kind of "logic of question and answer" brought into play when one is engaged in a contextual inquiry. Within a certain context of inquiry delineated by a configuration of practices one can ask a definite range of questions. A re-contextualization of the process of inquiry changes the horizon of questioning as well. Within the new horizon, the re-contextualized entities "provoke" the inquirers by posing new questions. This is the primary rationale for assigning a dialogical character to scientific inquiry.

[3] On an alternative view about recognition in objectifying scientific inquiry, see Crease (1993, Ch. 6). In drawing on Husserl's method of free variation and Heelan's phenomenological theory of perception, Robert Crease tries to characterize the way in which experimentalists are "recognizing" what they describe by data models of measurements as a profile of the phenomenon they study, provided that the phenomenon is distinguished by an invariance (under transformation of perspectives). The recognition involves the belief that this invariance structures other possible profiles of the same phenomenon that can be revealed under changed experimental conditions. See also Crease (2009, 2015).

The meaningful articulation is not caused or implied by a communicative dialogue. But it has a dialogical organization because of its contextuality. (Elaborating on the concept of a dialogue through re-contextualizing entities meaningfully constituted by experimental and theoretical practices provides a decisive argument against the following well-known verdict: It does not make sense to speak of interpretive dialogue in the natural scientific inquiry because—regardless of the relations of mutual interpretability between theory and experiment—the objectification achieved in this inquiry lacks the dimension of "dialogical-argumentative agreement about" [*die dialogische Verständigung über*] how to constitute objects of inquiry that have a being through their self-interpretation (Apel 1992, 253–260).[4] Karl-Otto Apel denies any role of dialogical contextualization in the sciences in which the objects of inquiry are not potential partners of communication. In hermeneutic realism, the dialogical organization of inquiry is trans-subjectively generated by the "facticity of inquiry"—being in this sense is a "hermeneutic-ontological fact"—and does not result from possible processes of communication [regulated by the norms of the "rational dialogue"]. Dialogizing—as informed by the facticity of inquiry—is not a pattern of intersubjective communication and experience [as studied by "transcendental semiotics"], but a feature of trans-subjective contextualization that has much to do with the "logic of practices" and practices' endogenous reflexivity.)

In this broad construal, recognition of endogenous reflexivity, i.e., reflexivity attributed not to what is objectified by practices, but to practices themselves as they disclose reality to be objectified, is a means for overcoming reification (and various forms of hypostatization) as implied by objectivism and scientism (understood as a position that consistently rejects reflexivity in scientific inquiry). The present study will develop this claim in several ways. Tentatively, the recognition that precedes cognition comes into being when there is a horizon of possibilities of meaningful articulation and objectification of a domain of reality disclosed within interrelated practices. It is the broad construal of the term of recognition that makes it relevant not only to the critical-interpretive studies of the human sciences, but also to the (hermeneutic philosophy of the) natural sciences. Furthermore, recognition is not a

[4] I am leaving aside the fact that the "*Verständigung über etwas*" operates at each stage of objectifying inquiry. (The achievement of agreement by means of negotiations—which is a kind of Apel's *Verständigung über etwas*—is the favorite subject of social constructivists.) My criticism has another focus. Apel assumes that there is—in the "productive mediation between empirical and normative reconstruction in the historiography of science"—a hermeneutic circle at work. This defense of a kind of historiographical hermeneutics concerning the historicity of the objectifying sciences is entirely under the aegis of the old-fashioned distinction between deductive-nomological explanation and individualizing understanding, as his confrontation with Popper's third-world approach to interpretation demonstrates (Apel 1998, 224–230). He accepts this distinction, and integrates it in the program of his "transcendental semiotics/pragmatics". The latter—as a transcendental theory of the rational dialogue/discourse—should be developed also as a philosophy of the non-objectifying (human) sciences, thereby providing the ultimate rationale for demarcating between the interpretive and the mathematical-experimental sciences. Since there is no place for a trans-subjective (non-epistemological and non-communicational) hermeneutics in Apel's program, the contextualizing facticity of objectifying inquiry escapes his attention.

gesture or a symbolic act, but a position that demands the use of a special methodology. What becomes methodologically recognized in the hermeneutic philosophy of science is the contextuality of all phenomena studied with the intent to become theoretically saved. This contextuality is due to research practices' endogenous reflexivity as manifested in the way in which they form and change their configurations.[5] The objectification by means of saving phenomena is indispensably contextualized by the configuration of practices through which it takes place. In recognizing the contextuality of objectification (along with the reflexivity of objectifying practices), one becomes aware of the contextual character of objectivity of scientific inquiry. However, contextual objectivity, as a particular doctrine of hermeneutic realism, has nothing to do with epistemological subjectivism or antirealist instrumentalism.

Roughly, hermeneutic realism opposes the views which admit the following clauses: (a) the credentials of all truth claims must be checked by a foundational theory of knowledge; (b) objective reality is organized into distinct objects (and "natural kinds"), and the distinctness of each of them is prior to the constitution of meaning; (c) the epistemic subject's mind is isolated from the world in a manner that enables the mind to represent the world through images, ideas, concepts, and categories; and (d) there is an invariant and universal semantic core in the mind that contains series of meanings related to the basic structure of objective reality. Roughly speaking, hermeneutic realism is a kind of realism that does away with Cartesian dualism, epistemic representationalism, foundationalism, and cognitive (including linguistic-semantic) essentialism. The hermeneutic realist advocates the primacy of facticity as the milieu in which the subject-object relation becomes contextually emancipated, the priority of the contextual representation of something-as-something (guided by the "hermeneutic as") over the epistemic representation of something-out-there by the mind of the knower, the ever open possibility of transcending any alleged foundation within existence, and the constitution of all stable cognitive structures (allegedly considered as "essences") through choices of possibilities within existence.

[5] I will repeatedly make use in this study of a distinction between practices' reflexivity and practitioners' reflexivity—a distinction that originates from ethnomethodology. Practices' reflexivity has much to do with the creation of local orders, while practitioners' reflexivity is what the concept of accountability refers to (Czyzewski 1994; Ginev 2014b). Not all ethnomethodologists are happy with this distinction, and more generally, with the way of making the issue of reflexivity a central one in the ethnomethodological work. Thus, Michael Lynch (2000) pleads for narrowing the concept of reflexivity by freeing it from critical-epistemological and emancipatory-political connotations. Lynch's concept of reflexivity refers to "locally reflexive orders of action". Reflexivity is "incarnated" in such orders. Yet this criticism of the extended notion of reflexivity, as it is used in critical social theory and various forms of cultural studies, attests the reasonability of the distinction being mentioned. The "incarnation" of reflexivity is due to practices' capability to arrange and regulate their interrelatedness. This "incarnation" antecedes (and sometimes prompts) the kind of reflexivity that depends on practitioners' epistemic virtues, cognitive skills, and emancipatory interests. My central use of practices' reflexivity will be with regard to the reflexive entanglement of the particular practices of inquiry (and their contextures-of-equipment) with contexts of inquiry and the interrelatedness of practices.

There is a widespread view that the priority mentioned is to be held even when a contextual and embodied character of the epistemic representation is acknowledged. Despite the fact that the research programs in "embodied cognitive science" have become developed as an alternative to the computational and representational theories of mind, the insistence on the embodiment of cognition still does not provide per se arguments against the admission of a foundational epistemic representation. By taking into account bodily mechanisms of sensory processing and motor control, one is able to show that embodied cognition is always contextually embedded. But this again is not enough to undo the alleged primacy of the epistemic representation. More generally, de-privileging the representational function of mind by privileging the cognitive function of the human body only leads to a new form of essentialism (even when the body is conceived of in a radically non-naturalist manner). This statement ought to be subjected to some qualifications. Those who insist on the embodiment of cognition quite often go on to oppose the embodied cognitive processes not only to objectivism but to objectification too. In so doing, they tend to forget that objectification is performed by embodied technologies of research. Some phenomenological approaches to technologies developed in science and technology studies STS try to eliminate this confusing ambiguity. Donna Haraway and Don Ihde are perhaps the most prominent champions of the view that humans are bodies in technologies. The approaches of these authors, however, do not reify the human body because technologies are not viewed as mediations located between humans and another bit of the world. Furthermore, these approaches are quite effective in undoing any assumption about the primacy of the epistemic representation. Technologies are seen as "organs and full partners" of the human body (Haraway 2006, 175). The way in which technologies become such "organs" must be studied in a phenomenological (and not in an objectivist) manner. The body-technology partnership is a "worldly embodiment" (Haraway). More specifically, making use of the concept of embodiment that includes instruments invites studies of practices in which the technical entanglements of the human body take place. At issue are human bodies entangled with culturally constructed locations (Ihde 2002, xi).[6]

The extended embodiment—as viewed by Haraway and Ihde—no longer privileges the human body per se. Their phenomenological approaches place emphasis on the primacy of bodies situated in technological practices. Within the tradition of hermeneutic philosophy of the natural sciences, one can find the claim—sounding much in the spirit of Merleau-Ponty's phenomenology—that there is "on the one hand, the 'flesh' of instrumental usage corporeally mediating the shared corporeal schema of a specialist group with the flesh of the material world; on the other, the translation of a scripted report into a skilled artistic performance that phenomenally presents the material world in the flesh" (Kisiel 1997, 75). In their studies on the hermeneutics of experimentation and instrumentation, Patrick Heelan and Robert Crease unfold this claim in different directions. Yet in so doing, they again recast the "corporeal factors and mediators" in terms of practices: The corporality (*Leiblichkeit*)

[6] For an interesting criticism of Ihde's phenomenology of the body that radicalizes the imagery of extended-bodies-in-practices, see Feenberg (2006).

operates not behind but only within the practices of instrumentation and experimentation. The embodied cognition is always situated within and transcended by practices.

The emphasis upon the non-determinacy (not being-determined) of existence (including scientific inquiry as a mode of existence) makes two sorts of existentialism indispensable partners of hermeneutic realism. These are a cognitive existentialism about the constitution of scientific inquiry's autonomy via free choices of possibilities for doing research, and a trans-subjective existentialism about the transcendence of the epistemic relation by the hermeneutic circularity of reality's meaningful articulation. (The epistemic subject is not situated once and for all by being doomed to have a socially determined standpoint. In opposing the relativist objectivism of standpoint epistemology, the hermeneutic realist holds that any situatedness of the epistemic subject is open to be transcended due to the choices of new possibilities. The epistemic subject has a mode of existence that takes the form of situated transcendence within the aforementioned hermeneutic circularity.) Depending on to which sort of existentialism more importance is attached, one might distinguish between a narrower and a broader sense of construing hermeneutic realism. In placing emphasis on cognitive existentialism, one chiefly pays attention to the ways in which the reality becomes disclosed, articulated, and objectified within scientific inquiry. In engaging primarily the problematic of trans-subjective existentialism, one develops hermeneutic realism in a broader sense as a family of post-metaphysical doctrines whose common denominator is the conviction that (*pace* Rorty) the place vacated by (foundationalist and representationalist) epistemology should be occupied by hermeneutics (Ginev 2014a). Hermeneutic realism in both senses opens avenues to new forms of a dialogue between (post)analytic and Continental traditions.

Hermeneutic realism is an attempt at a radical universalization of hermeneutics. In pursuing this goal, the position I will defend in the remainder deviates from mainstream philosophical hermeneutics. The deviation is most pregnant in the treatment of objectifying inquiry. Considerations about the *phronēsis* of scientific research provide a guideline of this study. In this regard, the study significantly revises the view of "method" in philosophical hermeneutics. Surprisingly enough, Gadamer appeals to traditional epistemological assumptions in his argumentation against the inclusion of the natural sciences in the hermeneutic universe. *Truth and Method* tells us that the research process in the natural sciences "penetrates more and more deeply into nature" (Gadamer 1989, 285). In contrast to the human sciences, in the mathematized empirical sciences the theme and object of research are independent of the facticity of inquiry. (In the human sciences this facticity is their own tradition that raises the important questions [about the ways of constituting themes and objects of inquiry] which the particular studies try to answer.) The objects of the natural sciences "can be described *idealiter*" as what would be known in a perfect knowledge of nature.

Thus considered, these are objects in themselves toward which the research process is directed.[7] (This Gadamerian position, which recognizes the sovereignty of objectivist naturalism in the mathematized empirical sciences while dispelling objectivism in the rest of culture, is continued and completed in Hubert Dreyfus's "pluralistic robust realism". In spelling out the doctrine of science in Heidegger's *The Basic Problems of Phenomenology*, Dreyfus reaches the conclusion that nature has a being in the ensemble of natural entities and phenomena that does not depend on practices whereby *Dasein* makes sense of innerwordly things. Roughly, Dreyfus's [and Taylor's] program of "pluralistic robust realism" is based upon this construal of Heidegger's "philosophy of science". To be sure, robust realism is not a realist position that assumes the existence of natural kinds outside current science.[8] It is a position that only aims to show "the coherence of the natural scientist's current practices for dealing with natural kinds as the way nature is in itself" (Dreyfus 1991, 30; Dreyfus and Spinosa 1999, 50). In developing the argument that humans have practices for achieving access to entities independent of all human practices, Dreyfus and Taylor advocate in their recent book [entitled *Retrieving Realism*] the claim that understanding the status of the structures revealed by the natural sciences requires making sense of an independent reality characterized not only by things-in-themselves, but also by its own intrinsic structure. Robust realism is a quasi-Heideggerian realism enclosed in a framework that attests the primacy of a de-contextualized subject-object relation. Like Gadamer, Dreyfus—in ignoring the facticity of scientific inquiry—is after a minimal access to the ultimate reality beyond the description of access practices. It seems to me that they both commit to a dubious view leading to unavoidable Kantian duplication of reality: The facticity of scientific inquiry discloses reality by guaranteeing the minimal access to the ultimate reality. It is this residual-objectivist image of having "access to reality" that the hermeneutic realist tries to recast in terms of disclosing and articulating reality without duplicating it in a transcendental-epistemological manner.)

The most important consequence following from the way in which Gadamer ostracizes the (presumably non-interpretative) constitution of natural scientific objects of inquiry is the impossibility of a hermeneutic philosophy of the natural sciences. The entities constituted by the other cultural activities (like works of art, documents, historical monuments, discursive embodiments, sacral symbols, etc.)

[7] To be fair, in the edition of *Truth and Method* from 1989, Gadamer (1989, 374) supplies his original elaborations with the following note: "Now, in the light of the past three decades of work in the philosophy of science, I willingly acknowledge that even this formulation is too undifferentiated."

[8] Dreyfus has good reasons to draw on *The Basic Problems of Phenomenology*. This is Heidegger's work in which the classical transcendental position and the kind of essentialism related to it are most consistently supported. Heidegger treats intraworldliness as a transcendental condition of the possibility for reaching the essence of things that would necessarily occur even if *Dasein* had never existed. It is not hard to see that, thus defined, the transcendental position is not commensurate with the ontic-ontological difference (and its transcendental dimension) as inaugurated by the existential analytic. For this reason, I believe, Heidegger relinquishes this position in his later work.

are—in Gadamer's words—entities characterized by a "fore-structure of completion". It is this fore-structure that invites one to dialogically complete it, thereby integrating the dialogue in entities' effective-historical being. The existence of these entities is not determined by methodological rules and epistemological norms. The entities in the universe of interpretation (or within the scope of "hermeneutic experience") are embedded in their own horizons of constitution. The dialogical completion of their being goes hand in hand with the celebrated fusion of horizons. By implication, all cultural entities, with the exception of the natural scientific ones, exist as "dialogical objects". It is the dialogical interpretation of these entities that "brings to light what is otherwise constantly hidden and withdrawn" (Gadamer 1989, 112). Keeping in mind that this interpretation has much to do with Gadamer's concept of mimesis, it becomes clear why he argues that for "nominalistic modern science" and its idea of reality the concept of mimesis has lost its driving force (Gadamer 1989, 115).[9]

The non-practical and non-dialogical character of the natural sciences' objects of inquiry and the methodological codification of the knowledge about these objects inform in the final reckoning Gadamer's struggle against the epistemologically stylized concept of scientific truth. This reduced concept is not to be overcome by a philosophical reform of scientific objectivity. At the end of an article (written in the late 1960s) on Husserl's concept of life-world, Gadamer makes it clear that the idea of "science in a new style" from which "rational decisions can be derived that would constitute a universal praxis" is a harmful illusion. The knowledge generated by the life-world's practices has a revolutionary power because it "is not a synthesis of theory and practice nor science in a new style, but rather the prior, practical-political limitation of the monopolistic claims of science and a new critical consciousness with respect to the scientific character of philosophy itself" (Gadamer 1976, 196). Concerning this critical observation, however, the question remains open as to whether "the monopolistic claims of science" are engendered by the logic of scientific research, or they come into being through the political (mis)use and manipulation of science. In opposing the life-world's practical knowledge to the "practical knowledge" of applied science, Gadamer insists that the latter cannot instruct us on how to be responsible for the future. Only "an authentic practical and political common sense" can give us the "rational justification for what we should do." Yet, is the *phronēsis* of this common sense so dramatically alien to the practices of scientific research? Gadamer seems to postulate the affirmative answer without any discussion.[10] Nonetheless, an alternative line of reasoning is not precluded by his

[9] Barbara Tuchanska (2008) suggests an excellent criticism of this view, developing at the same time a comprehensive critique of Gadamer's conception of science from the viewpoint of the hermeneutic philosophy of science. She focuses on such basic shortcomings as the assumption that the objects of inquiry of the natural sciences are objects-in-themselves, independent of the research process; the view that the research process is performed from "nowhere"; and the belief that the quintessence of scientific rationality is objectivity as defined by objectivist epistemology.

[10] To a question (posed by Riccardo Dottori) of whether *theoria* (as a strategy of participating in the universal *nous* by pursuing it through *phronēsis*) is also a kind of *praxis*, Gadamer responds that it is "the highest form of *praxis*" (Gadamer 2003, 35). Now this question can be specified—in a non-

elaborations. If the "monopolistic claims of science" are not produced by science in the making, and moreover, if these claims are at odds with the interpretative organization of scientific research, then the whole struggle against scientism has to be essentially redesigned. The political agenda of the hermeneutic-phenomenological philosophy of science consists in the new way of confronting and coping with scientism.

The way in which hermeneutic realism plays the role of a hermeneutic critique of scientism is a subject that will sporadically be touched upon. Let me tentatively clarify what this critique consists in. *Prima facie* scientism is the postulation of the natural sciences' objectivist norms, standards, and criteria as an absolute system of reference in recognizing and resolving global problems of public interest. Thus considered, scientism comes forward and conquers new public spaces, thanks to the unreasonable privileging of the normative framework of objectivism wrongly advertised as the framework of science's epistemological rationality. But in fact, the threat posed by the spread of scientism does not consist in the undue emphasis on the role of objectivism in social life. The most significant detriment of that spread is as follows: Representing the image of science and scientific rationality in terms of objectivism provokes unduly and dangerous attacks on science's autonomy. Undermining this autonomy for the sake of "democratizing scientific inquiry" and making science a machinery directly serving interests of various social groups threatens not only to distort scientific autonomy, but to impose scientism as an absolute ideology—controlling social life through politically manipulated "democratized science"—in the time of the agony of all classical ideological meta-narratives. (As Gerald Holton (1996, 554) nicely argues, the ideology of scientism is in a perfect agreement with the social engineering's view that doing science is to be considered "on a par with constructing technical artifacts or social policies.") The hermeneutic critique of scientism and reductionist objectivism is entitled to look for an alternative philosophical identity of science. Dialogical reflexivity and practical-contextual rationality are to be conceived of as the pivotal features of this identity.

In maintaining its reflexive autonomy and revealing reality in a contextually objective manner, science proves to be the only genuine exponent of rationality and the only reliable authority in the contemporary societies. Michael Polanyi's cognitive hermeneutics has a historical priority in criticizing scientism/objectivism—including the normative-objectivist stylization of scientific method—while combating all attempts at political intervention in scientific inquiry. Revealing truth in autonomous inquiry is an end in itself. A great merit of Michael Polanyi's cognitive hermeneutics is the way in which it advocates natural science's cognitive autonomy without committing his advocacy to naturalist objectivism. He has an

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Gadamerian manner—with respect to the character of *theoria* within the natural sciences. Quite intentionally, I am again using the Greek word because I do not have in mind "theory" as a quasi-axiomatic structure with a partial empirical interpretation. I am referring, rather, to the totality of theoretical practices in scientific research whereby one constitutes meaningful objects of inquiry. The following question will remain forever open: Had Gadamer understood scientific theorizing in this way, would he have continued to insist that practical-contextual rationality is irrelevant to scientific objectivity?

indisputable priority in outlining the strategy of science's interpretive internalism. Polanyi's (1958, 252–260) superb criticism of the destruction of science's cognitive autonomy in the post-war states of bureaucratic socialism still merits special attention today. His warning that the application of politically (ideologically) designed epistemology for the sake of administrative management of science would suppress natural science (with the exception of the narrow area in which pure science overlaps with technology) sounds even more actual nowadays.[11] Hermeneutic realism advocates a very similar position regarding the nexus of anti-objectivism and science's cognitive autonomy. Yet the strategy of defending this nexus is quite different.

The aim of Polanyi's cognitive hermeneutics is to revise (or better, relativize) epistemological norms of objectivity, conceptual simplicity, and explanatory economy in light of the "passionate participation of personal intellectual powers" in scientific cognition. There is no factuality—so Polanyi's argument goes—capable of revealing the objective truth without this participation. Polanyi does not detach the "personal intellectual powers" from the emotional powers. He observes that the "personal coefficient" in scientific research shapes all factual knowledge, and—in doing so—"bridges the disjunction between subjectivity and objectivity." This approach to the epistemic relationship "implies that man can transcend his own subjectivity by striving passionately to fulfill his personal obligations to universal standards" (Polanyi 1958, 17). By contrast, hermeneutic realism does not start with subjectivity and the subjective cognitive process in order to defend the autonomy of inquiry and to combat scientism (Ginev 2013c). The point of departure is the non-derivability of the trans-subjectivity (of the production of scientific factuality within the facticity of inquiry) from subjectivity.

2 Basic Concepts and Conceptual Figures of Hermeneutic Realism

One may raise serious objections against the assertion that human beings' constant involvement in practices opens up access to reality. Such an assertion still presupposes the primacy of Cartesian dualism inasmuch as reality is taken to be "out there", independent of practices that supposedly stand for a collectively organized mindset as distinguished by various kinds of patterns. Hermeneutic realism advocates a stronger claim: Practices as the facticity of a mode of existence that produces objectified

[11] It is worth mentioning that Ludwik Fleck maintains a quite similar position regarding the cognitive autonomy of science. The prevention of science from political distortion of the research process is a central motif in his debates with Tadeusz Bilikiewicz. In countering (and ridiculing) both types of "demagogical-mythical" doctrines in the mid-1930s—the programs of "proletarian science" as subjected to the goals of planned economics, and the ideas of scientific theories in which the "spirit of a race" gets embodied—Fleck argues that the dependence of scientific cognition on cultural-historical milieus is to be sought in the ongoing configuration of *Gestaltsehen* and the use of rhetorical figures in linguistic descriptions of phenomena (Fleck 2011a, 329–331).

factuality are disclosing domains of reality.[12] The suspicious idiom and imagery of "access to reality" have to be undone. It is the disclosure or revealing within practices that allows reality to manifest itself (in particular, to manifest itself as being amenable to becoming objectified). Since practices in their interrelatedness do not make a preexisting reality meaningful, but are the very reality-of-meaningful-articulation, one might state that the reality-of-objectified-factuality is rooted in facticity as a contextual-interpretive appropriation of possibilities within a potentially inexhaustible horizon. Specifying this claim with regard to the facticity of scientific practices and the factuality produced in scientific inquiry is the main task of hermeneutic realism. Doing justice in a hermeneutic way to science's potential to disclose reality at once as meaningful articulation and as objectified factuality has nothing to do with arguing that science provides a "privileged point of reference" in defending realism. (Arguing in this way is on a par with the idiom and imagery of gaining "access to reality".) In hermeneutic realism, *reality is genuinely disclosed to be objectified in* (*the facticity of*) *scientific practices exclusively*.

The facticity of scientific inquiry is the only mode of being-in-the-world in which reality becomes revealed as ready-to-be-objectified. (The everyday-practical [non-objectifying] experience faces contingent factualities within the particular contextures-of-equipment, but—despite its potential for typification [in Alfred Schütz's sense]—this experience fails to "standardize" the production and reproduction of factuality. In enabling intersubjective typifications and habitualizations, routine everydayness constitutes a dense texture of meanings. It would not be correct to say that the everyday-practical experience in its entirety is exclusively characterized by a prepredicative circumspective deliberation. The agents of routine everydayness constantly predicate what they encounter in their contextures. Yet this sort of predication still does not disclose reality as amenable to becoming objectified. It rather incidentally transforms entities that are ready-to-hand into something that is admittedly present-at-hand, i.e., distinguished by predicates that supposedly are independent of particular contextures. This is why Heidegger (1962, 122) makes the observation that practical experience is guided by the deliberative circumspection's operators of the "in-order-to", the "for-the-sake-of", and the "with-which", all of them resisting "mathematical functionalization". These operators do not exclude possible predications. But they exclude predications that through "mathematical

[12] On a thesis that is closer to Dilthey's idea of "productive nexuses" (*Wirkungszusammenhänge*) than to Heidegger's ontology, facticity and factuality are the two modalities of the empirical. The hermeneutic realist holds that the production of procedurally objectified factuality is only achievable in the facticity of scientific inquiry. By implication, if objectified factuality is addressed as being contextualized within the continuity of facticity, then factuality ceases to be an actual presence, and its being is revealed but in the possibilities of a domain's articulation. It is this continuous production of contextualized factuality within the facticity of objectifying inquiry that requires the implementation of the methodology of double hermeneutics. Without devising an integral hermeneutic circle that unites the interpretive study of the production of objectified factuality and the proper interpretive circularity of facticity studied, the factuality would be captured only as a manifold of discrete elements. In employing double hermeneutics, the hermeneutic realist is after the phenomenological unity of producing-factuality-within-facticity. It is this unity that—while contextualized—resembles Dilthey's "productive nexuses".

functionalization" would objectify what is ready-to-hand. Objectified factuality can be produced when reality becomes disclosed as amenable to being objectified.)

Scientific practices are capable, solely in their interrelatedness, of articulating reality in meaningful entities and structures.[13] Moreover, one is able to delineate a particular practice only by coming to grips with the background of already configured practices. The interrelatedness which appears as changing configurations of practices is ontologically prior to the particular (single) practices. The view that practices have a being of their own (and are not dovetailed by embodied agents' activities and the material settings in which these activities take place) is to be advocated—either by means of non-objectivist naturalistic arguments (as Joseph Rouse does) or by invoking conceptual figures of hermeneutic ontology—with regard to the interrelatedness of practices. Otherwise, not only is this view untenable, but the insistence on it may lead to a position that reifies practices. Practitioners articulate reality meaningfully by being involved in the changing configurations of practices. They understand the meaning obtained by carrying out a particular practice through the relatedness of the outcome to the contextual configuration of practices. Thus, practitioners make sense of reality by interpreting the particular units of articulated meaning within a whole of contextually configured practices. The mutual dependence of whole and particular units forms a hermeneutic circle of the reality's meaningful articulation. In a manner similar to the process of reading a text, this articulation moves in each context of configured practices from particular meanings to the contextual whole and back again.

Like the interrelatedness of practices, the hermeneutic circle and the articulation of meaning itself are not to be disentangled from the reality revealed in this interrelatedness. The hermeneutic realist advocates holism about practices without hypostatizing their interrelatedness. The latter would be hypostatized if it were detached from the interpretative circle of meaningful articulation, and treated as a cause of having meaning in human existence. Though admitting, in a sense, the ontological priority of interrelatedness, the hermeneutic realist holds that it does not exist per se. It is an integral part (and exists by means) of the hermeneutic circle of reality's meaningful articulation. The interrelatedness of practices never gets into a state of static presence. Being involved in changing configurations, practices open a (constantly shifting) horizon of possible meanings that might be articulated within them. According to hermeneutic realism, practices exist in the ways in which they

[13] This claim stands in stark contrast to Heidegger's existential conception of science. For Heidegger, scientific practices are objectifying regions of inquiry, but they cease to articulate the world meaningfully. To put it bluntly, while constituting thematic objects, scientific practices are de-worlding the meaningful reality. The existential conception of science developed in *Being and Time* is in line with the phenomenological tradition of sharply opposing the pre-objectified (prethematic, prepredicative) world to the objectified world of science. The hermeneutic realism, by contrast, holds that scientific objectification is only achievable within a new horizon of reality's meaningful articulation. This horizon is projected by the interrelated scientific practices. To sum up, scientific practices in their interrelatedness are not de-worlding but re-worlding the reality of meaningful articulation. (I unfold this claim as criticisms of the existential conception of science in Ginev (2011a, 1–22; 2015a, 181–197).)

project their being upon possibilities that they appropriate (and actualize), thereby enabling the meaningful articulation of reality. Accordingly, the interrelatedness of practices gains its ontological definiteness by having a being projected upon possibilities.[14] This claim is to be extended to practitioners as well: They understand and make intelligible the reality which once disclosed becomes articulated in their practices. The articulation takes place within the horizon of possibilities the practitioners can appropriate and contextually actualize. This horizon of understanding is at the same time the horizon in which they constitute their identities as practitioners who articulate reality in a certain way (in particular, as inquirers who articulate a scientific domain). Thus, the possibilities of reality's articulation are also possibilities for practitioners' reflexively achieved identities. The more possibilities they appropriate, the more prospective contextual configurations of practices become envisioned. There is an ongoing *interplay of practices and possibilities* in the meaningful articulation of reality. Being involved in this articulation (as it is characterized by a hermeneutic circularity) amounts to interpreting the reality as having a being projected upon possibilities that are engendered by the interrelatedness of practices. From an ontological point of view, the reality always has a potentiality-for-being (and potentiality-for-meaning) that can be transformed under special conditions into a thematic presence of objectified factuality.

In this study I will argue that the domains of reality are disclosed in the interplay of scientific practices and possibilities for doing research. The meaningful articulation of discrete entities and structures takes place in the continuity of this interplay. The entities and structures are contextually articulated: A particular context is a

[14] Thus considered, the interrelatedness of practices is a usual object of study of all programs dealing with culturally patterned forms of everydayness. However, here again one has to differentiate between studying it as factuality and as facticity. The facticity of a culturally individualized everydayness is the meaningful articulation in its capacity to enable interpretative fore-structuring of what is situated in it. The procedural objectification of such everydayness as factuality—say, within the scope of the sociology of everyday life or the social geography of routine regimes of spacing and timing—is doubtless a feasible task. But this objectification precludes one from comprehending the empirical-as-facticity. The argument for this claim follows a well-known line of reasoning in hermeneutic phenomenology: The world as ever transcending horizon—irreducible to the totality of what is ready-to-hand and present-at-hand within-the-world—can never be conceptualized as a theme of positive-empirical research. At first glance, this line of reasoning is in a conflict with empirical research programs that aim at studying the interpretive worlds of life forms as distinguished by their ethos and habitus. Understanding a culturally distant world and interpreting what is going on within the horizon of this world is a scientific strategy often deployed in programs of cultural history, phenomenological sociology, and cultural anthropology. This strategy is successful in identifying, describing, and conceptualizing the life forms articulated within the world-horizon. Yet, in making the life forms objects of inquiry, the adepts of the strategy decisively refrain from studying how the world is situationally transcendent in enabling the regimes of life forms' temporalizing and spatializing. Accordingly, they take the intended objects of inquiry to be already temporalized and spatialized. Following this strategy, one operates with interpretive factuality, but not with facticity. The hermeneutic realist argues that the interpretive research of life forms within their world-horizons can be extended to cover the issues of how the world is transcending in temporalizing and spatializing what is within-the-world. (For a nice unfolding of this claim with respect to the quest for a new identity of geography as scientific discipline, see Zahnen 2015)

relatively autonomous configuration of practices that projects itself upon possibilities waiting to be appropriated and actualized by the practices thus configured. The articulated entities and structures are at once situated in contexts and transcended by the interplay, thereby being open to re-contextualization. It is the reflection upon this state of *situated transcendence* that provides the argument against relativism based on framework-content dualism. In hermeneutic realism, there is no framework—regardless of how strongly conceptually codified and how rigidly formalized it might be—that may escape the interplay of practices and possibilities. In the same vein, there is no framework immune from re-contextualization. Like all other entities and structures in the meaningful reality, the linguistic and conceptual frameworks are situated in and transcended by the interpretative articulation of meaning.

Following the argument of situated transcendence, the hermeneutic realist argues that the interplay in question fore-structures the entities and structures identifiable by theoretically framed empirical procedures. By implementing such procedures, one constructs theoretical models of what becomes procedurally objectified as an actual presence of invariant structures and objects embedded in these structures. Yet isolating the construction of such models from the interplay of practices and possibilities is only to be accomplished at the price of ignoring the situated transcendence of reality's meaningful articulation. The theoretical models of objectified reality qua actual presence are rooted in this articulation. Making reality theoretically present depends on choices and actualizations of possibilities within the continuous stream of scientific practices. There is an ongoing interpretative fore-structuring of the objectified reality.

This fore-structuring is correlatively conjugated with the situated transcendence of the meaning articulated by practices and projected upon possibilities. With regard to this claim, the hermeneutic realist introduces the ontological difference between the reality-as-facticity disclosed by the interplay of practices and possibilities and the factually identifiable reality procedurally made present. The idea of the ontological difference between factuality and facticity is not entitled to dispute the unity of reality. (Throughout this book I will argue that hermeneutic realism deals with the empirical as a unity of producing-factuality-within-facticity. Reality manifests itself empirically through this unity.) The idea of factuality-facticity ontological difference rather states that the unity of reality is to be achieved by reflecting upon the hermeneutic circle of reality's meaningful articulation. The interpretative fore-structuring of objectified reality moves along the path of hermeneutic circularity: the co-interpretive relationship between particular meaningful units (actualized possibilities) and the horizonal whole of interplaying practices and possibilities. This fore-structuring is not predicated on (and is not reducible to) a relation of determination. From the perspective of the practitioners, this means that the choices of possibilities are contextually made, and not determined by a non-contextual essence.

The distinction between factuality and facticity opposes any kind of objectivist naturalism that ignores the ontological primacy of the meaning-projected-upon-possibilities. Against naturalist objectivism, the hermeneutic realist makes the case that since the constitution of meaning is not a particular anthropological capacity

(or capability), it is not derivable (or "extractible" as an epiphenomenon) from theoretically conceptualized kinds of factuality referring to, for instance, the social dynamics regulated by cultural patterns (as conceptualized by objectivist social and anthropological theories), the models of behavior (as developed by human ethology and developmental psychology), the basic features of human populations (as described by human ecology), the neurophysiological substrates of brain activities, the phylogeny of the human species, or—as in particular the case of what is called "cultural materialism"—the material conditions of human life in its physical environments. The non-derivability of the constitution of meaning provides a crucial argument for the self-sufficiency of the reality-as-facticity, and prohibits any explanatory objectification of the constitution of meaning as objective factuality. By implication, the arguments for the primacy of facticity are also the arguments which the hermeneutic realist brings forward against eliminativism. The latter could have proved to be effective in undoing folk-psychological abstractions, hypostatized mental states and propositional attitudes, or other mentalist states, processes, and structures, but it is—even when being successfully disassociated from sheer reductionism—completely powerless when used as a means for eliminating the facticity of meaningful articulation. Since all kinds of eliminativism rest on Cartesian dualism and naturalist objectivism, it is the way of conceptualizing facticity that may help one in undoing the wrong idealizations of eliminative materialism.

As already mentioned, the hermeneutic realist holds that the ontological difference between facticity and factuality is non-dichotomous and always relative to the unity of the empirical as production-of-factuality-within-facticity. A particular goal of this study is to show how the hermeneutic view of the empirical contrasts with the empiricist and the objectivist views of the empirical, both of which are strongly committed to the metaphysics of presence. Yet the view of the production-of-factuality-within-facticity is also at odds with the Heideggerian claim that there is no passage from factuality constituted by objectifying practices to facticity as phenomenologically analyzed and ontologically revealed. If there would be such a passage, then one could manage to translate (without remainder) existential ontology into the ontic fields of the factuality constituted by scientific inquiry—a possibility strongly forbidden by Heidegger's dichotomous interpretation of the ontological difference. (Studying how facticity is mediated by forms of factuality is the central task of what Georg Misch calls the "hermeneutic logic of life's expressivity". Misch criticizes Heidegger's hermeneutics of facticity for looking for an ontology behind life forms. For him, facticity is the very expressivity of the life forms, and the logical analysis of this expressivity leaves no room for ontology. Against the background of this criticism, Misch, following in Dilthey's footsteps, rejects the dichotomization between the ontic and the ontological [including the dichotomy between factuality and facticity]. Hermeneutic realism adopts some of the tenets of the "hermeneutic logic of life's expressivity" when criticizing Heidegger's strong

separation between ontic factuality and ontological facticity. But it does not dismiss—as Misch seems to suggest—the ontic-ontological difference.)[15]

All tenets of hermeneutic realism are formulated and defended in this study by invoking a theory of practices that in several respects differs from basic positions established upon the "practice turn". Elsewhere I deal with this issue in detail (Ginev 2013a, 15–38). Though in the remainder different aspects of the theory of practices relevant to hermeneutic realism will occasionally be touched upon, a systematic treatment of the theory's profile will not be offered. Yet some short notes cannot be avoided. To begin with, I agree with Stephen Turner's (2010) criticism of the normative theories of practices. These theories wrongly concede that the normative is somehow implicated or embedded in practices. Practices are normatively connected with one another, so that practices are normative. This is a thesis especially characteristic of the theories inspired by Brandom's inferentialism. An important goal of these normative theories is to conceptualize communal intersubjectivity by explaining how the chain relations of justification and inferential connections underwritten by practices remain preserved (Turner 2010, 145). Yet these theories are unable to explain how human beings become initiated in the normative worlds of culture. In other words, they lack explanatory resources concerning the issue of how one passes from the pre-normative to the normative. They should either assume that the pre-normative is already an elementary normative (or proto-normative) state or resolve the passage problem by committing a certain sort of naturalist fallacy (Ginev 2013b).

Turner criticizes these theories from a more or less naturalist viewpoint. This is why he reaches the conclusion that the normative theories of practices suffer from accepting a false idealization of a complex of real social facts of interaction. His aim is to show the "hard facts" that are outside "the circle of normative reasoning" (Turner 2010, 147). The theory of practices relevant to the tenets of hermeneutic realism has an essentially different agenda when at stake is the way of breaking the circle of normative reasoning. This theory takes a cue from the expression of the pre-normative state: It means neither a proto-normative state nor a natural-factual state. In the remainder I will try to show that interpretive pre-normativity is a central concept of hermeneutic realism. Pre-normativity refers to the constraining (and heuristic) force of fore-having, fore-seeing, and fore-grasping as they are specified as presuppositions by a characteristic hermeneutic situation. Phrased differently, pre-normativity is the constraining heuristic force of the hermeneutic circularity set up by the interplay of practices and possibilities. Thus considered, the concept of pre-normativity informs to a great extent the strategy of constructing a theory of practices.

The reality of practices (as projecting their being upon possibilities) should not be taken as harboring a destructive natural-normative dualism. If practices are entities consisting of spatially and temporally ordered actions and activities that contain normative elements, this dualism becomes part and parcel of the theory of practices'

[15] For the status of the hermeneutic philosophy of science between Heidegger's hermeneutics of facticity and Misch's hermeneutic logic, see Ginev (2011b, 45–64).

structure. The normative and the natural coexist in practices as two kinds of factuality in theory's empirical basis. As a rule, the hypostatization of normativity in the theories of practices goes hand in hand with the postulation of the immanent teleology of practices. To be sure, subjective and collective human activity is fundamentally teleological. More specifically, all rational activities have a teleological character. But is this conclusion generalizable to practices? Most of the theorists of practices are quick to answer affirmatively.[16] Like activities, practices are—so their argument goes—distinguished by normatively ruled directedness at ends. Thus, Theodore Schatzki (2010, 145) admits in developing his theory that norms "short circuit the teleological determination of practical intelligibility by themselves specifying what makes sense to people to do."

In hypostatizing normativity as normative teleology, the theories of practices fail to discriminate between actions/activities, on the one hand, and practices, on the other. The same frameworks of conceptualization are to be implemented in both cases. Accordingly, actions (activities) and practices share the same objectified factuality. But if all of them refer to facts about the temporal-spatial organization of normatively patterned acts, then why develop a theory of practices at all? Such a theory would be in the best case a special chapter of a theory of action. In hermeneutic realism, there is a principled difference between activities and practices that resonates the difference between factuality and facticity. The discrete actions and activities are not on a par with the continuous interplay of practices and possibilities. Obviously, it would make sense to develop an autonomous theory of practices if and only if there is a caesura in the transition from actions and activities to practices. This caesura can be described, and will be described in the remainder, in several ways. Of prime importance to hermeneutic realism is that the caesura does not amount to a change from a particular factuality to another one. It is rather a change that marks a passage from factuality to facticity. Actions and activities invoke intersubjective normativity (and its ontic factuality), whereas interrelated practices that are projecting and appropriating possibilities are facticity as characterized by hermeneutic pre-normativity. However, the theory of practices is admittedly an empirical theory. Accordingly, it has to approach the facticity of contextualized practices (and the intercontextuality of practices) in an empirical manner. The theory of practices relevant to hermeneutic realism deals with something that is prohibited by Heidegger's hermeneutics of facticity and the existential analytic. It deals with the constitution of "ontic facticity".

[16] To be sure, the admission that practices have a teleological character rests on sound intuitive assumptions. Conceived of as factuality, a practice consists of acts that are following a rule in achieving a goal. Together with the entities that the acts manage to enact (make ready-to-hand) and organize environmentally, the practice forms a contexture-of-equipment in which operators like "in-order-to" and "for-the-sake-of" determine the direction of activity. Conceptualizing practices as rule-following acts inherent in goal-oriented conduct implies the picture of teleologically ordered acts. However, this picture is about action and activities, and not about practices. Assuming a teleological framework of conceptualization is perhaps suitable for developing a theory of action, but it is, as I will argue in this study, ineligible for the construction of a theory of practices.

From the viewpoint of hermeneutic realism, there is non-teleological directedness of practices projecting possible contexts of inquiry and having interrelatedness projected upon a horizon of possibilities. This directedness (orientedness) is informed by the hermeneutic situation of the mode of being-in-the-world. It is due to the formation of a tendency to the choosing of possibilities. Since there are no choices without a horizon of possibilities that might be chosen, the directedness of practices is secondary to the interpretive appropriation of possibilities. Against this background, one is in a position to formulate a criterion for independence of practices from normative-teleological actions and activities. A particular practice is composed of acts, actions, and activities centered around normative patterns whose role consists in effectuating the achievement of a goal. Performing a singular practice is unexceptionally distinguished by a teleological orientation, and by a firm factuality schematized explanatorily by this orientation. However, when the same practice is involved in the interplay of practices and possibilities, it ceases to have a factuality of its own. To reiterate, practices projecting their interrelatedness upon possibilities are defined first and foremost by their capacities of interpretive disclosure and meaningful articulation of reality. Not allegedly inherent teleology, but hermeneutic circularity informs the ontological status of practices interplaying with possibilities. This change of status—from a goal-oriented and normatively sanctioned particular practice to practices involved in the hermeneutic circularity of reality's meaningful articulation—creates the independence of practices from normative-teleological actions and activities. It is also responsible for the aforementioned caesura in the factuality constituted respectively by a (normative) theory of action and a theory of practices.

3 Hermeneutic Realism and Interpretive Internalism

The position of hermeneutic realism that will be developed in this study counters two views of the "diremption of reality". Roughly, embarking on strategies against these views defines a thesis that I call *interpretive internalism*. Before tackling this thesis, a few words about the diremption of reality are in order. Both views, which advocate the duplication of reality—dividing it into a reality of "lived experience" and a reality alienated from the meaningfulness of this experience – admit that there is a crucial divergence between what is meaningfully articulated and what becomes idealized and (procedurally) objectified. The views differ on answering the question of where the source of the meaningful articulation of reality should be located. In the first view, reality becomes meaningfully articulated within the pre-scientific life-world. The gap between the contextualized meaning of mundane activities and the alleged de-contextualized objectification that extricates reality from meaning causes the irreversible diremption of reality. The second view is more sophisticated, since it denounces the wrong assumption that scientific inquiry is alien to the meaningful articulation of reality. Yet it insists on the divergence between meaningful articulation and procedural objectification by placing this divergence within the process of

inquiry. This process is, as it were, divided into two stages related, respectively, to the constitution of meaning and the theoretical construction of objectified factuality. The criticism of the first view is the topic in this section, while in the next one I will discuss the unity of meaningful articulation and objectification of reality within the practices of inquiry.

The well-known motifs of the "forgotten life-world" and the orientational deficit of scientific objectification stem from the first view. In line with the classical phenomenological doctrine based on these motifs, one upholds that the world of science's ideal essences and the world of the meanings generated by everyday practices, experience, and communication are crucially divided by the procedures of measurement as enabled by idealization and ideal essences (Sokolowski 1992, 164–170). Science's objective world is the world in which only measurable entities may exist. Within intuitive comprehension, which operates in the everyday experience, the entities become understood, while the investigation predicated on ideal essences stylizes the entities as variables to be measured. In idealization one transforms—so the classical phenomenological argument goes—the world of things to be understood exclusively into a world of things to be measured. Exact measurement totally replaces meaning. However, this conclusion becomes vulnerable when one poses the following question: Is any particular measurement—however strongly it is determined by ideal essences—not always already in a horizon of actual and possible (experimental, conceptual, formal, and instrumental) meanings? Being determined by an ideal essence, measurement objectifies (makes things reducible to or representable by measurable variables), but within a horizon of meanings.

How structures of elementary (life-world) meanings become transferred from everyday experience to the "methodical order" of scientific knowledge production is a central subject of the constructivists of the Erlangen-Konstanz school. At issue is a "series of steps to introduce the fundamental concepts of geometry, chronometry, and hylometry in that order using 'idealized' operations with physical bodies" (Lorenz 1989, 15). This approach—worked out in a radical opposition to any form of epistemic foundationalism—promises to overcome the diremption of reality implied by the phenomenological critique of objectifying science. Yet the price one has to pay for this overcoming is too high: By reducing the constitution of meaning to a normatively guided construction of systematizations—and thereby replacing the constitutional analysis with methodical reconstructions—these philosophers of science lose sight of the meaningful articulation of what takes place within the routine everydayness of scientific inquiry. One should not forget that all processes and procedures of constructing methodical order are also situated in and fore-structured by this articulation of meaning (Andreev 2004). Methodical constructivists tend to overcome the diremption of reality by assuming the unfathomability of the life-world's patterns of action. The hermeneutic realist counters this assumption by raising the argument that all patterns of action are formed within the interrelatedness of practices, and not the other way around. Patterned human actions are ingredients of

practices, but they become such ingredients only within the interrelatedness of practices.[17]

In his groundbreaking work, Joseph Kockelmans argues that the specificity of modern science consists in projecting observed and unobserved phenomena (as presented by measurable data) upon horizons of potential meaning that become actualized in the process of saving phenomena. Since this process is involved in a hermeneutic circle, scientific inquiry is "inherently hermeneutic enterprise" (Kockelmans 1997, 41). Hermeneutic realism receives and develops this view. My aim in the present study is to provide a general profile of hermeneutic realism by taking into account the issue of how reality is factually disclosed within the facticity of scientific research. One can tentatively admit that what becomes articulated in scientific inquiry are entities—already crudely delineated in everyday experience—that can be submitted to controlled observation, experimentation, manipulation through calibrated instruments, possible measurements, quantification and calculation through formalisms and mathematical models, and conceptualization by means of theories that put forward verifiable predictions. However, to the extent to which this claim separates meaningful articulation from the subsequent processing of entities already meaningfully constituted, the claim is misleadingly formulated. It leaves the wrong impression that scientific inquiry "imports" entities and (possibly even) structures constituted in pre-scientific practices and experience, and then "transforms" them via its own practices into experimentally testable, formalizable, and quantifiable objects and structures. The hermeneutic realist subscribes to the opposite idea that in scientific inquiry reality is afresh disclosed and meaningfully articulated by the changing configurations of scientific practices as they project the totality of their interrelatedness upon possibilities for doing research.

Some consequences of this idea contrast phenomenological doctrines concerning the relations between the meaningful life-world(s) and the objectifying-idealizing scientific inquiry: the doctrines which most typically instantiate the first view of the diremption of reality. More specifically, certain consequences following from the idea of the authentic disclosedness of reality in scientific inquiry are at odds with the assumption (shared by these doctrines) that all scientific objects are

[17] This claim is to be extended to elementary linguistic distinctions and practical orientations—both of them playing a crucial role in the scenarios for methodical reconstruction. Elementary linguistic distinctions and practical orientations presuppose horizons of interrelated practices. When the champions of methodical constructivism study the groundedness of science's theoretical concepts in such distinctions and orientations, they take the life-world to be not a horizon but an inscrutable ground. Accordingly, they deny the possibility for developing a theory of life-world. Such a theory would violate their principle that theoretical knowledge cannot go behind life, which implies that all methodically guided cognitive constructions in science are refining stylizations of "that which has always constituted the practical life-world" (Lorenzen 1987, 5). In hermeneutic realism, if the expression "theory of life-world" is only the alternative designation of the theory about the constitution of meaning within practices, then there is no threat of entering a vicious circle when grounding methodical reconstructions of science's theoretical constructions on such a theory. In so doing, one would rather commit the search for "methodical order" to the hermeneutic circularity (of meaning constitution) in which the construction of order is always already situated.

prefigured within the pre- and non-scientific life-world. It goes without saying that those who are committed to the assumption mentioned do not dispute that there are no counterparts of (say) quarks and regulatory genes in everyday (mundane) experience. The existence of quarks and regulatory genes is enabled by a network of highly sophisticated scientific practices that are entirely designed within long-lasting processes of inquiry. These entities are only understandable by esoteric communities speaking about them in languages that are absolutely foreign to the non-initiated. Furthermore, quarks and regulatory genes are reachable or identifiable within cultural and discursive spaces that do not have boundary points with the public spaces of laymen everydayness. Following such motifs, one unavoidably reaches the conclusion that entities instrumental in everyday experience cannot affect the existence of entities like quarks and regulatory genes.

Yet the rationale for holding the assumption that all scientific entities are prefigured in the pre- and non-scientific life-world(s) goes in another direction: However strongly diverged (from everyday experience) the scientific constitution of objects of inquiry is, there is no network of scientific practices that is capable of completely cutting this constitution off. Genetic ties with everyday experience and the entities instrumental in it still remain intact. For many followers of Husserl's classical views, it is the task of a special "genetic phenomenology" to restore these ties presumably lost—or better, blurred—within the scope of scientific experience (Ströker 1979, 1987, 156–169; Held 1991; Welter 1991; Vaysse 2006; Tonkli Komel 2008; Steinle 2010; Lembeck 2011). The restoration should recover the meanings which have once been imported from pre- and non-scientific life-world(s) and which have been subsequently sedimented in the constitution of ever more complex scientific entities. At stake in genetic phenomenology is a meticulous step-by-step tracking of meaning-sedimentation within science's "conceptual layers" of the methodically organized cognition. Covering life-world's texture of meanings with cognitive constructions based on mathematical idealizations supposedly creates and warrants scientific objectivity. Going back (*Rückgriff*) to the alleged life-world's ground of primary meanings aims at unraveling the "life-world's roots" of scientific objectivity.[18]

Elisabeth Ströker, the author who most extensively tried to ground philosophy of the natural sciences on Husserl's phenomenology, is by no means an uncritical supporter of the genetic-phenomenological scenarios which bestow the life-world on the source of meaning veiled (but not annihilated) by scientific objectification. For her, Husserl's original critique of modern science's objectivity from the viewpoint of life-world's grounding function (*Bodensfunktion*) makes an essential use of a fiction: that of the "immovable pre-scientific ground" (*der unverrückbare vor-*

[18] Moreover, attempting to recover the sedimented layers of meaning promises a life-world's grounding of the objectifying cognitive structures which have veiled the primary meanings constituted within the finite horizons of pre-scientific experience. It remains an open question as to whether, for Husserl and his followers, this recovery could have retroactive consequences for the structure of objectification in scientific inquiry. An affirmative answer would imply the possibility of moving from a phenomenological critique of science to a phenomenological-critical philosophy of science (Ginev 2008a).

wissenschaftliche Boden). This fiction seems to be inherited in most of the post-Husserlian scenarios of science's critique. In analyzing how scientific cognition based on idealizing-objectifying procedures "forgets" its roots in the meaningful life-world, the authors of these scenarios tend to forget that the life-world constantly becomes enriched by new layers of meaning, thanks to the impact of science on it. The scientification of the life-world consists not only in the introduction of scientifically designed technical innovations in it, but also in its "contamination" with meanings coming from science. Irrespective of all genetic ties between pre-scientific and scientific experience, there is no life-world that might serve a grounding function.[19]

At this point the next disclaimer should be introduced. Practices do not intervene from without in (a putatively "inert") reality whereby the latter becomes a meaningful construction. (Advocating this kind of practical interventionism would result in a sort of hylomorphism about the relation between the "passive reality" and the form-bringing practices.) By the same token, practices are not "transfusing" meaning—that originates in practitioners' (individual and collective) intentionality—into reality. In conceiving of practices as inherent in reality, the hermeneutic realist adheres to the view that there is but a meaningful reality. But now the question arises as to whether the practices-inherent-in-reality are not only a particular (possible) object of inquiry. If this is the case, then it is hard to imagine how the hermeneutic realist can avoid a kind of destructive dilemma. On the one hand, reality is articulated within practices, and all objects of inquiry are "prepared" (qua meaningful entities) within this articulation. Yet, on the other hand, when one is trying to conceptualize practices, they become de-privileged as the place of the constitution of meaning (and meaningful articulation of the objects of inquiry) and appear to be only a particular object of inquiry. Under these circumstances, one should either scrutinize the constitution of meaningful objects within the stream of practices without conceptualizing practices, or objectify them in a separate theory without pretending that this theory might explain the meaning-constituting function of practices. (Engaging in both enterprises would lead to a vicious circle.) Roughly, this a dilemma between the phenomenological and the objectivist view about practices. It

[19] In claiming that scientific inquiry discloses and articulates reality anew, the hermeneutic realist does not try to neglect the genetic ties with the life-world's experience. However, since these ties are not based on a continuation of the constitution of meaning, they have to be investigated not in terms of "genetic phenomenology", but as a subject of disciplines such as cultural history of scientific practices, history of concepts (*Begriffsgeschichte*), history of ideas, or (not necessarily Foucauldian) archaeology of scientific knowledge. Lorraine Daston coins the term "applied metaphysics" when referring to the historical studies of objects that in their coming into being, existence, and passing away have been oscillating across the boundaries of scientific domains and non-scientific areas of social practices. Applied metaphysics deals with the history of scientific objects and migrating entities (possibly becoming hybrid, natural-cultural entities) and is committed to what Bruno Latour calls "historical realism". In so doing, this metaphysics places the genetic ties between non-scientific practical experience and various kinds of scientific inquiry in diverse cultural-historical spaces without looking for a continuity of meaningful constitution. Applied metaphysics "posits that scientific objects can be simultaneously real and historical" (Daston 2000, 3).

is indeed an unavoidable predicament if one follows the mainstream in the so-called theory of practice(s), where practices are conceptualized through objectification but for the sake of accounting the practical constitution of social entities.

Hermeneutic realism suggests an approach to practices that is not on the horns of this dilemma: Conceptualizing practices in terms of interpretive facticity paves the way for combining the theorizing (by means of double hermeneutics) of the modes of interpretive-reflexive being-in-practices with the study of how objects (and whole domains) of inquiry become constituted within practices.

Notoriously, Joseph Rouse (1996, 158–178) outlines—by treating practices not as agents' actions and doings, but as meaningful situations distinguished by a narrative dimension—another way out of the dilemma. Rouse's conception of scientific practices is highly inventive not only with regard to the way in which it prioritizes practices without making them an independent essence, but also in connection with its strategy of a piecemeal reconstruction of science's being in practices: There is a growing multitude of narrative unifications of knowledge production in science, which excludes the possibility of a "grand narrative" about science writ large. Yet the aim of Rouse's practical (piecemeal) holism contrasts in an essential way with the agenda of hermeneutic realism. This aim consists in inducing—within the paradigm of science-as-praxis—an interdisciplinary program of cultural studies of science that would eventually empiricize (or "naturalize" in the broad Quinean sense) the studies of the constitution and circulation of scientific knowledge. Thus empiricized, the program exclusively deals with scientific practices as a pure factuality.[20] It is not a matter of chance that the subsequent development of this program led to Rouse's well-known form of naturalism. By contrast, the hermeneutic realist holds that the situated transcendence of being in scientific practices—including the production of objective knowledge as part and parcel of this being—is what cannot be reduced to factuality. Approaching situated transcendence requires taking into consideration the ontological difference between factuality and facticity of scientific inquiry.

It goes without saying that the approach to practices suggested by hermeneutic realism does not exclude the objectification of practices, and accordingly, their treatment as objectified factuality within a (more or less traditional) deductive-explanatory theory. This objectification is at stake in domains such as social geography and organizational studies. Any particular practice might be conceptualized in this way. A single practice is an entity localizable in physical space and time, and identifiable through the actions and activities that supposedly compose it. Furthermore, any particular practice is governed by pattern(s), and is purposively oriented (Tuomela 2002, 41–45; Barnes 2001; Schatzki 2010, 111–129). Following Anthony Giddens's lead, one may theorize the array of practices that design a field of social life by employing without reservation the paradigm of objectifying the

[20] Theodore Kisiel (1997, 71) is right when he stresses that Rouse's conception of scientific practices "eschews the banner of hermeneutics" and instead proposes to examine scientific-technological work by using different sorts of case studies. As a result, the phenomenological subject of the constitution of scientific domains is turned into the empirical inquiry of practices.

inquired as a discrete (theory-laden) factuality: Practices are patterned actions that recursively (re)produce the structures which enable (and constrain) the same actions. Objectifying the mutual reinforcement of actions and structures by means of the theory of structuration constitutes the discrete factuality of practices. (The phenomena which this theory is entitled to address are not divided into two separate sets, but exist through the duality of recursive actions and constraining structures.) Theorizing practices in a posthumanist vein does not get rid of this paradigm of objectifying practices as discrete factuality. The inclusion of nonhuman actors in practices enriches the factuality proper for their conceptualizing, but does not help the theorist to approach the continuity of hermeneutic circling in which each and every discrete practice is always already involved.

In claiming the inherence of practices in reality, the hermeneutic realist cannot make use of an objectifying conceptualization of practices that would present them as procedurally identifiable factuality.[21] In the perspective of hermeneutic realism, *practices in their interrelatedness do not amount to a diversity of functionally integrated structural elements. In its potentiality-for-being this interrelatedness is a moving continuity of changing configurations*. It would not be correct to state that practices as discrete units enclosed in their environments are not important to the hermeneutic realist. Yet what is much more significant to the champions of this position is the (hermeneutic and phenomenological) conceptualization of the stream of ever changing configurations of practices—a conceptualization that would not transform the continuity of this stream into manifolds of discrete units. To reiterate, the stream of practices is not to be objectified as something localizable in space and time. By opening the horizons of spatiality and temporality of meaningful articulation, the stream of practices is—through its contextually changing configurations—spatializing and temporalizing what becomes articulated through the appropriation of possibilities on which the configured practices project their interrelatedness as potentiality-for-being. A full-fledged unfoldment of this statement that should bring into being a phenomenological theory of practices is a task that will not be assigned in this study. According to a requirement weaker than the requirement of constructing such a theory, one has to conceptualize practices by means of a methodology of double hermeneutics, since only in this way their character of providing an open and inexhaustible horizon of possibilities for reality's meaningful articulation will not be destructed. This requirement will be met in what follows.

On a further basic claim of hermeneutic realism, reality becomes disclosed as amenable to being objectified only within the interrelatedness of the practices of scientific inquiry. Stated differently—and with the intent to counter the first view of

[21] Pierre Bourdieu's "logic of practice" as based on the concept of habitus serves much better the tenets of hermeneutic realism than the theories aiming at the objectification of practices as discrete factuality. My point is that the concept of habitus is commensurate with the hermeneutic circling of practices in which reality becomes disclosed. According to Bourdieu (1990, 54), once internalized in the form of schemes of perception, thought, and action, the habitus ensures the continuity of practices and their constancy over time more reliably than all formal rules and explicit norms. In the course of this study, I will show that some approaches to practices in ethnomethodology are also in line with the tenets of hermeneutic realism.

the "diremption of reality"—what becomes constituted within this interrelatedness is by no means to be "derived from" or "reduced to" non- or pre-scientific entities. In raising this claim, the hermeneutic realist implies that scientific inquiry is predicated on (what I called) interpretive internalism: Science articulates reality in a characteristic way due to the unique hermeneutic circularity set up in the research process (Ginev 2006, 48–67). Accentuating the interpretive internalism of scientific research does not entail the claim that the process of inquiry is immune to the infusion of external themes, values, or goals in this process. Scientific inquiry, especially under the conditions of technoscience, constantly reacts to its milieus by incorporating issues, problems, and tasks. It is precisely this incorporation (without "finalization") that creates the cognitive autonomy of scientific inquiry. The autonomy is not conditioned by a normative enclosure that seeks closedness of the process of inquiry. It is rather achieved by an openness characterized by selective assimilation of external subjects, issues, and goals.[22]

Joseph Rouse makes the case that the totality of scientific practices is not to be separated from the rest of the cultural world of practices only for conventional or pragmatic reasons. It is impossible (and unreasonable) to present this totality as a self-sufficient realm and as "a separable component of the world whose interface with other components is readily localizable" (Rouse 2002, 165). This is why the cultural studies of science he aims at "take as their object of investigation the traffic between scientific inquiry and those cultural practices and formations that philosophers of science have often regarded as 'external' to knowledge" (Rouse 1996, 239). Any attempt at ascribing a significant autonomy to the realm of scientific practices faces the challenge of the traffic of technological, instrumental, experimental, and conceptual practices across the alleged boundaries. One can also invoke in this regard Rorty's view that natural science is not a "natural kind": There is no philosophically significant difference between the methodically organized practices of inquiry and the rest of human practices that, in an essentialist manner, divides culture into science and non-science. The hermeneutic realist does not deny the constant traffic (in Rouse's sense) or the growing diversification of (what Peter Galison calls) "trading zones" of practices that progressively efface the borderlines between scientific domains and their ambiences. Yet the hermeneutic realist denies that this effacement provides a rationale for abolishing the creation of cognitive autonomy within the hermeneutic circularity in which a domain of inquiry is disclosed, articulated, and objectified.

Coming to grips with this autonomy as a hermeneutic phenomenon is the principal point of interpretive internalism (and cognitive existentialism). It is not an autonomy guarded by a normative border and methodological codex. While normative-epistemological internalism (of a Lakatosian style) draws a strong demarcation between internal (mechanisms) and external (influences) in science's cognitive dynamics, the hermeneutic strategy of internalism emphasizes scientific

[22] For an attempt to advocate interpretive internalism by using models of self-organization, see Krohn and Küppers (1987). The point of this attempt is that scientific research is not passively adjusted to various social milieus. Science actively constitutes its milieu.

practices' potential of disclosing reality without any support of external (non-scientific) practices. The interpretive internalist defends science's cognitive autonomy by arguing that the same horizons in which domains of reality are disclosed can merge with horizons of (non-scientific) interpretive practices whereby the scope of scientific inquiry expands. This "fusion of horizons"—as opposed to the normative demarcation between external and internal—does not jeopardize or compromise science's cognitive autonomy. The interpretive creation of autonomy (autonomous leeway for doing research) within the interrelatedness of scientific practices does not protect the domains of inquiry from the intrusion of external subjects, themes, and goals. However, by inscribing and circumscribing these "external factors" within the proper horizons of inquiry—so the argument of interpretive internalism goes—the creation of "autonomy through openness" facilitates the expansion of scientific domains.

Holding the view of interpretive internalism distinguishes hermeneutic realism from mainstream philosophical hermeneutics in an important way. A premise shared by otherwise essentially different thinkers like Hans-Georg Gadamer and Karl-Otto Apel is that science and objectivism go hand in hand. Champions of different schools of philosophical hermeneutics do not call into question the primacy of normative epistemology— and the normatively fixed subject-object relation—in objectifying science. What these thinkers have in common with normative epistemologists is the presupposition that re-contextualization of the very epistemic relation in the process of inquiry would destroy the objectivity (as they tacitly equate with objectivism) of science. Traditional hermeneutic philosophers deny the view that the epistemic relation of objectification is contextually situated and amenable to re-contextualization within inquiry's interplay of practices and possibilities. For these philosophers, objectifying inquiry lays, from the very outset, a de-contextualized foundation of knowledge production. Deconstructing this foundation by contextualizing the epistemic relation of objectification within inquiry's interplay of practices and possibilities is a task of hermeneutic realism. In coping with this task, the hermeneutic realist opposes any form of politically inspired control over scientific inquiry.

There is nothing dangerous in having scientific inquiry that resists external "democratic control" and determines its own values and goals. What is dangerous is the political insistence on such a control. Only scientific inquiry freed from social monitoring is able to serve societal needs, at the same time preventing a politically initiated scientification of societies, i.e., a scientification guided by dubious economic and political interests. What can be treated as a really menacing situation is the unduly proposed scientification of all spheres of socio-cultural life through sciences that are not able to preserve their cognitive autonomy, thereby becoming exposed to political control, manipulation, and misuse. Evelyn Fox Keller formulated in the 1980s a dilemma that has subsequently played a pivotal role in science wars: Scientific knowledge is either the only kind of objective and truthful knowledge, or science is divorced from nature and married instead to culture, which implies that scientific knowledge is characterized by cultural relativism. Grasping the first horn of this dilemma would lead to the acknowledgement that only scientists

are privy to objective truth and the authority of science is unassailable (Fox Keller 1987, 45). Choosing the other alternative would compel us to make cultural relativism and the "polytheism of values" our religion. The hermeneutic realist believes that Fox Keller's formulation expresses in several respects a wrong dilemma. First, it incorrectly assumes an ontic dichotomy between nature and culture. Second, the formulation introduces the opposition between objective knowledge and relative knowledge within a Cartesian framework. But the most significant deficiency consists in ignoring the ways in which the objectivity of scientific knowledge is contextualized without becoming relativized. *Contextual objectivity without relativism* is a formula advocated by the hermeneutic relativist. Following this formula as a counterpart of interpretive internalism has tremendous socio-political consequences for fighting scientism without undermining the authority of science.

The more adequate the reactions of the research process to its milieu, the higher is the process of inquiry's plasticity and the leeway in choosing possible roads of inquiry. Without this plasticity the external pressure would be destructive. In interpretive internalism, however, what becomes incorporated is not left unchanged. To reiterate, all themes, values, and goals infused in the process of inquiry become redescribed in accordance with the possibilities that can be appropriated within the domain's articulation. The incorporation of external tasks in the autonomous research is an assimilation of these tasks within the proper horizon of interpretation. In other words, the meaning of what becomes incorporated is recast in accordance with the interplay of scientific practices and possibilities for doing research. As already indicated with regard to the criticism of phenomenological doctrines ascribing a grounding function to the pre-scientific life-world, the view of interpretive internalism states that all meaning and meaningful entities in scientific inquiry are constituted in the process of inquiry. Scientific inquiry does not permit the import of external meaning that cannot be made "congruent" with the possibilities generated by the practices of inquiry, i.e., the possibilities whose appropriation—by the same practices which generate them—meaningfully articulates the domain of inquiry. Making external subjects, issues, problems, etc., to fit the intrinsic possibilities of doing research within the domain—and thereby incorporating the external demands into inquiry's interplay of practices and possibilities—proves to be the intrinsic device of preserving the hermeneutic circularity through which the domain of reality becomes disclosed in scientific inquiry.[23]

[23] One should stress the significance of taking interpretive internalism into consideration when discussing the subjects of legally relevant scientific knowledge. Though this knowledge is assumed to be authentically scientific, it is always extra-scientifically re-contextualized, thereby becoming unavoidably interest-laden knowledge. Sheila Jasanoff (1997, 209) observes that willingness to accept a particular scientific knowledge as providing testimony for the courtroom "amounts to an expression of confidence in the institutions and practices that produced it." Yet the criterial base of this confidence reflects only the interests of the parties in dispute. (The law's view of what constitutes authentic scientific knowledge is an artifact of the legal system's contingent ability to interrogate scientific communities.) There is no longer any scientific knowledge in the courtroom (as in any extra-scientific space of institutionalized social life). There is only knowledge isolated from the facticity of scientific inquiry. This isolation is the reverse process to that of internalizing

Curiously enough, well-elaborated case studies carried out by upholders of "finalization of science"—a controversial meta-scientific platform for investigating the incorporation of external aims into domains with "closed theories" whereby the formerly autonomous domains are transformed into socio-politically guided, task-oriented research areas—have eloquently demonstrated that scientific inquiry manages to avoid the destiny of becoming a politically controlled and socially planned process. This is due to its potential to project the being of entities implanted in contexts of inquiry upon its own horizons of possible research. By implication, the alleged finalization turns out to be rather a thematic proliferation of existing scientific domains (Bonss et al. 1995). Thus, the selection of what should be counted as man-made factors of carcinogenesis is undoubtedly heavily dependent on political, commercial, and corporative interests. Identified as "entities" laden with such interests, these factors have been implanted—via the clinical discipline of oncology—in various research contexts of biochemistry, cell biology, genetics, histology, and developmental biology. During the post-war development of the domains concerned, the man-made carcinogenic factors were translated into possibilities for studying anomalies in chromosomes, kinds of mutations, the transmission mechanism of genetic information, special metabolic chains within the cell, the ways in which antimetabolites operate as metabolism blockers, the interaction between viruses and cells at the genetic level, and trajectories of morphogenesis (Hohlfeld 1983).

With regard to the way in which scientific inquiry discloses the reality, hermeneutic realism is realism about what is ready-to-hand within changing configurations of readable technologies and spaces of representation in the research process. While in line with the position I will champion, this definition is in need of a serious specification. Scientific research collects pertinent data by manipulating entities that are ready-to-hand within specifically constructed and/or conventionally delineated environments. The acquisition and processing of data take place in such environments. This is why the collected data are idiosyncratic to the instrumentally arranged environment in which they are produced.[24] However, the process of inquiry manages,

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themes, values, and goals in the articulation of domains of inquiry. According to another important observation of Jasanoff's, courts produce the bulk of their scientific testimonies not from established (standardized) scientific knowledge, but from fragmented, contested, and fluid theoretical constructions and experimental results. The view of interpretive internalism states that not only the production of knowledge but also its withdrawal from the process of inquiry and designing as standard scientific knowledge take place within the interplay of scientific practices and possibilities for doing research. Courts very often—by ignoring science's interpretive internalism—usurp the prerogative of scientists to decide what has the status of standard scientific knowledge.

[24] Thomas Crump (2001, 346) is absolutely right when observing that the environments of "the old Cavendish Laboratory at Cambridge and Los Alamos belong to different worlds." Yet the need for arranging instrumental environments is what remains constant in the transition from classical (small-scale) science to Big Science. The search for a detection of gravitational waves as predicted by general relativity is no exception. The technology measuring movements in identical gold-platinum cubes caused by gravitational waves as it is installed on LISA Pathfinder arranges its own instrumental environment and contexture-of-equipment that is located in a circular orbit at an altitude of 1450 km.

through the configurations of its practices, to distance itself from what is directly registered and read through the use of instruments, and to constitute research objects by modeling and saving phenomena. It is the procedural distancing from the immediate manipulation of what is instrumentally ready-to-hand that enables and warrants the autonomy of the process of inquiry as this autonomy is epitomized by the thesis of interpretive internalism. Having a (reflexively controllable) theoretical distance from what is directly ready-to-hand in inquiry allows one not only to make theoretical predictions when saving phenomena, but to devise and construct new instruments for verifying the predictions, thereby setting up new environments of immediate manipulation. But the way of distancing is informed by the immediate manipulation and occurs within the environments of direct instrumentation. It is this instrumentation that produces distance from what is ready-to-hand in scientific inquiry. Therefore, arranging instrumental environments of data collection and (statistical) processing of data, on the one hand, and distancing from these environments for the sake of creating more sophisticated configurations of scientific practices, on the other, are events involved in relations of a mutual reinforcement. The (constructivist) attempts to come to grips with these relations by employing models of strongly successive activities—from immediate manipulation of what is ready-to-hand to theoretical conceptualization—are doomed to failure.

The approaches to inquiry developed in science studies (SSK and STS) that prioritize practices over knowledge exclusively work with the concept of (scientific) practice as rule-following and goal-oriented actions. Accordingly, these approaches are firmly tied to the aforementioned objectivist paradigm of conceptualizing practices as discrete (factual) units. In this paradigm, any particular practice forms a contexture-of-equipment in which all entities enacted by instruments become ready-to-hand. Designated by various expressions, the notion of a contexture-of-equipment plays a crucial role, especially in the conceptions of New Experimentalism. It serves an important function in hermeneutic realism as well. Nonetheless, this is only a subsidiary function. The picture of scientific inquiry as a diversity of discrete and self-enclosed contextures-of-equipment is not in harmony with the interpretive-phenomenological approach to scientific inquiry, where the accent is placed on the continuity and the openness of the research process. Obviously, a laboratory's environment as structured around the research instruments provides the most typical case in point for a contexture-of-equipment in the process of inquiry. This is the environment in which science "brings objects 'home' and manipulates them on their own terms" (Knorr Cetina 1999, 27). The entities within this environment are ready-to-hand and subjected to the conditions of the local social order of a laboratory.

Yet the notion of contexture is extendable to the empirical (objectifying) sciences which are working with controlled observations rather than with repeatable experiments. Most of the observatories might be considered as environmentally circumscribed contextures-of-equipment. The ground-based astronomical observatory equipped with a permanently mounted Newtonian reflector for lunar and planetary observations is the classical example. However, in many types of observatories the condition of environmental localization of data collection and data processing via instruments is either not fulfilled or strongly modified. These are observatories with

rather virtual contextures-of-equipment. The most interesting case in point in this regard is provided by the Ocean Observatories Initiative: a research-driven network organized by the National Science Foundation. The confluence of a number of emerging new technological capabilities (satellites, fiber-optic submarine cables, telecommunication cables, new sensors enabling in situ measurements, data archival systems that can retrieve volumes of data from arrays of sensors, and computer networks that bring real-time data) allows researchers to collect data on various scales by measuring physical, chemical, geological, and biological variables. It is this confluence that creates a virtual contexture-of-equipment. Stated differently, the contexture of data collection is the very network of coastal, regional, and global observatories (plus the facilities required for calibration of instrumentation). Yet the registration of unknown phenomena as measured by data models occurs, as a rule, not in this contexture, but in specifically configured practices of inquiry or in (what I call) contexts of inquiry. Thus, for instance, the prediction of change in the marine environment requires practices of theoretical conceptualization, construction of mathematically sophisticated models, and unfoldment of suitable interdisciplinary methods.

Though existing in a virtual environment, the contexture-of-environment of the Ocean Observatories Initiative is clearly delineated. The next case shows that this delineation is not always possible. I have in mind the case in which the environment of a research-driven data collection coincides with the environment of what is under investigation. The equalization of both environments, however, follows the way in which the respective domain of inquiry becomes disclosed in interrelated scientific practices. This equalization cannot take place before the incipience of the domain's meaningful articulation. This is why the proper environment of what is investigated takes the form of an environmental contexture-of-equipment.

Thus, for instance, the presuppositions of how to gather relevant data inform the way of delineating a suitable contexture-of-equipment in the domain of studying ecological succession. At stake is the controlled observation of succession as a process undergone by ecosystems (such as forests), provided that these ecosystems achieve—in the phase of maturity—an equilibrium between the community of (populations of) living organisms and its physical environment. (The equilibrium indicates a steady state of the ecological community.) When ecologists are studying the successional modes of behavior, they are looking for patterns of successive stages. Establishing the physical environment in which such patterns achieve ecosystems' equilibrium is a way of constituting a contexture-of-equipment. The entities in this environment are, in a sense, indirectly manipulable through the practices of controlled observation in ecosystem ecology. Identifying the patterns in question involves, for instance, (a) research activities that measure the increasing organic content and the increasing differentiation of levels of the mature soil of the ecological community which achieves an equilibrium with its physical environment, (b) research activities that register changes in the community's structure resulting from the utilization of environmental resources, and (c) research activities that measure the rate of replacement of populations of shorter lived species by populations of longer lived ones. All these activities—as involved in practices of controlled

observation—indicate the way in which the physical environment becomes a contexture-of-equipment of dealing with entities that are, in a sense, ready-to-hand. Moreover, the successional dynamics through which an ecosystem achieves its maturity is measurable within this contexture.

Against the background of the examples cited, one is to state that the interlinked activities—each of them following its rules and algorithms—and the material resources they utilize form a contexture-of-equipment that includes basic instruments by means of which entities that are ready-to-hand become manipulated. On this account, it is "ready-to-hand" that has the character of being manipulable. Of course, the contexture-of-equipment of a scientific practice is most typically exemplified by the classical research laboratory. Peter Galison (1987, 75–80) traces the genesis of what one might call the "non-classical laboratory environment" back to Ernest Rutherford's electric counting devices and Charles T.R. Wilson's cloud chambers. The new laboratory environment was spatially designed to allow the execution of many experiments coordinated by groups of experimenters. The main distinctive feature of this environment as compared with the classical laboratory consists in the need for answering the questions of when and how experiments end in an essentially new way. The end is to be sought in the manifold of theoretical beliefs and instrumental practices nourished by the growing complexity of the laboratory environment. Despite the growing complexity, the tendency toward enclosing (spatially, operatively, socially, and instrumentally) the contexture-of-equipment has not vanished. The changing "topology" of the laboratory spatiality offers new mechanisms of enclosing the experimental work in contextures-of-equipment.

To be sure, the contexture of any particular practice of experimentation is devised to be congruent with contextures organized by other scientific practices: There are entities ready-to-hand within it that can be transferred to other contextures. Yet each scientific practice keeps its contexture-of-equipment maximally enclosed. The practitioners manage to do this by retaining the entities manipulable within the contexture's environment. The transfer (and the import) of manipulable entities to (from) other contextures creates some regular links between contextures. Yet transferring and importing such entities is not sufficient to create and maintain a whole network of contextures. Moreover, the inquirers try to keep the particular contextures enclosed. Enclosing the contexture allows them to represent the outcome of practice's multifarious performance through homogeneous semiotic means. The autonomy of the contexture-of-equipment and the homogeneity of the semiotic representation of experimental practice's outcome go hand in hand.

Presumably, the contextures-of-equipment of research practices that collect pertinent data respond to natural orders by emulating them. It is a popular opinion that a laboratory has to reproduce a natural order. In fact, the activities and actions taking place in a contexture-of-equipment respond only to what is meaningfully constituted within scientific inquiry. At this stage, I still do not have enough resources to develop this claim in a consistent and comprehensive manner. But its very formulation stresses another important facet of interpretive internalism: Practices of experimentation, controlled observation, and data processing do not artificially reproduce

or imitate a reality that is somewhere beyond the process of inquiry. Phrased differently, the readable technologies of these practices do not render objective factuality that is beyond—and not constituted within—the facticity of inquiry. Social constructivists seem to hold that it is the other way around. They consider the laboratory milieus as technological and semiotic embodiments of natural orders. Thus, according to Karin Knorr Cetina (1999, 26–32), the "natural order" becomes reconfigured as an order of signs in a laboratory contexture-of-equipment (which by itself is characterized by a local social order). From the reconstruction of natural events and processes through instruments of experimentation—so her argument goes—physicists creates variables (as second-order signs referring to data as first-order signs) that are designed to be employed in the formal models of theoretical physics. The reconstruction of natural orders and the production of signs are construed in terms of practices of representation (in a sense more or less related to representational epistemology). In summary, the semiotic orders created within the socially organized environment of experimentation somehow reproduce something that is "out there", and thus, what is studied becomes technological and semiotic artifacts constructed under laboratory conditions.

Accordingly, the semiotic reproduction and representation of natural orders is universally valid for all kinds of scientific inquiry. Knorr Cetina provides the example of astronomy as a discipline that has been transformed (after the use of photographic plates) from a kind of research that surveys natural phenomena (or observational field research) into a research enterprise that processes images of these phenomena. The insistence on such a transformation, however, still implies a strong opposition between manipulable entities and natural phenomena. The effects and images produced through laboratory manipulations should (somehow) represent the natural phenomena. This is the point of the "enculturation of natural objects" conception. The hermeneutic realist denounces this opposition because it contradicts the thesis of interpretive internalism. All phenomena studied in the environments of scientific practices are meaningfully constituted within these environments. They are neither outcomes of transformations nor do they represent something that by itself is deprived of meaning. They are phenomena of the reality disclosed and meaningfully articulated by scientific practices. Knorr Cetina wrongly admits, in my view, that there is an initial process of imaging the natural phenomena that precedes the articulation of meaning within the laboratory contexture-of-equipment. There is no room for an absolute (non-contextualized) distinction between natural and "cultural" in scientific research, since the very distinction is always already "encultured" and properly carried out in the contexts of inquiry and not beyond them.

In anticipating more extended discussions, I should like to cite a claim that *prima facie* makes hermeneutic realism a kind of interpretive constructivism: All phenomena supposedly entitled to be saved in the research process are meaningfully produced within this process. (This claim is nicely defended by Paul Teller (2001), who—in contrast to Bas van Fraassen—argues that the phenomena to be saved are not to be directly described by empirical substructures of theoretical models. What data models describe and measure are idealized and laboriously constructed

phenomena that have little to do with the descriptions of phenomena predating data models. Yet even these—more intuitive than methodically ruled—descriptions in the process of inquiry are always already contextualized by scientific practices. In admitting that scientific instruments create new phenomena, van Fraassen (2001) seems to accept Teller's argument.)[25] From a constructivist viewpoint, scientific inquiry turns out to be enclosed in a large cycle that involves observable and unobservable phenomena, data models that measure phenomena, theoretical models that save phenomena, theoretical entities that supposedly receive empirical interpretations through saved phenomena, and predictions about the existence of new phenomena that can be saved if they are constructible by instruments.

In contrast to constructive empiricists, social constructivists promise a way out of this cycle. Andrew Pickering and many others argue that behind every phenomenon lies a set of practices. This is an attractive formulation that implies multiple ways of arranging data, phenomena, models, and theoretical models, depending on the social contexts of inquiry. But it is burdened with an unpleasant problem consisting in the unclear status of "behind". If practices are behind phenomena, then the former are causing the latter. Since practices supposedly "pertain" to culture, and phenomena are manifestations of nature, then the unavoidable conclusion is that culture is causing nature. The hermeneutic realist categorically rejects such an absurdity implied by the mysterious way in which practices are put behind phenomena. She insists that all phenomena are contextually revealed within contextualizing practices. Revealing-phenomena-within-practices is neither culture nor nature, and—what is much more important—it is not a causal (or whatever) relation of determination. It is rather a kind of hermeneutic circularity of meaningful articulation within the facticity of inquiry.

At this point an essential specification is needed. I agree, all phenomena are in a sense constructed—by selecting and proceeding patterned data—within contextures-of-equipment by employing instruments of experimentation. These phenomena, as measured by data models, become saved by theoretical models constructed within theories that have predicted the existence of the phenomena. However, the whole constellation—the selection of data, the discovery of patterns in the data outputs, the construction of data models, the measurements of phenomena, the conceptual work of making theoretical predictions, the construction of explanatory models by specifying theory's mathematical formalism, the search for a morphism between data models describing phenomena and explanatory models, and eventually the theoretical way of saving these phenomena—takes place "always already" within a context of scientific practices in which the phenomena are revealed and projected

[25] Some constructivists of the Erlangen-Konstanz school radicalize this role of the instruments for experimentation, and argue that the commonplace view that technology is applied natural science has to be reversed: natural science is applied technology. According to them, only when the scope of the natural scientific experience is strongly determined by the technological infrastructure of measuring, experimenting, and constructing phenomena does scientific inquiry begin to deploy the techniques of "idealizing stylization". On that account, technology is not a particular sphere of social life or a particular "symbolic form" (in Cassirer's sense). Technology is a dimension of the teleological essence of human existence and culture (Janich 2015).

upon possibilities. By implication, all constructive procedures—regardless of whether they will be treated as purely cognitive procedures or as manifestations of social processes of negotiations—are rendered possible within the contexts of revealing the phenomena.

The distinction between a contexture-of-equipment (of a single practice) and the context of inquiry (formed by a configuration of practices) that I introduced in the foregoing considerations looms large, and will play a central role in the remainder. It is a distinction that resonates the ontological difference between the objectified factuality and the facticity of inquiry. A single scientific practice is defined by (a) its functioning as a "readable technology" (Patrick Heelan), (b) its space of semiotic representation of what is read, and (c) its contexture-of-equipment where all entities being submitted to reading and representing are constantly ready-to-hand. Reading and representing are intertwined when producing meaningful results (expressible by signs of various kinds). Intertwining reading with representing has much deeper philosophical roots. From the viewpoint of the kind of philosophical anthropology Hubert Dreyfus and Charles Taylor are developing, human representational abilities presuppose a prior non-causal and non-representational engagement with the world (Dreyfus and Taylor 2015, 62). Reflecting upon and properly conceptualizing this engagement with the world do not undo the importance of representing in human life, but substantially transform the very idea of representation from a mental device of copying the reality-out-there into a medium that is inextricable in the interpretive being-in-the-world. Interpretation is the primary engagement with the world that "circumspectively" (contextually) articulates the world. The articulated meaning is constantly represented-as-something. To represent something-as-something in the ongoing articulation of meaning is what Heidegger calls the "hermeneutic-as" of "circumspective concern".

Notoriously, Heidegger coins the term "circumspective concern" for the pre-objectifying being-in-the-world and the corresponding meaningful articulation of the world. It is this interpretive mode of being that is entirely guided by the hermeneutic-as. The non-representational engagement with the world might be approached in naturalist terms. But this should be a kind of naturalism without essentialism and objectivism, and without hypostatizing a concept of causality. Otherwise, the naturalist account of circumspective concern would run against the tenets of that anthropology which claims the primacy of the non-causal (and non-representationalist) engagement with the world. (An interpretive theory of behavioral coping with the environment—granted that such theories are discussed in artificial intelligence and cognitive science—could be an appropriate candidate for providing the intended naturalist account.) Hermeneutic realism does not admit that the operative range of circumspective concern must be restricted to pre-scientific experience and practices. All practices and contexts of scientific inquiry are guided by circumspective concern as well. Yet the latter operates in science as an intertwinement of reading and representing that dissolves the stability of any referential representation in the sense of representational epistemology.

4 Scientific Inquiry from the Viewpoint of Hermeneutic Realism

The motif of the entanglement of single practices with the interrelatedness of research practices in the process of disclosing, articulating, and objectifying a domain of reality occupies a central position in this book. In developing her program of "agential realist ontology", Karen Barad deals with several issues related to this motif. Since her elaborations are of prime importance to my study, I will take the liberty to comment briefly on them. (The discussion of Barad's views will be continued from another perspective in the next chapter.) Following Niels Bohr's epistemological doctrines that surround the principle of complementarity, she argues that the primary unit of the experimental inquiry is not independent (isolated and distinct) objects with inherent boundaries and properties but rather phenomena that embrace and internalize the procedures of objectification. In claiming this, however, Barad is not seeking a kind of (epistemic or ontic) structuralism. She is rather looking for an ontology that generalizes the quantum-mechanical concept of entanglement.

Barad (2007, 139–141) argues that phenomena—seen as primitive, non-determined relations—are the ontological inseparability/entanglement of "intra-acting agencies". It is the material arrangement involved in intra-actions that effects an "agential cut" taking the form of a non-Cartesian epistemic relation. The agential cut produces resolution within the ontological indeterminacy of a phenomenon that is necessary for measuring and making the phenomenon quantitatively intelligible. Thus, intra-actions enact (contextual) "agential separability"—the non-Cartesian subject-object relation as producing resolution—that enables the exteriority of measurable data within phenomena. Agential separability—always relative to the ontological inseparability/entanglement—provides the ontological condition for non-classical objectivity. ("Non-classical" here is to be understood in a twofold manner: in the sense of quantum mechanics as a non-classical physical theorizing, and as an epistemic property that cannot be cast in terms of classical, representational epistemology.) Barad admits that phenomena ontologically express relations without preexisting *relata*. Reality is composed, so her ontic argument goes, of things-in-phenomena. Dealing with phenomena is the starting point of both meaningful articulation and objectification. The reality of phenomena rules out the delineation of objects. Reality is interwoven human and nonhuman sources of agency (or, to use another expression of hers, a "flow of agency"). Bohr's insistence on the "embodiment of concepts" in material arrangements is part of this story. Concepts and "things" are not to be divided within the flow of discursive practices, granted that the notion of discursive practices is re-conceptualized to cover their intrinsically material-technological nature. Concepts are not merely embodied in apparatuses. Barad (2007, 148) holds the stronger view that apparatuses are discursive practices.

In applying the quantum-mechanical concept of entanglement to "agential ontology", she (like Joseph Rouse) looks for a revisited view of causality. At issue is not

causality as a relation between distinct entities. Such a view is incompatible with her "agential realism" as a position guided by the rejection that separately determinate entities preexist their intra-action. Causality should rather work within the phenomenon revealed by means of a material apparatus. In scientific inquiry, this causal intra-action takes the form of measurement. Since what is measured becomes enacted within the phenomenon, "agential intra-actions are causal enactments" (Barad 2007, 178). (According to Barad, phenomena are material-discursive totalities. Both materiality and discursivity play an agentive role in the causal intra-action.) This holistic view of causality obviates the depressing consequences of dichotomies like natural-cultural and human-nonhuman. The opposite entities involved in these dichotomies do not preexist the totality of causal intra-actions.[26] In this regard, the view of causality-within-phenomena is a necessary counterpart of agential realism as a post-humanist doctrine. Yet, if one—in coping with the task of creating ontology for realism that radically overcomes Cartesian dualism—replaces the classical (physical) view of causality and determinism with a view of causality based on the concepts of entanglement and complementarity, one would only continue to speak naturalist-essentialist prose. Unlike Monsieur Jourdain, however, Barad knows and wants to speak in this way.

Roughly, the necessary counterpart of agential realism is a program of naturalizing epistemology by implementing resources of non-classical physics. (In his review essay of Barad's *Meeting the Universe Halfway*, Trevor Pinch (2011, 431–432) tells a story confirming that agential realism crucially hinges on a kind of naturalizing science studies. In asking her whether this form of realism should depend on the outcome of experiments in physics, Pinch received the answer that she is "happy for her work in science studies to stand or fall alongside the best work in physics." In Pinch's critical argument, using science to bolster a view in science studies is a dangerous game. The hermeneutic realist revises this argument in the following manner: Using science in meta-scientific studies without taking into account the non-objectivist forms of science's endogenous reflexivity unavoidably leads to subjugating these studies to naturalist objectivism. The hermeneutic realist also supports an argument that complements the previous one: Meta-scientific studies that are not commensurate with these forms of reflexivity are a metaphysically dangerous game. It goes without saying that Pinch and all champions of SSK—but possibly not all ethnomethodologists, especially those who follow Harvey Sacks's program of "primitive natural science"—would not be content with this argument.)

[26] However, one might raise the question as to how an intra-active phenomenon "embraces" the causal intra-actions constituting it. Is this "embracement" to be attributed to a "global causal effect" created by all relevant intra-actions? Or is there a non-causal intra-action that elicits the synergy of causal intra-actions? This strategy of questioning can be continued in the following manner. For Barad, (1) the intra-active phenomena are not predetermined by dichotomous differences (like the subject-object one) that preexist them, and (2) the causal intra-actions taking place in them produce differences that are always contextualized. In combining (1) and (2), one confronts two questions. Is the force of contextualization to be derived from the causal intra-actions? Or should one admit that this force operates in a non-causal manner?

A basic tenet of this study is that the philosophy of science—as an interpretive enterprise—has to be continuous not with science's results as they are achieved through (classical or non-classical) procedural objectification, but with science's hermeneutic situations of inquiry and the forms of endogenous reflexivity they engender.

It is my contention that studying intra-active phenomena within scientific inquiry by taking into consideration that the very process of study takes place within the phenomena's intra-actions appeals to reflexivity that cannot be recast in terms of causal intra-action. Without such reflexivity, Barad's central idea of contextual objectivity would be meaningless. (She does not ignore the subject of reflexivity. Yet she uncritically accepts the models of reflexivity suggested in SSK [and other science studies]. Accordingly, Barad admits that two assumptions are indispensable when reflexivity is at issue. First, reflexivity only aims to acknowledge the inquirer's role as a factor in the constitution of evidence. Second, reflexivity is founded on representationalism, and [like reflection] it "still holds the world at a distance" (Barad 2007, 87). Reflexivity is nothing more than iterative mimesis based on a representational distance from what becomes emulated. In my view, both assumptions are wrong.)[27]. Replacing classical causality with a kind of non-classical one as the ultimate foundation of defending realism does not avoid that essentialism from which standard realism suffers. In resisting any kind of naturalist essentialism, the hermeneutic realist admits that all kinds of causality are revealed within the interpretive facticity of practices. Accordingly, there is no causality that preexists the hermeneutic circularity of facticity. This is why the concept of entanglement is applied quite differently in hermeneutic realism as compared with agential realism.

In microphysics, quantum entanglement is a process underlying what is called decoherence: a phenomenon that might be directly observed in some experiments and that supposedly explains the transition from quantum to classical states. Phrased otherwise, in characterizing the loss of quantum superposition (as described by the linearity of the quantum mechanics basic equations), decoherence may explain the emergence of the classical appearance of the macroscopic physical world (Zurek 1991; Schlosshauer 2004). Quantum entanglement has a clear mathematical meaning that refers to the impossibility of rewriting the state vector describing the quantum system composed of two subsystems as a tensor product of state vectors

[27] Against the first assumption, the hermeneutic realist argues that the primary place where reflexivity comes into prominence is not the inquirer's cognitive activities, but the interrelatedness of scientific practices. (Ascribing reflexivity solely to the inquirer as epistemic subject is also not in full harmony with Barad's post-humanist agenda.) The second assumption is wrong since it unjustifiably binds reflexivity to the physicalist notion of reflection. In criticizing the models of reflexivity in the Strong Program, Barad misses the opportunity to approach non-physicalist (in particular, hermeneutic) concepts of reflexivity. It is no accident that she suggests another physicalist notion, that of diffraction, as an alternative to reflexivity: The non-representationalist "diffractive methodology"—i.e., the methodology which looks for differences within entangled states—has to replace the reflexive methodologies. This requirement is simply a corollary to Barad's naturalist attitude.

describing the two subsystems. The states of these subsystems are regarded as being entangled with the state of the composite system. Consequently, there are physical properties that are not derivable from measurements on the subsystems; they can be measured only on the composite system. With regard to quantum mechanics' non-classicality, the concept of entanglement refers to a type of interaction (between physical systems) that is not based on causal relations. It is an interaction grounded upon quantum correlations, i.e., correlations implied by the probabilistic structure of quantum mechanics and its theory of measurement. However, when one delineates as an object of study not the entangled state of a composite system, but the composite system-environment state, then one has to take into consideration the kind of system-environment entanglement. By implication, quantum coherence should be ascribed to the system-environment state, which leads to a violation of quantum superposition and decoherence. This is why entanglement underlies decoherence.

Like the subsystems of a quantum system—and so the heuristic analogy I am going to draw—a particular practice of inquiry (as located in its instrumental environment as a contexture-of-equipment) and a particular configuration of practices (as creating a context of inquiry) cannot be regarded as individual entities (existing per se) when what is at stake is the ongoing meaningful articulation and objectification of a scientific domain. Both the single practice and the context of inquiry are entangled with the totality of the domain's articulation/objectification. This totality is not to be reduced to what the sum of all particular practices and all contexts of inquiry might achieve. There are "quantum correlations" between single practices and contexts of practices (as well as between single contexts and the whole of co-referential contexts) that take place in the articulation and objectification of a scientific domain. Here is an illustration of such a "quantum correlation": When a certain result is obtained by a particular practice of inquiry, the implications of this result are immediately spread out (delocalized) and scattered over a range of (not necessarily directly interconnected) contexts of the domain's articulation. If the quantum entanglement asserts the nonlocal character of microphysical reality, the kind of entanglement invoked by hermeneutic realism implies the nonlocality of scientific practices' factual outcomes within the facticity of inquiry as disclosing the domains of reality. In the course of this study, I will bind the heuristic analogy with the quantum-mechanical concept of entanglement to the discussion of issues like endogenous reflexivity of practices, the characteristic hermeneutic situations in the research processes, the semiosis and textualizing of scientific domains, and the situated transcendence of the production of objectified factuality within the facticity of inquiry. (The concept of scientific domain as the interrelatedness of practices that in their contextuality disclose a domain of reality will play a central role in the remainder. I strongly distinguish this hermeneutic-ontological concept from Dudley Shapere's (1984, 273–276) purely epistemic notion of domain.)

It follows from the considerations in the preceding section that a particular scientific practice—composed of a range of actions and activities operating in a contexture-of-equipment—does not provide the necessary conditions under which a domain of inquiry might exist as a reality *sui generis*. If this practice were to

become isolated from the inquiry's texture of orchestrated practices, it would lose its meaning and its role in the process of meaningful articulation. A scientific practice gains (and manages to maintain) its existence (and reproduction) only through its being entangled with the processual interrelatedness of scientific practices within a domain of inquiry. Only this interrelatedness turns out to be endowed with autonomous (ontologically self-sufficient) existence, and accordingly, with the capability to disclose a distinctive domain of reality.

When the hermeneutic realist argues that the interrelatedness of scientific practices of the process of inquiry enables the opening of the domain's meaningful being, she strongly distinguishes this being from the total (ontic) scope of possible entities, events, and phenomena that can be objectified and constituted as a domain of inquiry. The scope of a domain is first and foremost a scope of objectified factuality that is constructed by means of empirical and/or semantic interpretation of theoretical objects and structures. A plausible way of identifying this scope extensionally is through the set of all possible data models that might (empirically) interpret the theoretical models derivable from the domain's basic theory. Although this is a (potentially) infinite set, the total scope of a domain thus (semantically) delineated is an actual presence. It is fixed by a formal structure of objectification: the theory's formalism (and all specifications it undergoes in the construction of particular theoretical models). The family of all models interpreting this formalism delimits the domain in terms of the theory's validity. (A model is a structure that satisfies the theorems of the theory.) This delimitation can be achieved via the two main formal-semantic approaches: the one based on the specification of "set theoretic predicate" (Sneed-Stegmüller), or the "state space" approach (van Fraassen, Suppe). In the second case, a domain (with one basic theory) would become delimited by delineating configurations and trajectories on the state space, granted that the theory describes a dynamic of the system —which presumably covers the domain's empirical content—in terms of its possible states. (Generally speaking, the semantic approaches to scientific theories are important to hermeneutic realism since they provide images of scientific knowledge's structures that are relevant to the constitutional analysis of meaning within configured practices of inquiry. Hermeneutic realism addresses scientific knowledge as fore-structured and meaningfully constituted by these practices. The semantic approaches identify structures withdrawn from the ongoing fore-structuring.)

In contrast to the extensional-semantic (and the extensional-empirical) delineation and delimitation of the domain's scope as the latter is determined by the basic theory's postulates (and their symmetry and invariance group), the processual interrelatedness of scientific practices opens the domain's being as an ongoing meaningful articulation that never becomes a mere presence. Disclosing and articulating reality within the facticity of practices is guided by a kind of reflexivity. On several occasions, I will argue in the remainder that this reflexivity is due more to the "logic of practices" than to the reflexive behavior of inquirers. Scientific practices constitute the contexts of inquiry—and accordingly, the contexts of a domain's meaningful articulation—by pursuing the ways of creating possible configurations within their interrelatedness. By implication, their interrelatedness does not build an independent structure of relations that preexist the arising contexts of inquiry. The

totality of interrelated practices disclosing a scientific domain consists in constantly changing configurations or contexts of configured practices. The interrelatedness of scientific practices is projected upon a horizon of such possible configurations. Since the possibilities of configuring entirely depend on the capability of practices to be compatible with one another under certain circumstances, the pursuit of possible configurations characterizes practices' endogenous reflexivity. Each particular practice of inquiry embedded in the interrelatedness (which discloses a domain) is always already committed to this reflexivity.

Seemingly, the epistemologically organized objectification "receives" the reality of this articulation. Accordingly, the subject (the scientific community) performing the objectification commences to apply norms and criteria to what is "received", thereby trying to attain objective knowledge by presupposing—and only occasionally reflecting upon—the domain's articulation within and through the interrelatedness of practices. However, drawing such a conclusion leads us to a distortive doubling of reality in the sense of the second view of the "diremption of reality". As already indicated, in splitting the reality of a domain—in ongoing articulation and objectified factuality—within the process of inquiry, this view does not prioritize the pre-scientific life-world as the only source of the constitution of meaning. Moreover, the view is commensurable with the thesis—advocated by hermeneutic realism—that only through the practices of scientific inquiry does reality become meaningfully articulated in a manner that permits objectification of a domain. In contrast to hermeneutic realism, however, this view admits that the reality of a domain objectified in scientific inquiry—in accordance with epistemological norms and criteria—is built upon the meaningful articulation accomplished by scientific practices and their contextures-of-equipment. Consequently, the reality of a domain as objectified factuality somehow supervenes upon the reality of the meaningful articulation within the interrelatedness of scientific practices. Assuming that such a supervenience takes place in scientific research implies that there is some order of determination (possibly involving chronological sequences) between the "realities" of articulation and objectification.[28]

In opposing this view that tacitly or explicitly appeals to a conception of supervenience between objectification and articulation, the hermeneutic realist holds the following relation of complementarity: There is no meaningful articulation of a

[28] I am using here the term "supervenience" in a manner similar to that in which analytical philosophers use it in characterizing the relationship (say) between moral properties and natural properties, or between mental characteristics and physical characteristics. In this context, altering something in the regime of meaningful articulation of a scientific domain necessarily alters something in the procedural objectification of that domain. Changes taking place in the former necessarily entail changes appearing in the latter, granted that the relation of entailment does not exhaust the relation of supervenience. If formulated as a necessary condition for having a relation of supervenience, the entailment of changes is possibly met by the relation between articulation within scientific practices and objectification through procedures. Yet several analytical philosophers show that the relation of supervenience is a non-symmetric relation. By contrast, the relation between meaningful articulation and procedural objectification is presumably symmetric: A change in the meaningful articulation of a phenomenon supervenes on a change in the regime of its objectification.

scientific domain if this articulation would not fore-structure the constitution of a structure of procedurally objectified factuality. Vice versa, there is no cognitive structure (of knowledge) about objectified factuality that avoids interpretive fore-structuring within the facticity of inquiry. The hermeneutic realist makes sense of domains of inquiry (as domains of reality) by elaborating on the complementary interpretations of the dynamic unity of meaningful articulation and procedural objectification, granted that interpretive fore-structuring and structure of objectification contrast with each other in every respect. In the remainder, several of these interpretations will be scrutinized. I will start with complementarity between the "hermeneutic-as" and the "apophantic-as" in the process of inquiry.

The heuristic analogy with quantum-mechanical entanglement is first and foremost invoked in order to eradicate the diremption of reality based on the assumption that procedural objectification (and the production of objective knowledge) supervenes on the manipulation of what is ready-to-hand in scientific inquiry. The outcome of manipulating entities within a contexture-of-equipment of a scientific practice is immediately dislocated and scattered over contexts of objectification. The hermeneutic realist counters the assumption of supervenience by arguing that objectification is not a "procedure" secondary (and successively accomplished) with respect to the constitution of meaning by the interrelatedness of scientific practices. There is no relation of entailment between the constitution of meaning through readable technologies and the production of objective knowledge by implementing normative procedures such as making diagrams based on experimental data, sketching position-time graphs, experimental testing of a theoretical prediction, fitting data models to a theoretical structure, and achieving a covariant formulation of the basic equations (describing the dynamics of systems characteristic of a domain) whereby the equations become invariant under certain transformations. But there is also no consecutive order of manipulative reading and objectifying procedures in the process of inquiry. By the same token, objectification is not procedurally implemented *post festum*, when there is a "piece of reality-at-hand" already meaningfully constituted. Any admission that objectification works ex post still does not dispense with the metaphysics of presence: There is a present reality that after being articulated waits to become objectified.

In hermeneutic realism, objectification is always situated and embedded in practices' interrelatedness. Though fore-structured by the facticity of interpretive constitution of meaning, objectification is accomplished—without temporal lag—together with the domain's meaningful articulation. (In an alternative formulation that will be clarified later, meaningful articulation and procedural objectification share the regimes of "temporalizing of the temporality" of inquiry.) There is a complementarity between the hermeneutic-as of articulation and the apophantic-as of predication/objectification in each configuration of scientific practices. They complement each other within the contextures-of-equipment as well as within the contexts of inquiry. Suppose that one is experimenting with DNA molecules by using the most basic laboratory equipment. Manipulations like the extraction of a crude DNA, precipitating the nucleic acids with cold ethanol, resolving the extracted DNA in a buffer, lysing plasmids of certain types, purifying the plasmids from other

cellular components, and separating plasmid DNA from chromosomal DNA are carried out within a laboratory contexture-of-equipment. The execution of these manipulations is entirely guided by the hermeneutic-as without making use of objectifying predication. But within the same contextures one distances oneself from what is manipulated, and predicates, say, that the double-stranded molecules of non-chromosomal DNA contain genes for the production of degradative enzymes. Furthermore, one embodies this result in a system of signs (sentences, graphs, diagrams, etc.). The way in which the apophantic-as works in this contexture results in objectifying predication and its semiotic representation.

The result thus obtained becomes immediately dispersed in several configurations of molecular-biological practices. In each particular context of inquiry, one is working out the experimental result about the function of these non-chromosomal genes again in accordance with the hermeneutic-as, which articulates meaning, and the apophantic-as, which underlies the production of objectified factuality. Yet the way in which both types of "as" complement each other on the level of the contexts of inquiry essentially differs from their complementarity on the level of the particular contextures. I am not going to discuss this problematic now. It will be handled in the chapter titled "Meaningful Articulation and Objectification of Reality in Scientific Inquiry". At the moment, we only note that addressing the complementarity on the contexts level requires a much broader concept of hermeneutic-as than that of the existential analytic. My point is that there is within a context of inquiry a circulation of semiotic representations, each of them originating from a particular contexture-of-equipment. The hermeneutic-as articulates meaning by mediating between the semiotic representations. (The apophantic-as of theoretical predication objectifies what is contextualized.) Thus considered, the hermeneutic-as contributes to the entanglement of instrumental contextures with contexts of inquiry.

A possible objection against the complementarity of articulation and objectification might be raised from the viewpoint of normative epistemology. According to this viewpoint, what is meaningfully constituted through manipulation of entities that are ready-to-hand only becomes subsequently identified via epistemological criteria of objectivity. Before applying such criteria, there is no objectification. This objection wrongly equates objectification with normative estimation of what is objectified. It is the identification by means of criteria of objectivity—and not the objectification itself—that is postponed by the complementarity of articulation and objectification. Roughly, the complementarity takes place in the constitution of a domain, while the application of epistemological criteria is a matter of justification of what has been constituted.[29] These criteria are applicable under the condition that the particular space of representation is de-contextualized, and consequently, the signs serving the representation function are treated as having firm references. Under this condition, what is represented becomes identifiable as objective values of quantifiable variables, as objective experimental results, as objective measurements, and as objective data models that can be embedded in the

[29] Here I mean the distinction between the "context of constitution" and the "context of justification" as it is introduced and championed in Ginev (2000, 60–69).

mathematical structure of a theory, etc. In all these cases, the complementarity of the hermeneutic-as and the apophantic-as is replaced by a strong dominance of the apophantic-as. (There is no room for the hermeneutic-as in the normative-epistemological estimation and justification.)

Though the results of manipulative reading are located in the (physical and social) environment of a particular practice (readable technology) and its contexture-of-equipment, the ensuing semiotic representation is—at the very moment of producing signs from what is manipulated within the contexture-of-equipment—deferred to the space of representation of another scientific practice. In paying attention to the polysemy of the term of representation, Hans-Jörg Rheinberger (1997, 104) focuses on the description of "the process of making science as a process in which traces are generated, displaced, and superposed" in the sense of representing something-as-something. Accordingly, at stake is a semiotic representation that represents something seen as being there and not being there. The deferral of spaces of semiotic representation—so Rheinberger's argument goes—takes place in this process of producing and displacing/dissipating semiotic "traces". It is this deferral that enables the ongoing contextualization of scientific practices in the form of contextual configurations. (By definition, a configuration of practices of inquiry that at once enables and is enabled by a deferral of spaces of representation is a relatively autonomous context of inquiry. Accordingly, within a particular context the spaces of representation—as related to the specifically configured scientific practices—are interpenetrating each other: The space of measurements is already deferred in the space of designing new experiments, the space of data models is deferred in the space of interpreting theoretical models, the space of calculation penetrates the space of initiation of new measurements, the space of revising the formalism of theoretical models overlaps with the space of constructing new data models that register an unobservable phenomenon, and so on.) The chapter titled "The Production of Objectified Factuality Within the Facticity of Scientific Inquiry" will make the case that this ongoing contextualization is characterized by a kind of endogenous reflexivity.

In introducing semiotic motifs for tackling issues of meaningful articulation, one is in a position to pinpoint another distinctive feature of the entanglement of single practices with the whole of contextualized (and contextualizing) practices. The entanglement underlies the conjunction of the local production of signs and the dislocation of their meaning due to the deferral of semiotic systems and the circulation of representations. At stake is again the potential dispersal of the output of any particular contexture-of-equipment in the total semiosis of a domain's articulation. Being meaningfully constituted, the objectified factuality as manifested by semiotic representations exists both in the systems of signs produced within contextures-of-equipment and the circulation of signs and significations—Rheinberger speaks of "graphemes"—in any context of research. This dual existence is due to the entanglement on a semiotic level. Thus, for instance, the urea cycle as a particular metabolic pathway is an object of inquiry—or an entity envisioned by a piece of objectified factuality—that can be read and represented by manipulating items ready-to-hand. This object becomes primarily fixed by locating it in the cells of

certain organs. When the study of the urea cycle is confined to mammals, the location is the cells of the liver and the kidney. A further step is its more precise identification in the intracellular fluid and mitochondria. This step requires the construction of data models. Within the latter the object is specified as a series of enzyme-catalyzed chemical reactions.

The metabolic function of the urea cycle is to convert two amino groups into a nontoxic excretion product. Thus envisioned and specified as an object of inquiry, the urea cycle is capable of laboratory measurement in various contextures-of-equipment enabling, for instance, measurements of the kinetics of different enzyme systems and regulatory factors, the compounds related to the urea cycle, the production of N-acetylglutamate for the sake of establishing the role of this allosteric cofactor in the urea cycle, the variability of glutamine as related to metabolic inhibitors, the conversion of arginine to ornithine and urea, etc. The resulting data of such measurements are represented through diverse semiotic means, e.g., screening tables, images obtained by thin-layer chromatography, graphs, diagrams, representational devices of urine screening programs, and so on. The output of data represented by a system of signs becomes dispersed in (say) contexts of clinical inquiry such as the quest for differentiating between types of ornithinemia, the early diagnosis of enzymatic defects causing disorders of the urea cycle, the development of the "artificial liver" for studying enzyme systems embedded in fibrin membranes, and the study of enzyme kinetics with regard to the role of inhibitors. In any of these contexts a circulation of semiotic representations takes place. One contextualizes the empirically and analytically identifiable properties responsible for the specificity of the (clinically normal) urea cycle. Identifying such properties comes into being through relating enzymological models to data models. At the same time, a range of physiological, cytological, and biochemical phenomena are amenable to being saved in the contexts in which the urea cycle is envisioned.

The preceding considerations provide an additional argument for the claim that the interrelatedness of practices is not a structure of relations imposed upon the readable technologies as operating in their contextures-of-equipment. The interrelatedness owe its existence to the deferral and the interference of spaces of semiotic representation and the concomitant transfer of semiotic systems (encompassing signs as diverse as tables, samples, diagrams, equations, graphs, charts, and photographs, etc.).[30] This is always an interrelatedness in the making. However, the overlap and the transfer mentioned take place within the horizon of possibilities upon which the same practices project their interrelatedness. By implication, the production of semiotic representations and the total semiosis of a scientific domain are also predicated on a horizontal continuity.

The talk of meaning in the hermeneutic philosophy of science has two focal points, related roughly to the semiosis and the fore-structuring of objectified factuality. On the one hand, at issue is the meaning articulated in the facticity of

[30] But vice versa, a requisite of the circulation of representational devices in the process of inquiry is the mutual compatibility of practices and their reflexive capacity to form contextual configurations.

inquiry. This is the meaning that fore-structures and becomes objectified in the produced factuality. On the other hand, one is dealing with the meanings originating from particular practices and circulating within any particular context of inquiry. The contextual circulation of meanings corresponds to the circulation of semiotic representations. The meaning of signs produced by a certain readable technology in its space of representation is made comprehensible by the representational device of another readable technology.[31] Thus, experimental measurements are made intelligible by being represented as data graphs and data diagrams; the meaning of the latter is comprehensible by being used in designing computer simulations; they become meaningful by being related to new computational techniques; the meaning of the output of applying these techniques is embodied in new data models; they should receive meaning through their embeddability in theoretical structures; and so on. Taken separately, each device/space represents signs referring to manipulable entities. Granted that the manipulations within contextures-of-equipment are accomplished to produce signs embodying meanings of objectified factuality, the isolated space of representation refers to this factuality. Yet, placed in the whole semiosis of scientific inquiry, a particular space of representation expresses a particular facet of the constitution of objectified factuality within the facticity of inquiry.

The deferral of shifting and interfering spaces of representation within a relatively closed configuration of practices also forms a relatively autonomous cycle. After closing such a cycle, certain signs (or even whole semiotic systems) prove to be eliminable in principle. Thus, the process of inquiry based on path analysis in population genetics employs diagrams to visualize how simultaneously varying factors work in causal pathways. They become eliminable when the practice of solving linear equations comes into effect. The semiotic system of equations not only translates but also eliminates the semiotic system of diagrams. However, James Griesemer shows that this eliminability does not take place in the domain of population genetics. Though they are mathematically replaceable by linear path equations, diagrams are ineliminable since their implementation "has the side effect of making path analysis more powerful than causally indiscriminate statistical methods lacking such devices" (Griesemer 1991, 172). The use of alternative representational devices is in several prominent historical cases tied to basic conceptual controversies in the development of a scientific domain. Thus, Philipp Sarasin (2007) shows the importance of the devices of visualization in the dispute between Rudolf Virchow's cellular pathology and Robert Koch's bacteriology. The opposite parties' reciprocal accusations of incapability to distinguish between facts and artifacts by means of

[31] The different representational devices are characterized by different degrees of plasticity in making comprehensible signs already produced by a readable technology. Thus, Roger Krohn (1991) makes it clear that statistical graphs as a representational device reemploy the researchers' powers of visual perception and pattern recognition, which facilitates the creation of models. Statistical graphs belong to a large class of scientific visuals (diagrams, drawings, maps, photographs, etc.). An open question that deserves a separate study is the question of whether there is in the articulation of a wide range of scientific domains a tendency toward amplifying the role of visuals in the circulation of semiotic representations.

the visualizations employed are a symptomatic feature of this dispute. Interestingly enough, the new spaces of representation and the circulation of new semiotic means prompted to a great extent the emancipation of bacteriology.

In scrutinizing the impact of the realism debate in the analytical philosophy of science on the ways of discussing the issue of the epistemological status of semiotic representation in scientific inquiry, Paul Tibbetts (1988, 119) argues that the salient topic is "the extent to which realist and constructivist elements are mutually at work and interactive in the design and utilization of representational devices in scientific contexts." The hermeneutic realist cannot concur with this suggestion. The problematic of scientific representation is not to be addressed by combining elements of realist and constructivist positions, while keeping intact the very conceptual framework which all these positions share. The debate between realists and antirealists regarding the status of representation exclusively revolves around the referential meaning of representation. In other words, at issue is only the kind of representation in the sense of epistemological representationalism. Both parties recognize or deny representation "in the sense of an adequation or approximation of something out there, either conceptually or materially" (Rheinberger 1997, 104). For both parties, the kind of processual scientific representation as discussed above remains hidden.

In the ongoing deferral of spaces of representation, a quasi-semiotic play of signifier and signified often takes place: What is represented as a signified outcome in a certain space becomes a tool of representation (signifier) in the next space. This brings me to an extension of the conception of textualizing—originally developed in Ginev (2011a, 17–22)—and the introduction of the concept of "text" (hereafter always put in quotes in order to be distinguished from all other uses of the word). Reading and representing qua textualizing articulate meaningfully a domain of research by working out the immediate meanings obtained by instrumental manipulation of entities that are ready-to-hand in scientific inquiry, and transforming this meaning into a meaning contextualized and intercontextualized by means of the translatability of systems of signs. In a nutshell, the view that will be defended is that the non-immediate meaning—produced not in contextures-of-equipment but in contexts of configured practices—is at once incorporated in "texts" and always beyond any textual structure. This is meaning constituted by the interplay of practices and possibilities in scientific inquiry, and not by the subjective intentions and intentional actions of inquirers. The contextualized meaning has a being in the process of textualizing that is projected upon possibilities.

Tentatively, a "text" constituted through contextual reading and representing in the process of inquiry at once (a) "documents" the facticity of interplaying practices and possibilities and (b) incorporates theoretically structured knowledge about objectified factuality. The concept of "text" should do justice to both the objectified factuality and the facticity of inquiry which fore-structures the objectification of factuality. If one were going to overlook (a), one would turn the "text" into a theoretical structure interpretable in sets of data, thereby arriving at a classical image of the analytical philosophy of science. The concept of "text" should be defined in a manner that ought to make (a) ineliminable.

The conception of textualizing is not to be confused with Rorty's "textualism" whose core is the thesis that there is no reality transcending the plurality of texts. Textualism is a doctrine complementing Rorty's epistemological behaviorism by alluding to devices of undoing representationalism, presumably avoiding the dangerous proximity to social-interactionist naturalism. At the same time, this doctrine specifies epistemological behaviorism by providing additional rationales for discarding the idea of a "meta-practice of justification". Roughly, textualism offers new arguments in favor of (what Rorty calls) "conversational justification" as opposed to the concept of justification embedded in the epistemological tradition. Textualism is not a new (post-classical) sort of epistemology (cum pragmatic semantics) but a radical attempt at eliminating the idea of a meta-textual epistemological framework of interconnected concepts of truth, meaning, epistemic representation, method, and normative rationality. The doctrine assumes that "all problems, topics, and distinctions are language-relative—the results of our having chosen to use a certain vocabulary, to play a certain language game" (Rorty 1981, 155). All vocabularies are culturally constituted and by no means causally determined by what they describe. There is no extratextual reality that has at its disposal an immanent vocabulary (for instance, a vocabulary of nature's "natural kinds"). Rorty distinguishes between a weak and a strong form of textualism. The weak textualist still insists on a philosophically significant difference between what natural scientists do and what literary critics do. Thus, he remains captivated by the Diltheyan postulate of the epistemic uniqueness of interpretation as compared with science's cognitive procedures, and still tolerates the absoluteness of the natural scientific vocabulary. In addition, the weak textualist embraces the classical dogma of structuralism (in literary criticism) that each text has its own code that determines the way in which the text represents something extratextual. This is why he is still a victim of the metaphysics of presence. The weak textualist is not willing to compromise his belief in the reality of a "transcendental signified".

By contrast, the strong textualist "simply asks himself the same question about a text which the engineer or the physicist asks himself about a puzzling physical object: How shall I describe this in order to get it to do what I want?" (Rorty 1981, 168). According to strong textualism, scientific inquiry is no more than an activity of creating texts in which pragmatic inclinations and orientations are incorporated. These texts are distinguished by specific literary genres. Now, the question arises as to how one should construe the attribution of literary design to scientific texts. If the strong textualist's claim is restricted exclusively to the texts composed for the purpose of communicating scientific results, then the claim is trivially true. Scientific texts (papers and other publications) inevitably contain threads of argumentation and persuasion, and they are accordingly rhetorically designed. By implication, they are distinguished by something like literary genres in the broad rhetorical sense of that concept. Reaching this conclusion, however, is by no means the strong textualist's intention. He is rather preoccupied with the idea that the pragmatic delineation of objects of inquiry is but a creation of texts (in the sense of being organized by discursive genre vocabularies). Hence, discursive genres are to be ascribed (not only) to the composition of texts for communicating results of scientific inquiry. If

genre is the structuration of meaningful events in accordance with a regime of temporalizing a horizon of meaningfulness, then textualism needs a conception about the "genre" articulation of meaning. Rorty tacitly admits that the post-epistemological, pragmatic-romantic placing of literature at the center of culture assumes the universality of (what I called) "textualizing", but his view is too static to conceptualize the latter. Rorty's doctrine strongly resembles the way of absolutizing texts used in legal textualism.

In accordance with the descriptivist attitude of his epistemological behaviorism, Rorty cuts off the diversity of vocabularies embodying various discursive genres from the process of "textualizing" (the ongoing constitution of vocabularies/texts). Consequently, textualism lacks the resources to address process-related characteristics of the texts-in-the-making. In depriving textualism of relevance (to the ontological problematic of the constitution of meaning), Rorty ignores the meaningful articulation which both constitutes texts and becomes "written down" in texts. It is this articulation that cannot be addressed in a purely descriptivist manner. Furthermore, though Rorty (1991) insists on a view of "inquiry as re-contextualization", strong textualism has no resources to study precisely the contextual constitution of texts.[32] By contrast, the hermeneutic realist argues that there are "texts" in scientific inquiry because textualizing is in the first place a proper contextualization of domains' meaningful articulation (Ginev 2014d). Reading-as-textualizing constantly re-contextualizes meaning in the articulation of a domain of inquiry. Stating that meaning is only produced by textualizing and re-contextualization implies an extension and specification of the de Saussurean view that meanings ("linguistic values") are produced through the differences between signifiers.

For the hermeneutic realist, this view is to be extrapolated to the meaning of the whole contextualized "texts" articulating a domain: Any particular "text" gains its meaning through its differences from other contextualized "texts".[33] Yet, this extrapolation does not imply that only the "play of differences" within the alleged intertextuality generates the meaning of the particular "texts". The hermeneutic realist is not willing to compromise the basic concept of interpretive fore-structuring, dissolving it in the intertextual play of differences. In insisting that the differential

[32] With regard to his criticism of (scientific) realism, Rorty (1991, 63) argues that realists insist on the idea that the object of inquiry has a context of its own, a context that is privileged by virtue of being the object's rather than the inquirer's. For Rorty, privileging such a context provides the broadest criterion for realism, a criterion that unites champions of scientism with non-ethnocentric anthropologists and literary critics who still believe in structuralism. Interestingly enough, this criterion is formulated in terms of a distinction that echoes the Cartesian dualism, namely the distinction between the object's context and the inquirer's context. The epistemological behaviorist (being a pragmatic antirealist) sticks to the inquirer's context, i.e., the context in which what exists is whatever the contextually generated beliefs hold true for.

[33] There is a kind of Derrida-like "economy" operating on various levels of the domain's meaningful articulation and abolishing any allegedly invariant structure of meaning (and/or allegedly static presence of meaning). Defined by means of the "economy of differences", meaning (of particular items like measurements, observations, diagrams, data models, theoretical concepts, etc., as well as of whole "texts") is always "absent presence".

between "text" and relevant context is not to be blurred, the hermeneutic realist assigns the interpretive fore-structuring first and foremost to the horizon of inquiry. In other words, this fore-structuring lays out the horizon of possibilities for the formations of cycles of circulating semiotic representations and meanings. Textualizing is the ongoing formation of relevant contexts for possible "texts". The play of differences, through which the particular "texts" are intertextualized, is always already contextualized, i.e., carried out under the conditions of contexts that in their coreferentiality constitute the intercontextuality of a domain of inquiry. Accordingly, the intertextuality dictated by the play of differences is subordinate to the intercontextuality—a claim that will be discussed for several reasons in the remainder.

The usual way of opposing the strong textualism of poststructuralist literary criticism to the strong contextualism of traditional historiography is basically irrelevant to the conception of textualizing. At stake in this controversy is the strategy of decoding texts. Hermeneutic realism has little to do with cultural studies of textualized artifacts in science. The conception of textualizing cannot be reformulated in such studies. Textualizing is not merely a creation of "cultural texts" or textualized artifacts. It is first and foremost a contextual constitution of meaning that—by being from the very outset scattered over an undetermined number of contexts—becomes intercontextualized. On another formulation, textualizing in scientific inquiry refers to the processual unity of factuality and facticity with regard to the way in which the meaningful articulation of a scientific domain is related to semiosis. From this perspective, a claim already raised can be reformulated: In preserving the validity of the text-context distinction—but stressing at the same time the priority of textualizing over both texts and contexts—the hermeneutic realist insists more on the domain's intercontextuality rather than on the "tracing game" taking place in the relations among the "texts" in a scientific domain.[34]

Let me reiterate: A "text" stands for the (always unfinished and incomplete) outcome of reading, representing and textualizing within a context of configured scientific practices. In avoiding the essentialist image of a text-within-context, the chapter titled "Meaningful Articulation and Objectification of Reality in Scientific Inquiry" focuses on the sense in which a "text" is constituted by a circulation of representations and a synergy of practices' readable technologies. The Concluding Chapter is entirely devoted to the concept of "text" as the unity of producing-objectified-factuality-within-the-facticity-of-inquiry. The contextual constitution of a "text" contains a kind objectification that—through intertwined reading and representing—creates objectified factuality. Within a "text" isolated from the facticity of inquiry, the objectified factuality only has actual presence as manifolds of values of quantifiable variables. (A "text" withdrawn from the meaningful articulation of a domain becomes theoretical knowledge structured by its semantic interpretation. Taken in its isolation from the facticity of inquiry, this knowledge is amenable to

[34] To claim that there is, in the articulation of a scientific domain, nothing outside the textualizing intercontextuality amounts to defending a realism about the facticity of inquiry, since reality-as-facticity—as disclosed, in particular, by the facticity of inquiry—projects the totality of its meaning upon this intercontextuality.

reconstruction in accordance with the norms which have governed the epistemic procedures of its production.) In the process of inquiry, the kind of objectification (involved in the "text") is still entangled with (and fore-structured by) the domain's meaningful articulation. Conceptualizing a relatively autonomous "text" as being open to re-contextualization and further fore-structuring requires an approach to the meaningful articulation and objectification of a scientific domain based on a unitary conception of textualizing.

The interpenetrating spaces of representation prompt the ways in which a synergy of readable technologies comes into play. What becomes meaningfully articulated in a certain (relatively autonomous) context of inquiry is a unity of experimental data, measurements, data models, observable and unobservable phenomena, and theoretical model(s) entitled to save the phenomena. The hermeneutic realist does not deny that this unity can be reconstructed as an intratheoretical process, or as a process of theory construction. However, since this unity does not "exhaust" what the "text" is about, and the "text's" meaning is always already within a horizon of possibilities, it would not be correct to state that the "text" itself is in its relevant context. The reconstruction of the aforementioned unity of data, phenomena to be saved, and models is the agenda of constructive empiricism (or structural empiricism). With this agenda, scientific investigation ought to represent "the empirical phenomena as embeddable in theoretical models, and those models are describable only up to structural isomorphism" (van Fraassen 2006, 305). This is what scientific representation is all about, provided that the process of inquiry is totally encapsulated within the theory construction. The structural empiricist might also introduce and work with an (intratheoretical) concept of text.. Accordingly, a text would be that logically/semantically self-sufficient unity of lower level structures and procedures which are necessary for embedding the empirical phenomena in the highest level structures, provided that the embeddedness is describable only up to isomorphism (or at least to other kinds of structure-preserving morphisms).

Following the idea of the interpretive openness created by the interplay of practices and possibilities, the hermeneutic realist holds that any intratheoretical text (thus defined) is always open to be re-contextualized within the facticity of inquiry.[35] Accordingly, a relatively autonomous "text" cannot be reconstructed as a unity of discrete structures that is adequate to saving a phenomenon (or a class of phe-

[35] By contrast, the constructive empiricist argues that all (non-theoretical) scientific practices must be considered as a continuation of the theory construction by other means. Assuming that the theory construction is situated within scientific practices would rule out the implementation of empirical adequacy as a criterion for a successful way of saving observable (and unobservable) phenomena. Notoriously, the search for empirical adequacy in constructive empiricism goes hand in hand with the semantic view of scientific theories. Van Fraassen (1980, 64) clearly avers that some models of a scientific theory are specifiable with regard to their empirical adequacy as "candidates for the direct representation of observable phenomena." This kind of representation is still in the spirit of representationalist epistemology. My point is that—despite van Fraassen's efforts to subject the search for empirical adequacy to the logic of the hermeneutic circle—the irremovable remainder of this epistemology is due to the intratheoretic enclosure of the process of inquiry. (For this criticism of constructive empiricism, see Ginev 2011a, 37–40.)

nomena). Reading-representing-textualizing constantly transcends the theory construction. (Moreover, since the theory construction consists in practices of theorizing, the former is part and parcel of textualizing.) A "text" embodies the totality of textualizing within a relatively autonomous context of configured practices. As such an "embodiment", any particular "text" documents processes and events that are stretched out over the whole intercontextuality of a domain and the facticity of inquiry.

Reading-as-textualizing is a well-known view in literary criticism and literary hermeneutics. In discussing the role of the implied/implicit reader/author, many literary theorists of different schools are prone to conceive of a literary work as an incomplete text that becomes completed in the process of its reading. ("The process of reading" in this formulation is to be understood in a twofold sense: as an act of reading and as a historical process of reception.) The fusion of the work's original horizon with the horizon of reception and the filling—on the part of the reader—of the text's "empty places" supposedly left by the author exemplify two scenarios of how the completion of the text of a literary work takes place in reading. Reading the text of a literary work is not an act/process that supervenes on the creative act. Starting with the implied/implicit reader, reading is from the very outset a constitutive part of a literary work's creation. This is a thesis that unites the schools which replace the traditional aesthetics with a version of an aesthetics of reception. Though in an entirely different sense, the hermeneutic realist also holds the view of reading-as-textualizing or the view of reading that by means of its spaces of representation brings semiotic systems into being that become textualized within a context of configured research practices. (At the same time, the "text" being contextualized in this way becomes intercontextualized since each context is co-referential with the totality of contexts of inquiry articulating a domain.) Thus, reading-as-textualizing is not an act/process of productive reception, but the very constitution of meaning within the horizon of meaningful articulation of a scientific domain. Accordingly, a scientific domain is to be viewed as contextualized "texts" in a process of intercontextual textualizing. (The way in which single practices are entangled with the interrelatedness of practices as well as the complementarity of meaningful articulation and procedural objectification are "written down" in such a "text" that is always already amenable to being contextualized anew.)

Reading and representing are intertwined when one uses them as "intervening devices" for both (a) manipulating what is ready-to-hand in a contexture-of-equipment and (b) textualizing meaning constituted within a context of inquiry. Reading and representing work in concert when they serve the primary instrumental manipulation and the initial semiosis in scientific research. Reading and representing retain their coordination and cooperation but change their joint function on the level of the interrelatedness of practices when the meaningful articulation and objectification of a whole domain is at issue. The term of textualizing covers the "emergent properties" of reading and representing on the level of a domain's articulation-objectification. (This is why I will also use the expression "textualizing a scientific domain".)

The chapter titled "Meaningful Articulation and Objectification of Reality in Scientific Inquiry" will make the case that reading and representing on the level of contextually configured practices take part in a special semiosis that characterizes the facticity of scientific inquiry. In the perspective of textualizing, the idea of semiosis emerging in the process of inquiry is to be adumbrated as follows. Textualizing does not start with the semiotic representation of a local outcome obtained by the implementation of a readable technology. Its point of departure is the point at which such a local semiotic representation is dislocated and disseminated. However, the reading and representing is always already (inter)contextualized. This is why the point of departure of textualizing is not to be understood in a chronological sense. It is a point within the process of textualizing. The dissemination of locally produced semiotic representation in various contexts of inquiry does not distort any of the representing systems of signs. The dislocated semiotic representations become intercontextualized in the sense of being dispersed over particular contexts of inquiry within the meaningful articulation of a domain. Textualizing takes place in each particular context. Thus considered, the process of textualizing is based on the entanglement of the contextures-of-equipment with the contexts of inquiry. Textualizing is no longer dealing with entities that are immediately ready-to-hand, but is processing signs displaced from their initial places of production.

In functioning at once within contextures-of-equipment and contexts of configured practices, reading-and-representing proves to be a transmitter that enables the constitution of "texts" from dislocated semiotic systems. Yet being such a transmitter, reading-and-representing does not occupy an intermediate position between instrumental manipulations and textualizing. Because of the entanglement of particular contextures-of-equipment with the whole of co-referential contexts of inquiry, the ubiquity of "entangled states" of reading and representing is underlying the process of textualizing. A certain system of signs—say, illustrative drawings, or bifurcation diagrams, or photograph-diagram pairs, or a system of linear partial differential equations, or photomicrographs, or statistical tables—arises out of the way in which a readable technology operates within a contexture-of-equipment. Yet this system is "always already" involved in the transmission of signs (the contextual and intercontextual circulation of semiotic representations). Both the particular readable technology (and its space of representation) and the whole circulation of semiotic means are equally important to the process of textualizing. It is the kind of entanglement of the semiotic result of a single readable technology with the transmission of systems of signs that enables semiosis in a scientific domain. Reading-and-representing qua textualizing meaningfully articulates a domain of research by working out the immediate meaning and transforming it into meaning contextualized and intercontextualized by configured spaces of representation and readable technologies that become incorporated in relatively autonomous "texts". A hermeneutic phenomenology of scientific inquiry could be a successful enterprise if it were capable of coping with the constitution/articulation of meaning engendered via circulation of representations and textualizing through readable technologies.

Discriminating between the constitution of meaning within, respectively, the contextures-of-equipment and the contexts of configured practices allows one to

introduce the distinction between a purely factual (descriptive and/or explanatory) and an interpretive-ontological perspective on a domain's articulation. In the former perspective—typified by cognitive sociology (as an explanatory version) and ethnomethodology (as a descriptive version)—the meaning that goes beyond the factuality of the immediate contextures-of-equipment should be regarded as a "second-order" meaning.[36] The latter is based upon the meaning generated via direct manipulation of what is ready-to-hand in scientific inquiry. This perspective is still consonant with the undesired duplication/diremption of the domain's reality. In the interpretive-ontological perspective, by contrast, the meaning generated in contexts of configured practices (and not in immediate contextures)—or the meaning enabling textualizing—is the ontologically "primary meaning" of a domain of research since it discloses the domain's meaningful being. (The meaning directly produced within the particular contextures-of-equipment retains the ontic primacy. But this production takes place in a constantly open ontological horizon of meaningful articulation.) The chapter titled "The Production of Objectified Factuality Within the Facticity of Scientific Inquiry" shows how hermeneutic realism follows this perspective by elaborating on a non-dichotomous construal of the ontic-ontological difference between factuality and facticity.

5 From Practices to "Texts"

I argued that the meaningful articulation of a scientific domain is contextualized by changing configurations of interrelated practices. It should be emphasized again that the domain's meaningful entities and the whole meaningful articulation are not detachable from the interrelatedness of scientific practices. There is meaning in a domain of research if and to the extent to which there are configured scientific practices. Their ever-changing interrelatedness manages at once to contextualize and to dissipate/disseminate this meaning over multiple contexts of inquiry (i.e., to intercontextualize it). Though the particular practices are composed of goal-oriented and rule-following actions and activities, a configuration of scientific practices through which a domain's being becomes disclosed is by no means an extended composition of action and activities. *A decisive caesura marks the passage from a particular practice to the interrelatedness of practices* (and accordingly, from particular contextures-of-equipment to the totality of co-referential contexts of inquiry). A whole configuration does not endure thanks to the agency's goal-orientation and the agents' rule-following. It owes its formation, stability, and reproducibility to the very meaningful articulation it launches and carries out. The multiplicity of relations within a configuration—or the totality of interrelations it comprises—projects itself upon possibilities whose appropriation articulates what becomes disclosed through

[36] Let me say that in this perspective the factuality of the immediate contextures (as objectified, for instance, in sociological terms) is not to be confused with the objectified factuality (experimental data and measurements) as obtained within the particular contextures.

the interrelatedness. Thus, the articulation takes place in the hermeneutic circularity of projected whole and articulated units. It is this circularity that replaces the regulative and teleological character of the activities composing a particular practice. Because of this replacement, the interrelatedness of scientific practices cannot be conceptualized in terms of motives, personal intentions, collective intentionality, rules, norms, resources for performing activities, and goals. Accordingly, the meaning constituted in configured practices of inquiry is entirely a kind of trans-subjective meaning.

The interrelatedness of practices becomes detached from the socio-psychological organization of actions and activities, and due to this detachment it manages to reveal the being of meaningful articulation.[37] The same is valid for the contexts of inquiry constituted by the configurations. They not only cannot be reduced to the contextures-of-equipment instituted by the particular (single) practices, but through their changeability organize actions and activities into practices. The whole of a contexture-of-equipment arising out of discrete actions and activities is forestructured by the continuity of changing and re-contextualizing configurations of practices. In the narrow perspective of a theory of human agency, practices (including scientific ones) have existence only through stable (normative) orders and organizations created by reflexive agents: Practices are in this perspective units of (normative) intersubjectivity. In the perspective of hermeneutic realism, human agents (including the members of scientific communities) are always already in interrelated practices whose interrelatedness has a being in the interpretative circularity of meaningful articulation, which in turn is enabled by practices' changing configurations. Practices in their interrelatedness and in the interplay with the possibilities they project are part and parcel of existential facticity. Both the interrelatedness (as distinguished by practices' endogenous reflexivity) and the interplay are trans-subjective aspects of facticity—or features of the situated transcendence of ways of being within the reality's meaningful articulation—and are not intersubjectively constructed in accordance with a Habermasian universal-pragmatic normative rationality.

As already pointed out, the present study develops various arguments against the splitting of the being of a scientific domain into the reality of meaningful articulation and the reality of what becomes objectified (and epistemologically and semantically delineated). The crucial argument for this thesis is to be sought again by scrutinizing the research process as a process of textualizing a domain of inquiry. The unity of meaningful articulation and the constitution of research objects and structures (as incorporated in knowledge about objectified factuality) is "embodied" in the "texts" of scientific inquiry. The essential ambivalence in the configured

[37] Speaking in terms of a hermeneutic social theory, the cultural life forms articulated within an ontologically self-sufficient interrelatedness of practices are characterized by ethos and habitus. Yet these are not socio-psychological characteristics. Ethos and habitus rather refer to the way in which the life form creates its kinds of intersubjectivity, its typical "thingness" (*Sachlichkeit*), and its mode of historicizing that constitutes authoritative tradition. Ethos and habitus are ontological characteristics of the way of being as situated transcendence.

scientific practices—endowed at once with the capabilities of meaningful articulation and objectification of what they manage to contextualize in their configurations—becomes manifested in these "texts". Approaching the process of inquiry-as-textualizing also allows one to study the ways in which contextures-of-equipment are entangled with contexts of configured practices. Since meaningful articulation and objectification share the same origin in the interplay of practices and possibilities, there is no relation of (causal, functional, structural) determination between them. In the remainder I will advocate the view that articulation and objectification are united within the hermeneutic circularity of scientific inquiry-as-textualizing. More specifically, a configuration of scientific practices at once contextually fore-structures the objectification in its facticity and objectifies what is factuality of inquiry, thereby creating knowledge about objectified factuality.

Admittedly, scientific research does not by any means start from the constitution of meaningful objects and structures. There is a much lower layer of disclosing the meaningful articulation of reality in the research process. The meaningful articulation of reality within the interplay of scientific practices and projected possibilities for doing research begins with the acquisition of data. Notoriously, several authors claim that theories predict and explain phenomena (that are usually unobservable), but not data. But phenomena are experimentally constructed through the acquisition of data. More specifically, data are "scientifically useful and interesting insofar as they provide information about features of phenomena" (Woodward 2011, 68). Phenomena are identifiable (or constructible) in a more or less wide range of contexts. The distinctive characteristics of phenomena are detectable by different configurations of scientific practices (or readable by different technologies). By contrast, data are unstable outcomes of a manipulative reading within the particular experimental contextures. Yet the articulation of data as meaningful units takes place in the hermeneutic circularity of contextual reading where a much larger class of scientific practices are at work and act in concert. The constitution of data depends on instrumental technologies, calibration of instruments, and statistical techniques that are capable to constitute meaning within the horizon of the domain's interrelatedness of practices. On a claim that will be scrutinized in the chapter titled "Meaningful Articulation and Objectification of Reality in Scientific Inquiry", practices of instrumentation always project more possibilities for data collection and selection than actually detected data in a given context.

The observation that something (represented by data) exists in accordance with a model does not imply that the detected and selected data are determined by the intrinsic logic of theorizing. Like theorizing itself, the production of measured data patterned by a model is situated in scientific practices and horizons of possibilities. For many years Joseph Rouse has developed the view that the concept of scientific theory has to be reconsidered by putting the practices of theorizing first. Theories are not extra-practical, purely mental constructions. Hermeneutic realism radicalizes this view and relates it to a conception (outlined by Patrick Heelan) that the articulation of data is not a theory-laden, but a praxis-laden process. The hermeneutic circle in which data are constituted meaningfully characterizes the primary form of scientific articulation of reality. However, this circle already takes place in the

interpretative circularity of creating data models as the next step towards reality's articulation. The chronological unfolding of the research process proceeds from the collection of data to the construction of data models. From a hermeneutic viewpoint, however, the collection of data is interpretatively fore-structured by the possibilities one chooses and appropriates when creating data models. Accordingly, the acquisition of data is always already within the horizon of possibilities for presenting phenomena by means of data models. In the philosophy of science which serves the tenets of hermeneutic realism, the construction of data models in the process of articulation and objectification of a domain mediates between contextures-of-equipment and contexts of configured practices.

At first glance, the construction of data models seems to be the (chronological) next step towards extending the hermeneutic circularity of reading/representing by taking into account practices and possibilities involved specifically in the processing of data. The construction of data models is always already within the horizon of saving possible (observable and unobservable) phenomena. As I pointed out, the interpretative circularity that characterizes this saving appropriates possibilities of embedding phenomena (as represented by data models) in theoretical models. From the viewpoint of formal semantics, a data model becomes semantically meaningful when it proves to be a substructure of a larger mathematical structure. On a central claim of hermeneutic realism, always when a phenomenon is saved by fitting a data model in a theoretical model, a theoretical object becomes partially envisioned (read and represented) in the respective context of inquiry. This envisioning evolves from its own interpretative circle, and is the most significant event in the meaningful articulation of reality as it is disclosed in scientific inquiry. Before unfolding this assertion, however, some summarizing considerations concerning the three stages of disclosing, articulating, and objectifying a domain of research are in order.

The first stage takes place within the contextures-of-equipment of scientific inquiry. But the acquisition of data is situated within configured practices of constructing data models. By the same token, the hermeneutic circularity attributed to the process of saving phenomena circumscribes and orients the construction of data models. Thus, each new stage in the process of articulation and objectification of a domain fore-structures the previous one. The interpretative fore-structuring of the reality disclosed in scientific inquiry consists in an integral interpretative circularity of meaningful articulation that involves the detection and selection of data, the construction of data models, and the theoretical saving of phenomena. The interplay of practices and possibilities through which theoretical objects become partially/contextually envisioned via saving phenomena provides the broadest horizon of articulation in scientific inquiry. Within this horizon phenomena become saved in particular contexts. Saving a phenomenon by means of a theoretical model remains situated in and transcended by the interplay of practices and the possibilities. Both the data models and the theoretical models through which phenomena become saved are expressions of the domain's reality, and not representations (copies) of this reality in the sense of representational epistemology. (James McAllister (2011) frees the discussion of the relations between data models and theoretical structures from the narrow methodological framework and places it in a much more interesting

ontological context. He formulates a "principle of evidential correspondence" that relates features of patterned empirical data to structures revealed in scientific inquiry. McAllister treats this principle as a requisite for licensing the move from patterns of data to disclosing emerging structures of a "radically polymorphous world". On this account, the structures in the world are superposed on one another and exist simultaneously.)

Since the first two stages of a domain's meaningful articulation are fore-structured by saving phenomena whereby theoretical objects become contextually envisioned, one is to state that it is the joint work of reading and semiotic representation of theoretical objects that constitutes relatively autonomous—and amenable to a further re-contextualization—"text" in scientific inquiry. (Vice versa, each "text" documents a contextual envisioning of a theoretical object as this occurs in the facticity of inquiry.) The widest hermeneutic circle of reality's meaningful articulation and objectification in scientific inquiry is the circle of saving phenomena by means of reading theoretical objects. Like the interplay of practices and possibilities for doing research, the theoretical objects' reading/representing is an infinite process. Science's theoretical objects are always predicated on a dual existence: Theoretical objects are at once "inscribed" on horizons of possibilities—thereby constantly having potentiality-for-being—and empirically identified in contexts of inquiry. There are possibly infinite contextual realizations of the theoretical objects' potentiality-for-being that come to the fore through actualizations of possibilities upon which the objects' being is projected. Thus characterized, a theoretical object is constantly envisioned in contexts of inquiry, but can never be empirically identified in a definitive manner with respect to the totality of its constitutive properties. (There is no "final context" in which the object can be read and represented as something existing per se, or as something whose "intrinsic properties" and ontic identity are totally revealed.)

In having a potentiality-for-being in the whole intercontextuality of a scientific domain, a theoretical object is dissipated in possible contextual readings and representations. The object's existence is distinguished by a growing diversification of its contextual identifications. The ways in which one ascribes contextualized empirical identities to a theoretical object are dictated by the scenarios of how to save particular phenomena. The theoretical objects are not empirically unreachable. On the contrary, the contexts of their empirical manifestations are potentially infinite. This view confronts in the first place the empiricist doctrine of observability which presumes that there is actually present meaning—contained in the terms referring to theoretical objects—to be made explicit by unfolding an observational language. In this doctrine, the meaning of a theoretical term is fixed and can be made explicit without remainder by explicating the empirical basis that makes this meaning observable. More generally, the hermeneutic realist repudiates the equation of the concept of theoretical term (procedurally interpretable either by an observational language or by means of empirical models) with that of theoretical object. But in countering empiricism, the hermeneutic realist also strongly refuses any assumption that ascribes a hidden essence behind the phenomenality of a theoretical object.

The hermeneutic realist insists on the continuity and potential infinity of textualizing a domain of inquiry. The interplay of practices and possibilities is ever constituting new contexts, each of them situated in the facticity of inquiry and open to revision and transformation. Since the interplay of scientific practices and possibilities for doing research is a non-finalizable re-contextualization, the research process which articulates a scientific domain is also potentially infinite. *Pace* the believers in Carl Friedrich von Weizsäcker's "closed theories" that might finalize the intrinsic development of scientific domains, there is no intrinsic reason in this interplay that may finalize it. The end of a particular episode—cognitively marked, in particular, by the experimental verification of a theoretical prediction, and socially distinguished by the attainment of a consensus between experimentalists and theorists regarding the conditions under which a successful experiment should be counted as a test—is always widening the horizon of possibilities for doing new research.

The Production of Objectified Factuality Within the Facticity of Scientific Inquiry

1 The Practice Turn in Science Studies

I will resume in this chapter the discussion set up in the Introductory Chapter by supplementing the thesis that hermeneutic realism is a realism about reality's meaningful articulation within (scientific) practices with the ontological stipulation that human existence has a being in practices constantly and continuously constituting meaning projected upon possibilities. The position of hermeneutic realism ought to be discussed against the background of the "practice turn" in the realism debate. This position is part and parcel of this turn, and should be juxtaposed with other positions and doctrines emphasizing the role of practices. Actually, as the editors of a recent volume devoted to analyses of scientific practices argue, there is no single "practice turn" but rather "multiple practice trends" in the philosophy, sociology, and history of science. According to them, a practice trend (like New Experimentalism) emerges when one pays attention not only to particular classes of practices of inquiry but to fundamentally practical facets of science in general. This trend is a line of investigation that places primary emphasis on "the transformative-technical-pragmatic dimension of science, with its material, somatic, skillful and utilitarian aspects" (Soler et al. 2014, 9).

Another nice characterization of the experimentalist trend in the "practice turn" allows me to undertake a further step in the attempt at locating the position of hermeneutic realism. According to Mieke Boon (2015, 59), the New Experimentalists "defend a philosophy that considers scientific practices, and they do not accept the restriction to the logic of science … The traditional distinction between the context of discovery and the context of justification … is abandoned. Instead, the New Experimentalists aim at an account of the rationality of scientists in scientific practices that includes how scientists reason about experiments, instruments, data, and theoretical knowledge." Against the background of this panoramic characterization, I would say that the deficiency of New Experimentalism consists in the deficit of accounting for the being of "scientists in scientific practices". Scientists are in

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ecstatic unity with their practices: Scientists create scientific practices by being "created" by these same practices. There is nothing mysterious in this formulation if one takes into account that both scientists and scientific practices participate in the hermeneutic circularity of inquiry. Though "creating" each other, neither practices nor scientists determine or are determined. Being in hermeneutic circularity informs the ecstatic unity of practices and scientists, granted that each of them is characterized by endogenous reflexivity. Boon is right that the New Experimentalists abandon in their work the traditional context distinction. Yet they do not overcome this distinction. Overcoming it requires working out a new context beyond the dichotomy between purely factual (ethnographic, sociological, psychological, etc.) studies and rational (normative) reconstructions devised to reveal the "logic" of inquiry. The hermeneutic realist suggests in this regard the "context of constitution". Roughly, one studies scientific inquiry in the context of constitution by putting the aforementioned hermeneutic circularity first, thereby paying special attention to the forms of endogenous reflexivity operating in this circularity.

Tentatively, the following disclaimer should be stressed: Hermeneutic realism has nothing to do with the dictum that all facts are reducible to interpretations. This dictum belongs to the repertoire of relativism. As a realist position, hermeneutic realism strongly opposes any form of relativism. By the same token, hermeneutic realism is not to be confused with the interpretative version of the dualism of conceptual scheme and empirical content, which states that we are doomed to interpret facts in frameworks. Not only the procedurally achievable facts (like the experimental facts) but the allegedly immediate facts (directly given to the perception) are always already conceptualized. Like the design and the implementation of procedures for achieving (theoretically predicted) facts, perceptions are working in frames. In our empirical cognition and knowledge of reality—so the argument for the scheme-content interpretive position goes—we are prisoners of our conceptual frameworks. Being thus imprisoned, we have no direct access to facts per se: The access is mediated by conceptually framed and theoretically laden perceptions that unavoidably transform the alleged facts into interpretive artifacts. Discarding the doctrine of the framed access to reality—opening the door for interpretive speculations within the dualism of conceptual scheme and empirical content—leads to an extended view about the constitutive role of facticity: The hermeneutic realist admits that all conceptually framed interpretations are constituted within the reality-as-facticity, and cannot be regarded as responsible for the interpretive constitution of factuality.

In this chapter, central focus will be given to empirical scientific facts. Though quite relevant to hermeneutic realism, I will skip for several reasons a discussion of the non-empirical scientific facts. The mathematical theorems form the largest class of such facts. Thus, for instance, it is a non-empirical fact that the equation relating the triple integral as a volume integral over a volume in a three-dimensional space with the surface integral over the boundary of that volume represents the relation between the total vector field's sources to the total flux across the boundary. By holding a view that equates theorems in the formal sciences with non-empirical facts, I am not trying to take a position in the philosophy of mathematics, or to

position hermeneutic realism (about "mathematical existence") in the debates taking place in this philosophy. The equation of formal theorems with non-empirical facts can be interpreted in terms of Quine's naturalist and nominalistic stance to mathematical objects as well as in terms of different forms of mathematical Platonism. However, the claim that mathematical theorems express non-empirical facts (some of them in principle transformable into empirical facts about finite, discrete, and concrete entities) appeals to a distinction that requires a separate study. I have in mind the distinction between mathematical factuality and the facticity of mathematical inquiry. The formal theorems are non-empirical facts produced within a special kind of facticity.[1]

In rejecting any form of relativism, the hermeneutic realist also disavows that kind of relativist softening of standard realism which Latour describes as "historical realism". Latour (2000, 268) claims (with Whitehead) that relativism and realism are synonymous expressions. He advocates this view by stressing that the twin limits of realism and cultural-historical relativism are alleviated as soon as historicity and socialization are extended to all members of collectives. According to Latour, the realist defends her position by de-historicizing the reality of natural objects and phenomena, limiting at the same time history to society. Relativists and constructivists, on their part, insist on the absoluteness of social history as a means for undoing non-historical and non-collective claims about matters of fact. Alleviating the twin

[1] The special unity of these kinds of facticity and factuality is addressed in two brilliant studies, accomplished from completely different positions: Lakatos's (1976, 4) informal studies of "the phylogenesis and the ontogenesis of mathematical thought", and Eric Livingston's (1986) studies of "the living foundations of mathematics" (in particular, the "lived-work of the provers of mathematical theorems"). The most profound study of the facticity of mathematical inquiry ("mathematical existence") remains, in my view, Oskar Becker's (1973, originally published 1927) hermeneutic-phenomenological approach to the processes of mathematical construction. At stake in this approach is the passage from a constructivist criterion for the existence of mathematical objects to the facticity of the mathematical construction as an existential mode. Oskar Becker's "demon" (the *Dasein* of the mathematical existence) is not an absolute creator, but a creature that is able to transcend its own finitude—not once and for all, but—a potentially infinite number of times. This demon is doomed to exist in this way in order to constitute meaningful objects of a certain type. Within a mode of existence that is deprived of the capability to transcend its own death such objects (like transfinite numbers) would cease to be existentially meaningful. Yet Becker's demon is by no means a creature that—by overcoming once and for all its existential finitude—would become able to directly face the presence of the infinite objects. In "transcending" its own death, the demon has a mode of being as potentially infinite repetitions of the finite existence. The constitution of the objects of transfinite induction and recursion assumes the historical transsubjectivity of "mathematical existence". A Divine Creator does not need to constitute meaningful objects. The Creator possesses all objects in their absolute (non-constituted) meaning. Constitution of meaning can only take place in the modes of existence distinguished by death (finitude). The objects of transfinite mathematics are also meaningful objects; i.e., they assume such a mode of existence. Becker's demon keeps the existential characteristics of the finitude as a prerequisite for the constitution of meaningful objects. The mode of being of the subject of mathematical existence (the mathematical *Dasein*) looks like a "recursive repetition" of the finite being-in-the-world as thrown projection. As an epistemic subject it follows the epistemology of mathematical constructivism. Regarding Becker's formula for synergizing the constitutional analysis of hermeneutic phenomenology with mathematical constructivism, see Ginev 2009, 2015a, 190–192.

limits leads to the view that the non-human reality (consisting of all non-human collectives of actors) is always socialized and historicized, which is the quintessence of historical realism (as a position closely related to actor-network theory). Now, the argument for historicizing natural (non-human) reality must appeal to a notion of historical time that cannot be on a par with the notions referring to the natural reality which the standard realists have in mind. If historical time is a part of this reality, then it would characterize natural processes, but would not be able to historicize natural reality. In alleviating the limits (and thus universalizing) relativism, Latour tacitly refers to a notion of the historical temporality of meaningful being-in-the-world (i.e., a notion of the historicity of meaning constitution). Yet when he alleviates the limits of realism, thereby relativizing it, he appeals to a notion of historical time that is entirely in line with naturalist objectivism. Latour reconciles realism and relativism at the price of admitting (what Heidegger calls) a "vulgar notion" of historical time and historicity, which makes his historical realism an incoherent position. Had he implemented a non-objectivist notion of historical temporality in relativizing realism, he would have had to undertake a much more complex revision of standard realism. But the outcome would not have been the version of historical realism he advocates.

The claim of the revisability of factuality within the facticity of ongoing meaningful articulation—as this claim is adopted in hermeneutic realism—does not amount to the epistemological claim that the (empirical) intuitions are unavoidably conceptually prefigured. Seemingly, the rationales for both claims are rooted in the finitude of human existence. Yet the claim of hermeneutic realism presupposes that the constitutive role of existential finitude consists in enabling the way of transcending each particular context since the facticity of finite existence is always open to possibilities transcending any state of being-situated-in-a-context. (There is always an open horizon of possibilities that is potentially inexhaustible. In each particular context, this horizon is restricted to a manageable leeway of possibilities. Yet the contextual choice and appropriation of possibilities transcends the context and opens a new manageable leeway. Within the new context a new regime of revealing and concealing possibilities takes place. The horizon is constantly contextually limited to a finite set of possibilities, but because of intercontexuality it is potentially infinite. This unity of contextual finitude and potential infinity corresponds to the figure of situated transcendence. It is also this unity that informs the infinity of meaning within the finitude of human existence.)

By contrast, the epistemological claim (which at least tacitly invokes the finitude of humans) assumes that the conceptually framed accesses to factual reality are strongly enclosed in themselves. Accordingly, any "enclosed access" prohibits the openness to possibilities that are incompatible with the principles underlying the respective access framework. More specifically, there is in this claim—that has its roots in Kantian philosophy, and nowadays is most consequently developed in Michael Friedman's conception of the "relativized a priori"—a tacit commitment to the following view: Regardless of whether the world-out-there comes in cognition pre-divided into objects and "natural kinds" (as scientific realists assume) or the talk of objects only makes sense with regard to cognitive discriminatory classifications

of the world, we are doomed—because of our constitutive finitude—to have an access to the empirical world that is necessarily mediated by means of linguistic and conceptual ("internal" in Putnam's sense) constraints on reference. (The hidden ontological premise here is that existential finitude triggers the diversification of conceptual frameworks, each of them enclosing its own factual reality. Since the incommensurability thesis has the same hidden premise, this thesis proves to be a natural partner of the conceptions relating the finitude of existence to the aforementioned diversification.)

In the case of hermeneutic realism, existential finitude manifests itself as situated transcendence of what is interpretively constituted, while in the epistemological-relativist case the finitude comes to the fore as unsurmountable diversity of framed/enclosed interpretations. No doubt, the discussion of the nexus between existential finitude and the approaches to (scientific) factuality discarding the God's eye point of view has to take into account the treatment of factuality within the conceptions rejecting "the third dogma of empiricism". Yet I will refrain from such a move since it will lead to a discussion of problems which have little to do with hermeneutic realism. Let me only point out that the rejection of the idea of conceptual schemes does not imply a liberation of the epistemological analysis from its tacit commitment to (the ontology of) the finitude of human existence. On the contrary, conceptions like epistemological behaviorism strongly influenced by this rejection are distinguished by a radicalized observance of existence's finitude, though—paradoxically enough—the finitude itself is not an explicit topic for them. The unavoidable indeterminacy of (semantic) interpretation involved in the rejection of the idea of conceptual schemes can be viewed also as a tacit appeal to finitude. Making this appeal explicit would enrich—and possibly complete—the argumentation for abandoning the scheme-content dualism.

By stressing the revisability of objectified factuality within the facticity of meaning-constituting practices, the hermeneutic realist does not invoke the strategy of ontological relativity. To be sure, every ontology assumed by the conceptual-linguistic organization of objectified factuality is—in a Quinean sense—relativizable to a firmer ontology of another conceptually structured language. Yet, *pace* Quine, this observation does not invite or imply an infinite regress. It is, as I will try to show, the ontological difference between factuality and facticity that precludes such a regress.[2]

[2] My point can also be summarized as follows. For Quine's theory of translation (as well as for Davidson's theory of interpretation), Tarski's metalanguage T-sentences are the very vehicles of interpretation. Because there is no metalanguage devised to reveal preexisting meanings, the indeterminacy of translation/interpretation— undermining the notions of invariant meanings and invariant reference—is irremovable. On this account, semantic truth is a basis for interpreting the sentences. However, T-sentences—enacted through disquotation—might only play the role of "the very vehicles of interpretation" if the reality of what is interpreted would have already been disclosed. Quine makes the case that interpretation is broader than translation, and that any actual interlinguistic dictionary is a "manual of interpretation" (Quine 1999, 75). Guiding the construction of such a manual is the belief that all entities being denoted have identities (or are individuated). But the entities' factual identities are not to be postulated. They become constituted within

In a nutshell, putting practices first is a common concern of all philosophers who try to defend a form of realism without committing to a God's eye point of view. For many advocates of "realism with a human face", the insistence on the priority of practices is a sine qua non in the struggle for getting rid of the presupposition that there is a fixed, uniquely structured reality beyond or behind reality's descriptions. The appeal to practices—either as epistemic mediators or as a medium of knowledge production—helps one to dismiss the picture of the static presence of reality in toto as depicted by metaphysical realism. Without succumbing to empiricism or conventionalism (as kinds of antirealism), the practical turn has brought into being versions of realism that are consonant with pluralist assumptions—in particular, the assumption that the practitioners/agents use a plurality of contextually equivalent ways of describing reality.

Two main approaches to epistemic, discursive, expressive, evaluative, instrumental, and technological practices have gained currency in the attempts at working out versions of realism that oppose metaphysical realism. These approaches are typically represented by Hilary Putnam's "natural realism" (as distinguished by its inclination to pragmatism) and Karen Barad's "agential realism" respectively. (A precursor of the second approach is Hacking's "intervening realism" with its peculiar criterion for reality identification in scientific research: Only the manipulability of a certain entity for the sake of experimenting on something else is capable of committing the researchers to believing that this particular entity exists.) In the first approach, the kinds of practices being mentioned are situated between the knowing subject and reality. The practitioners' point of view—as expressed not only discursively, but also in the way in which practices are enacted and performed—must not be overlooked. More specifically, this viewpoint elicits the mutual dependence of truth and verification, which is the kernel of Putnam's recent—after the period of internal realism—version of realism.[3] In line with pragmatism, the champions of this approach formulate referential principles in a manner that permits their contextual specifications. Ronald Giere (2006, 14) cogently argues that integrating perspectivism into realist philosophizing does not amount to degenerating the latter into a silly relativism. He indicates that the output of instrumental practices is perspectival. It is perspectivism that makes room for influences determined by epistemic interests even in a scientific investigation governed by the most rigid epistemological norms of objectivity.

Though rejecting the vindication of an autonomous transcendental position, some forms of this approach make use of (contextually valid) transcendental arguments. Yet again, the use of such arguments is not to be detached from studying the

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the facticity of practical existence. (Like Quine's radical translation and Davidson's radical interpretation, Rorty's epistemological behaviorism is unable to address this constitution of factual identities.) In hermeneutic realism, only at a certain stage of the meaningful articulation of a domain do the constituted identities allow the employment of denotations that are indispensable for having Quinean translation and interpretation. The latter (qua a cognitive procedure) is enabled by the existentially primordial interpretation involved in the world's meaningful articulation.

[3] See in this regard Putnam (2002), where he defends the claim of mutual dependence in responding to Rescher's criticism.

ways in which practices organize cognitive experience. Albeit in a softened modification, Cartesian dualism remains preserved in this approach. Placing practices within the epistemic subject-object relationship allows one to converge (say) the internal realist picture with pragmatism. Of course, this is not the only option within the first approach. By arguing that referential semantics and the correspondence theory of truth are enterprises independent from each other, one can merge kinds of non-metaphysical realism with, for instance, non-representational epistemology, Brandom-like inferentialism, Rescher-like pragmatism, Cassirer-like symbolic Kantianism, or soft versions of constructivism.

Hacking's conception from the early 1980s is—as already mentioned—such an important precursor to the second approach because it de-privileges any particular practice in favor of the medium of interrelated scientific practices. Experimentation still does not guarantee a commitment to believing in the reality of theoretical entities. Placed in the much broader context of manipulability, where several other scientific practices take place, experimentation enables such a commitment. Yet Hacking's conception is not distanced enough from assuming the primacy of a static subject-object cut.[4] It is this assumption that became a primary target of the adherents of the second approach. In this approach, practices are not to be regarded as being immersed in the epistemic relationship. The reverse is rather the case: This relationship is situated and takes shape in the medium laid down by practices. Starting out from the ontological primacy of this medium prevents one from hypostatizing the duality of conceptual framework and empirical content, provided that the respective conception has enough resources to avoid the hypostatization of the medium itself.[5] For Barad, the ontology of knowing-within-practices does not leave room for a fixed line between subject and object. This line "does not preexist particular practices of their engagement, but neither is it arbitrary. Rather, object and subject emerge through and as part of the specific nature of the material practices that are enacted" (Barad 2007, 359). The agential realist aims at showing that the traditional (Cartesian) subject-object distinction is a prejudice of representationalist epistemology.

As mentioned in the preceding chapter, the agential formation of the subject-object cut is entangled with the phenomena under investigation. In trying to extend Bohr's complementarity to the very logic of scientific objectification, Barad notes that the agential cut enacts a resolution by being involved in the ontic indeterminacy of the phenomenon whose objectification it is entitled to accomplish. The "agential separability" is enacted within the phenomenon's objectification. In this regard,

[4] For this criticism of Hacking's conception, see also Woody (2014).

[5] This approach to scientific practices is ideologically heterogeneous. The ideological and political values behind its ontological, epistemological, and methodological suggestions range from stances expressed by members of the Stanford School—in particular, John Dupré's (2001, 183) anti-naturalist and anti-reductionist stance that only a pluralistic model of scientific practices can be effective in combating scientism and replacing it with a non-scientistic view of science that "goes all the way down to the basic metaphysical issues of causality"—to positions advocated by radical feminists who look for a change in the traditional, objectivist identity of science by addressing scientific practices.

symptomatic for her realism is the concept of "exteriority-within-phenomena" which refers to the ontological state of enacting the agential cut within indetermined phenomena. Yet insisting on the contextual-practical variability of the line dividing subject and object does not violate or damage the objectivity of scientific inquiry. I already dealt with the threat that may come from basing a non-Cartesian epistemology on a view of causality directly imported from non-classical physics. However, such a criticism cannot cast a shadow over Barad's truly innovative epistemological reading of Bohr's complementarity. Moreover, this reading is highly instructive in studying how scientific objectification is situated in scientific practices. In Barad's approach, objectivity is not achieved by acquiring knowledge from a standpoint that must be specified in accordance with socio-political criteria. It is not a politically inspired standpoint epistemology that can allegedly surmount the view from nowhere. Objectivity is achieved through "enacting the between" of the contextualized subject-object relation. Following this tenet, Barad replaces Hacking's intervening (which is supposed to provide objectivity in scientific inquiry) with intra-acting (the "enacted between") which is supposed to create objective knowledge within experimental and theoretical practices.[6] In her account, objectivity "requires a full accounting of the larger material arrangement (i.e., the full set of practices) that is a part of the phenomenon investigated or produced" (Barad 2007, 390).

The adherents of the view of situated objectification aim at overcoming not only Cartesian dualism but any kind of representationalism as well. Thus, Barad consistently maintains that a comprehensive approach to understanding "technoscientific and other naturalcultural practices" requires blasting not only the tenets of classical epistemology, but also the grounds of metaphysical individualism and humanism. Her agential realism (and her version of posthumanism) argumentatively rejects the hypostatized division of culture and nature, accentuating on the ways in which the nature-culture boundary is actively configured and reconfigured by means of technoscientific practices. Since the main preoccupation of the agential realist is to show how matter (plus discourse and discursive practices) matters, matter-within-technoscientific-practices is treated as agentive (as produced and productive, generated and generative), and not as a fixed essence or property of things (Barad 2007, 137).

The proponents of this approach admit that a naturalist, or a structuralist, or a functionalist theory of epistemic practices has to occupy the place left vacant after the failure of foundationalist epistemology. Accordingly, the demarcation line between knowing subject and reality becomes normatively drawn by the "grammar

[6] Symptomatic for studying the uncertainties generated by the interaction of experimental and theoretical practices is the work of Mara Beller. She nicely shows—by focusing on correspondences between the pioneers of quantum mechanics—how "dialogical creativity" is enabled by the interactive milieu of such practices. With respect to the approach I am discussing, Beller's studies of the origin of matrix mechanics, the emergence of Born's probabilistic interpretation, and the birth of Bohr's complementarity are of special importance, since they bridge the investigation of scientific practices with a kind of hermeneutics of scientific communication that lays emphasis upon dissent and disagreement. Beller ascribes a mediatory role in the interaction of experimental and theoretical practices to the rhetorical strategies of persuasion which "disguise arguments of consistency as those of inevitability" (see Beller (1999, 199–206)).

of practices" and not by postulated epistemological norms of objectivity.[7] The ambition in this regard is the development of a full-fledged alternative to the approach based on the image of science as a body of propositions that—by being distinguished with truth-values—form deductive structures through their logical relationships. The grammar of scientific practices has to push the logical structures away. Guiding here is the belief that "the habit of analyzing science in terms of actions will make us recognize that even the most abstract aspects of science are rooted in doings" (Chang 2014, 76). However, it remains an open issue as to whether the replacement of science-as-cognitive-structure with a grammar of scientific practices is not involving a kind of *petitio principii*. In designing a pertinent network of actions and activities, the champions for a purely practical approach to science tacitly assume a theoretical framework responsible for the way in which the elements involved in the network are operating in concert. How this fallacy is surmounted in hermeneutic realism will be a subject discussed on various occasions in the course of this study.

In radicalizing this approach to epistemic practices, Joseph Rouse tries to overcome both the doctrines which suggest scenarios for connecting intra-linguistic systems (like conceptual systems, discursive formations, or scientific theories) to something extra-linguistic, and the doctrines which—predicated on a sort of theoretical holism—manage to treat the reference to objects as an intratheoretical characteristic. For Rouse, practices—qua "configurations of the world"—and physical systems form an interactive whole of causal relations. There is no reality to be found as something external to this whole. The presumption of God's eye is renounced through naturalistic arguments based on the primacy, i.e., inscrutability from without, of the "causal intra-action" within nature's entangled practical-physical systems. Given the normativity of epistemic practices, Rouse insists on an irreplaceable normative dimension of nature. In pursuing the goal to unfold a realism built upon practice theory, Rouse (2002, 161) addresses practices in terms of normative accountability of contextual performativity. Following Davidson's discursive-practical view of natural languages, he denies any underlying regularity or commonality involved in practices' performances. Rouse's normative conception of scientific practices seems to be instrumental in the quest—on the part of social epistemologists—for a philosophy of science that would be able to exercise a normative control over the design and outcome of scientific research.[8] (The normativity

[7] On the concept of the "grammar of practices", see Chang (2011).

[8] The normative philosophy of science which social epistemologists have in view has to exercise control over science by making scientific research self-conscious about its own practical normativity. On Steve Fuller's account, "a self-consciously normative discipline is one that makes the ends of its inquiry an ongoing subject for negotiation" (Fuller 1993, 211). Control achieved by means of negotiations is the alternative (to the traditional cognitive autonomy) which social epistemologists try to figure out. Rouse's conception is convenient for pursuing this goal since it implies that the change in the regime of arranging scientific practices and their causal dependences changes the normative way of saving phenomena as well. Thus, if the negotiations result in demanding a new direction of the research process, then the change of the normative regime of saving phenomena would be the adequate response to that demand. It is another question that such a normative control

of this control is not to be derived from scientific research's methodological and epistemological normative codices as they are, in particular, a subject of Lakatos's work. These codices are entitled to maximally enclose the research process in its own epistemic space, whereas the social epistemologists' idea of normative control is the creation of some leeway for external interventions in scientific inquiry.)

Roughly speaking, the position of hermeneutic realism admits the primacy of practices as a medium in which the epistemic relationship takes place, but strongly denies any account of this primacy in terms of causal interactions.[9] A position of realism that starts from a concept of causal interactions is unavoidably doomed to reify them. In hermeneutic realism, causal interactions are "events" meaningfully articulated within practices, but not enabling the interrelatedness of practices as the being of existential facticity. Practices are interrelated not by causal interactions but by relations of mutual interpretation. The interrelatedness of practices brings into being the interpretative articulation of meaning as a prerequisite of meaningfully delineating causal interactions. Hermeneutic realism leaves aside—as completely irrelevant to its agenda—the question as to whether mental states supervene on states of the neurophysiological substrate of cognition. Yet the hermeneutic realist firmly rejects any approach to the mind that regards it as a (disembodied) privileged instance or point of reference in the realism debate. The mind does not provide means or devices whereby humans might become detached from reality, thereby taking up a stance on making decisions about how entities of different types exist in the "reality out there".

Since the mind cannot be isolated from reality in a manner that would make it an "apparatus" for representing reality through images, ideas, concepts, and categories, all epistemological formulations that include "out there" with regard to the mind are wrong. Because the mind is always already situated within reality, it cannot produce "framed representations" of reality that assume a distance from (and a non-situatedness in) what is represented. (Of course, being situated within reality does not exclude the possibility that the mind is able to represent reality within reality. Yet thus considered, the way of representing is no longer to be conceived of in terms of representationalist epistemology. Representing-reality-within-reality is a kind of representation-as and not representation-of what is "out there".) By championing the view that the mind is placed and constituted in reality-as-facticity and cannot serve as a privileged instance of representing reality (in the sense of representationalist epistemology), hermeneutic realism proves to be not a version of "minimal realism", but rather a kind of hyper-realism.

Notoriously, Thomas Nagel addresses the issue of how to account for the perspectival engaging with the world on a personal level. His approach consists in combining the point of view of a person inside the world with an objective view of

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over scientific inquiry may lead to the perfect combination of a bad scientification of social life and a bad "democratization" of scientific inquiry.

[9] As already indicated, this denial does not foreclose the possibility of a "naturalizing philosophy of science" that is compatible with hermeneutic realism. See, in this regard, Ginev (2015a, 165–168).

that same world. To be sure, he is aware that in most cases the two standpoints resist any attempt at intertwining them. But Nagel's basic intention is to combat "the view from nowhere". Bringing the standpoint of personal being-in-the-world with the objective rationalization of the world seems to be the appropriate means in this regard. Juxtaposing the internal and external viewpoints provides him with the point of reference for criticizing objectivism as it is most typically expounded by the view from nowhere. In accentuating on the ineliminability of the subjective perspective, Nagel (1986, 11) debunks scientism as an absurd ideology purporting that "everything there is must be understandable by the employment of scientific theories" that supposedly express the pure objectivity. But the weak point of Nagel's approach is its point of departure. Nagel starts with the firm differentiation between external (third-person) and internal (first-person) standpoints, and subsequently admits that this distinction is a matter of degree that covers a wide spectrum. Nagel's approach ignores that the degrees of objectivity of the "forms of thought" are differentiated not by artificially juxtaposing two standpoints, but within existential facticity from where all epistemic standpoints stem. His position assumes that the degrees of objectivity result from a play of standpoints and have no existential roots. On hermeneutic realism, the differentiation of such degrees takes place within the ecstatic unity with the world, which enables the multiple engaging with the world on the part of any particular person. It is the facticity of practices within-the-world that sets limits of objectivity. In countering Nagel's approach, the hermeneutic realist raises the claim that it is not "the subjectivity of consciousness" but the hermeneutic situation of objectifying the world within-the-world that is an irreducible feature of reality. The insistence that there is no coherent way in which reality can be viewed from nowhere must be supplemented by a strategy of accounting for the existential phenomenon of contextualizing objectivity in a hermeneutic situation.

Does such a strategy imply a kind of anti-epistemology? In recent debates, the concept of anti-epistemology is associated with programs that seek a definitive supersession of the inner/outer dichotomy in addressing the issue of how the direct encounter with the surrounding entities of the world enables and grounds the accumulation of knowledge. The champions of anti-epistemology state that there is no propositional content that mediates the multiple practical ways of coping with reality (Dreyfus 2004, 54). Charles Taylor seems to be the most radical exponent of this doctrine. The figure of "absorbed coping"—as being in the world that is not based on distant representations of the world, and mediated by propositional content—cogently describes the quest for conceptualizing the basic relation to reality without invoking the inner/outer dichotomy. Yet there is a paradoxical move involved in developing the anti-epistemological position. Taylor pretends to be much more radical than Davidson and Rorty in discarding the traditional epistemological dichotomies. Nonetheless, his anti-epistemology presupposes Cartesian dualism in order to combat any form of Cartesian epistemology in the most radical way. The embodied cognition of everyday experience is in a sense pre-epistemological, but—as Taylor acknowledges—it is too elementary to provide a point of departure for addressing the issue of realism in a post-metaphysical manner.

The anti-epistemologists are aware that in relying only on the picture of absorbed coping with things that are ready-to-hand (and constantly evoking Merleau-Ponty's imagery) does not suffice when one has to account for forms of knowledge that go beyond everyday experience. Still, they are not willing to rehabilitate propositional content and/or beliefs as mediators in humans' interaction with the world. Such a rehabilitation would be a concession to epistemology. I completely agree with their reluctance to admit that propositional content mediates the ways of practical coping with reality. But should this eliminate any form of mediation operating in the practical encountering reality? Is not the practical coping with reality mediated by horizons of practical understanding and interpretation? The phenomenological description of the direct involvement with things is the way to overcoming epistemology. But this way describes a contingent reality that has nothing to do with the robust reality of science. In reaching this conclusion, Merleau-Pontyan interactive phenomenologists start to make serious concessions to science's allegedly inherent realism. For them, anti-epistemology has no place in the treatment of the objective knowledge about the objects studied by "the best scientific theories". This is why Taylor's anti-epistemology (in particular) is necessarily complemented by the (already discussed) position of robust realism. They assume, at least tacitly, that the production of objective knowledge requires not only robust realism, but also objectivist epistemology.

Hermeneutic realism is the exact opposite of the (unhappy) combination of anti-epistemology (based on a direct, embodied encounter with the reality of everyday experience) and robust realism ascribing a structure to the universe. The common denominator of the two extremes involved in this combination is the disavowal of reality-as-facticity. (Clifford Geertz (1994, 86) is completely right when pointing out that the coexistence of anthropologically grounded anti-epistemology and robust realism is rooted in the scarce picture and the "tendency toward oversimplification" of what natural science is. Geertz has in mind the lack of any view about the facticity of post-classical-physics' scientific inquiry, and all "non-classical events" it generates.) In the Introductory Chapter, I already spelled out the main argument of hermeneutic realism against robust (and minimal) realism. However "minimalist" minimal realism is, it cannot avoid (a) essentialism about the "ultimate reality", (b) the metaphysical presence of what is beyond all access practices, and (c) the priority of the correspondence theory of truth over the concept of truth as aletheia. Furthermore, the robust realist assumes that the characteristic practices of disclosing a domain of reality are but a means for having "access to the structure of ultimate reality". These practices should be removed (and are always totally removable) after gaining access in question. The robust realist seems to follow Wittgenstein's advice: He throws away the access ladder after he has reached the ultimate reality.[10]

[10] In addition to the previous characterization, I should like to state that robust realism presupposes the accessibility of "ultimate reality" (understood as the totality of things as they are in themselves). But it rejects the arguments for this accessibility forged by standard realism. The coherent defense of robust realism requires a supersession of relativism via embarking on the pluralism of

I will conclude the present section by specifying the argument against anti-epistemology. The champions of the latter tend to forget that the "encounter with the world" always takes place within the world, and that the world-of-the-things (that are either ready-to-hand or present-at-hand) is always situated within the world-as-horizon. In other words, they do not pay enough attention to the situatedness of the practical encountering innerworldly entities within the world-horizon which transcends and mediates this encountering. By implication, anti-epistemologists curtail the coping with the world, reducing it to unmediated contact. In the anti-anti-epistemology argument I adhere to, the situated transcendence of all forms of practical coping within the innerwordly environments amounts to a hermeneutic mediation of practical experience. The (non-hermeneutic) phenomenological chimera of unmediated contact with reality implying the elimination of any mediation is to be dispelled. One can still find the subject-object cut behind the "unmediated contact with reality". Indeed, it is hard to imagine how both Merleau-Ponty's phenomenology and Taylor's anti-epistemology can come to terms with a concept of horizon that always already transcends and constitutes this cut.

Anticipating further considerations, I will posit for the moment that—although all relations and structures envisioned through epistemological means are grounded upon interpretive-practical experience—a kind of epistemology preserves its validity in the hermeneutic philosophy of science. More specifically, a kind of non-representationalist epistemology of the formation of structures in scientific theorizing is an indispensable counterpart of hermeneutic realism. Summing up,

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access practices. Several lexicons—including some which are incompatible with one another—can be constructed for ultimate reality, and each of them can be true. Nonetheless, there is no relativism following from the "acknowledgement that our practices are a more primordial form of truth that makes truth as agreement possible" (Dreyfus 1991, 40). Because humans are finite beings—so the argument goes—they are capable of discovering truth only by revealing in many ways things as they are in themselves. Accordingly, several incompatible lexicons can agree with how things are in themselves. No single way can assure a privileged access to ultimate reality and its absolute factuality. Accordingly, the finitude of human existence invites the advocacy of plural (or multiple) realism (Dreyfus and Taylor 2015, 130). An interpretation-free understanding of ultimate reality does not make sense. The competing lexicons are constructed within characteristic access practices (say, the practices of mathematical physics). Robust realists argue that the interactions with the "defamiliarized strange" establish a "proto-theoretical space" distinguished by certain constraints on what should be counted as significant relations. Within this space with its constraints, we could—by employing the means of rigid designation—make sense of things independent of us. Making sense is a prelude to investigating the essence of these things. On this account, a minimal version of realism is indispensable for postulating the being of ultimate reality. The way in which characteristic practices inaugurate a meaningful articulation of reality as facticity (in the sense of the hermeneutics of facticity) is, as it were, super-structured over the picture of reality obtained thanks to the access to ultimate reality. Dreyfus does not explicitly declare this view, but the combination of his Heideggerianism and robust realism makes it unavoidable. Bluntly, pluralistic robust realism accounts for how the essence of ultimate reality becomes specifically revealed in any particular lexicon constructed by characteristic access practices. Accordingly, one should conclude that realism about facticity must rely on minimal realism about ultimate reality. Yet to admit that the independent ensemble of things-in-themselves has a structure that becomes in different ways, through imposing diverse access practices, a meaningful framework amounts to committing a neo-Kantian, and not a hermeneutic-phenomenological position.

while rejecting any form of robust realism in approaching natural science, the hermeneutic realist is not willing to dispense with analyzing the structures of knowledge constituted within the facticity of inquiry.

2 Hermeneutic Realism as a Hermeneutic Philosophy of Science

Any particular (non-scientific or scientific) practice constitutes (what Heidegger in *Being and Time* calls) an "environment" (*Umwelt*): a local reality that in its readiness-to-hand is spatially arranged by practitioners. Environment is the operative spatiality that belongs to a contexture-of-equipment. Put in terms of the existential analytic, environment is created by the circumspective concern that is inherent in a practice as a concernful dealing with contextualized entities that have the character of equipment within-the-world. In a way that deviates from the existential analytic, the hermeneutic realist admits that the worldness of the world is the totality of overlapping environments, but not the global reality as facticity of meaningful articulation. The global reality as facticity becomes unveiled through the way in which practices in their interrelatedness open horizons of possibilities for this articulation. Accordingly, reality is both what is (locally) ready-to-hand in particular practices and what becomes (globally) disclosed (and under special conditions, objectified) in their interrelatedness. Now, this line of reasoning is intrinsically tied to the central distinction of the present study: the distinction between reality qua facticity and reality disclosed and transformed into objectified factuality within facticity. (Obviously, the outcome of this transformation is the reality-as-objectified-factuality. Yet this expression is an elliptical construction that stands for the "meaningful articulation of reality which is capable of bringing into play the objectification of reality as factuality".)

The empirically identifiable reality might be approached either as factuality that is objectified within theoretical frameworks interpretable through discrete semantic models, or as temporalizing/temporalized and spatializing/spatialized facticity in which the hermeneutic fore-structuring (of contextually constituted meaning) remains enmeshed in the manifestations of what becomes constituted. This distinction should not be trivialized by admitting that facticity is both contextualizing and contextualized in its ongoing fore-structuring, which implies its contextual flexibility and relativity, while objectified factuality is invariant (and admittedly, decontextualized). A relativizable objectified factuality is not only hypothetically imaginable, but it is the main topic of discussion in the post-empiricist epistemology of the growth and change of scientific knowledge in its historical dynamics. In this epistemology, the relativity of factuality is expressed by the observation that the same facts might repeatedly be re-conceptualized in the development of science whereby they—in accordance with the theory-ladenness thesis—acquire the status of different empirical bases of different theories. Yet the revisability and the

relativizability of objectified factuality do not make it a kind of facticity, since it still remains—after its re-conceptualization—determined by a theoretical framework and its semantic interpretation.[11]

The interpretative fore-structuring operates in each context in which articulation of meaningful entities and structures takes place. In this regard, one might detail an earlier claim by holding that the reality revealed by interplaying practices and possibilities (qua reality-of-meaningful-articulation) constantly fore-structures the reality-as-objectified-factuality. In the perspective of hermeneutic realism, what is fore-structured is what becomes objectified in its state of situated transcendence. The concept of *hermeneutic fore-structure* stands for the way of being situated within a horizon of possibilities that while being appropriated become contextually objectified. This concept refers also to the way of temporalizing what is in a state of situated transcendence. The horizon of possibilities is not existing out there per se, but has a being to the extent to which the possibilities are to be appropriated by choosing them. The horizon is open when choices of possibilities take place within it. Otherwise, it does not exist (i.e., does not disclose reality projected upon possibilities). Thus considered, the horizon is always transcending both what becomes appropriated and those who are making the choice. Since the horizon is not existing per se, it does not transcend "once and for all" but in a situational and contextual manner. The horizon is "moving" from one to another situation/context, provided that the movement is propelled by the choices of possibilities. In each situation/context the horizon is transcending the outcome of appropriated and actualized possibilities anew. Though the horizon might seem in each situation/context a finite range of possibilities, its movement is potentially infinite.

With regard to the way in which it fore-structures, the horizon is constantly opening a future (futural possibilities), while the appropriated possibilities bring into being trajectories of having-been—trajectories that become intelligible only with regard to what is chosen to be appropriated. The actualization of chosen possibilities makes them present within the context in which the choice takes place. With regard to scientific inquiry, the actualization of possibilities results in contextually objectified factuality. Considered in terms of facticity's way of temporalizing, the hermeneutic fore-structure is a futural horizon of open possibilities that brings into being possible trajectories of having-been by making present the contextually chosen possibilities. Reality is properly disclosed to be articulated and objectified but within

[11] Let me draw attention to the fact that I am speaking of "relativizable objectified factuality". Starting with social constructivism, many programs in science studies have laid claim to the dependence of the way of obtaining factuality in scientific research (and the factuality itself) on social negotiations, gender, contingent biases, historical prejudices, and so on. Yet these programs are stressing in the first place not the revisability and relativizability of scientific factuality, but the impossibility of having (epistemological justification of) independent objectification of factuality. What they call into question is the objectification. By contrast, the post-empiricist philosophers insist on factuality's revisability and relativizability without casting doubt on the possibility of objectification and the constitution of objectified factuality (within the frameworks of epistemologically acceptable theories). This explains the strong protest of Kuhn and Lakatos—who otherwise represent the two poles of post-empiricism—against the constructivist sociology of science.

the hermeneutic fore-structures of scientific inquiry. Vis-à-vis the continuity of re-contextualization in scientific inquiry, there is a continuous process of interpretive fore-structuring of what becomes objectified.

One should take into consideration that the fore-structuring is always specifically directed. This directedness is to be illuminated as a dominant tendency to appropriate certain possibilities. In a more extended formulation, this is a tendency to projecting the process of meaningful articulation upon preferred possibilities that turns out to be at the same time a tendency to appropriate these possibilities in the same process. The interpretive fore-structuring being specified by such a tendency is a *characteristic hermeneutic situation* of articulating and objectifying a domain of reality. From the participants' viewpoint, the characteristic hermeneutic situation is experienced in terms of orientations toward and anticipations of entities that will be articulated meaningfully within their more or less routine practices. A case in point is the anticipations, expectations, and orientations characterizing the Kuhnian normal-scientific (puzzle-solving) work.

A scientific domain is disclosed for a meaningful articulation and objectification within a characteristic hermeneutic situation. As a tendency to projecting and appropriating possibilities for doing research, this situation consists in the triad of fore-having, fore-seeing, and fore-conception of what becomes meaningfully articulated and objectified within the domain of inquiry. From the participants' perspective, the tendency to choosing and actualizing possibilities is manifested through states of "collective subjectivity"—the already mentioned orientations, expectations, and anticipations—that roughly correspond to fore-having, fore-seeing, and fore-conception. (Vis-à-vis the traditional context distinction in the analytical philosophy of science, and the fact that the "context of constitution" of the hermeneutic philosophy of science is neither reducible to the "context of justification" nor is it replaceable by the "context of discovery", one may argue that the orientations, expectations, and anticipations [as addressed in the "context of discovery"] are counterparts of fore-having, fore-sight, and fore-conception as they are spelled out in the "context of constitution" (Ginev 2006, 135–145)[12].)

Characterizing "collective subjectivity" in terms of fore-having, fore-seeing, and fore-conception makes it the *Dasein* of scientific inquiry. The triad of interpretive fore-structuring expresses "presuppositions" settled by lasting configurations of scientific practices that might become a normal-scientific routine. Scientific practices in their interrelatedness display the predisposition to create and retain certain configurations. Putting this predisposition into effect brings into being fore-having, fore-seeing, and fore-grasping as presuppositions of choosing and actualizing possibilities for doing research. On this account, the presuppositions are neither encapsulated in the "collective mentality" nor effectuated by the "collective

[12] It is important to underscore that, in contrast to "social construction of scientific facts" philosophers, the hermeneutic realist does not imply that there is no distinction between justification and discovery because evidence is always a social product. The point she makes is that the constitution is not only completely independent of discovery and justification, but also that the former is an ontological prerequisite for having the latter as socially organized epistemic processes.

intentionality" of a community of inquirers. They are rather a part of the interplay of practices and possibilities and the hermeneutic circularity of the research process. In other words, the presuppositions defining a characteristic hermeneutic situation are not mental factors but "ontological states" distinguishing the *Dasein* of scientific inquiry. It goes without saying, however, that they operate through mental acts and activities. It is the reflexive attitude of inquirers toward the process of inquiry that might make the fore-having, fore-seeing, and fore-conception of a characteristic hermeneutic situation explicit. More importantly, such an attitude might hold sway over the established hermeneutic situation and change it. To sum up, the interplay of practices and possibilities for doing research creates presuppositions that might become reflexively changed, which would imply a change of the characteristic hermeneutic situation. In the next chapter, I will show that there is a play of two types of (endogenous) reflexivity involved in this self-referential control and change of the tendency to appropriating possibilities.

Yet there is another aspect of the concept of characteristic hermeneutic situation that I deal with elsewhere (Ginev 2011a, 69–77). This aspect has to be interpreted in terms of a balance between de- and re-contextualization in the constitution of meaningful entities in the research process. At issue is the competitive coexistence between the two basic dimensions assigned to the reading-representing of the meaningful objects of inquiry. When de-contextualization dominates, then the projection (of what is disclosed in inquiry and the reality of the whole domain) upon possibilities is strongly limited and determined by the formal structure of objectification. In this case, the objectification tends to become intratheoretically enclosed, and the objectified factuality seems to be detached from the facticity of inquiry. Presumably, there are no traces in this factuality left by the interpretive fore-structuring of the objectification. Accordingly, there is no reason for making use of the expression "contextual objectivity" of the produced knowledge. (On several occasions in the remainder I will make the case that the de-contextualization in the process of inquiry is not to be absolutized. De-contextualization is always hermeneutically fore-structured; i.e., it takes place within interplaying practices and possibilities. Put differently, there is no de-contextualization freed from a context of de-contextualizing practices. On this account, de-contextualization is not a strong antipode to, but rather a special form of re-contextualization. In view of this peculiarity, I prefer now to put more emphasis on the interpretation of the concept of a characteristic hermeneutic situation in terms of a tendency to appropriating possibilities through which the fore-having, the fore-seeing, and the fore-conception of inquiry are specified rather than the interpretation in terms of a balance between de- and re-contextualization.)

If there is a preponderance of re-contextualizing the constitution of the objects of inquiry, then what prevails is the openness to a growing number of new possibilities, and the readiness to intensify the merging of the contextually objectified factuality with meanings that remain non-objectified and projected upon possibilities. (These meanings bear a resemblance to Michael Polanyi's "tacit knowledge". But in contrast to this idea, the non-objectified meanings I have in mind belong not to a

knowing consciousness, but to the facticity of inquiry.)[13] By dominating in a characteristic hermeneutic situation, the dimension of re-contextualization makes the objectification dependent on the variability of contextual interpretations of (say) what should be counted as relevant measurable parameters; which patterns of data are to be taken as representing phenomena that are in need of theoretical explanations; and which phenomena are worthy enough to be saved.

What has been articulated and objectified within the contextualizing facticity of interplaying practices and possibilities remains an integral part of inquiry's facticity. Accordingly, the objectified factuality is not fixed by a conceptual-formal framework (and freed from practical context), but contextualized by everyday practices and open to be re-contextualized. Since the interplay of practices and possibilities as specified by a characteristic hermeneutic situation belongs to reality, one has to state that the reality disclosed in scientific inquiry has neither meaning nor being beyond such a situation. However, this claim is hard to be comprehended, since the "factical life" and its hermeneutic situation are "suppressed" by secondary objectivist images and representations of scientific practices, all of them foreign to the laboratory everydayness. Accordingly, objective reality and the everydayness of inquiry (replete with contingencies and particularities) are viewed as completely orthogonal. Frederick Grinnell nicely demonstrates how the everyday facticity of inquiry is hidden not only by "the scientific method", but also by the institutionally organized forms of scientific life. According to him, science textbooks and research publications exclude the dynamics of everyday practices. He shows in particular how everyday laboratory research operates with "unintended experiments" that promote a way of thinking characterized by Peirce's abduction. It is the everydayness of unintended experiments that pushes the research in new directions (contexts) within the leeway basically constrained by the characteristic hermeneutic situation

[13] In his earlier work Polanyi devises an outstanding argument for the implicit hermeneutics of scientific inquiry. First, he makes the case that the natural laws cannot be formulated and defended by applying explicit known operations to measurements. A mathematical function connecting instruments' readings could not constitute what one is accustomed to regard as a natural law. Second, Polanyi (1946, 10) shows that the missing element for having a law-like formulation cannot be compensated by the introduction of new operations, rules, and instruments' readings, but by the scientist's intuition that "can integrate widely dispersed data, camouflaged by sundry irrelevant connexions, and indeed seek out such data by experiments guided by a dim foreknowledge of the possibilities which lie ahead." Third, he argues that the formulation of a new scientific proposition involves the reconsideration of known phenomena in a new context. It follows from these three elaborations that no scientific proposition can be obtained from observational data, and "we must therefore accept also that no explicit rules can exist to decide whether to uphold or abandon any scientific proposition in face of any particular new observation" (Polanyi 1946, 15). The conception of personal knowledge is devised with the purpose of weakening epistemological normativity, and to demonstrate that normatively stipulated objectivity in science is a "false ideal". Yet in looking for a position beyond Cartesian dualism without taking into consideration the ontological facets of the subjective-objective fusion in the production of knowledge, Polanyi's hermeneutics of scientific inquiry remains an uncompleted enterprise. It is the facticity of inquiry that provides the (trans-subjective) terrain on which the fusion of the subjective and the objective occurs. Personal knowledge operates by mediating between facticity of domain's meaningful articulation and the experimental, conceptual, and theoretical production of factuality.

(Grinnell 2009, 30–34). Leaning on Grinnell's study, one should conclude that several steps of "phenomenological epoché" ought to be undertaken to reach the "everyday stream of practices".

In order to flesh out the concept of characteristic hermeneutic situation as well as some related concepts conceived so far in general terms, I will turn to an episode in the history of post-war biochemistry. The following analysis of this episode does not pretend to unfold (and does not meet the criteria for) a historiographical case study.[14] It serves only an illustrative function. The episode refers to the hermeneutic situation in which the domain of vectorial metabolism has been disclosed in the late 1950s and the early 1960s. Before analyzing the hermeneutic situation, I have to sketch out the historical situation of the domain's formation.

The studies in vectorial metabolism were promoted by a novel context of biochemical inquiry that nurtured a special style of scientific thinking. It is a style—developed to a certain extent in conjunction with F.G. Hopkins's holistic and dynamic biochemistry, Marjory Stephenson's enzymological approach to metabolism, and Joseph Needham's ideas for embryological morphogenesis—that lays much emphasis on mathematical descriptions of matter and energy flows in living cells. The implementation of images of spatial organization and vectorial motion related to thermodynamic models of enzymatic reactions is a distinctive feature of this style. The new context of inquiry came into prominence thanks to the research work of Peter Mitchell, who was the most significant exponent of the corresponding style (Prebble and Weber 2003, 49–53). To be sure, his work has a rich prehistory. Ideas of (and research attitudes towards) vectorial processes in energy-requiring metabolic reactions have been gaining currency since Elmer Lund's pioneering studies (from the mid-1920s) of the trans-membrane directive force in the formation of new cell structures. Inspired by C.H. Waddington's formal models about how gene regulatory products could generate developmental phenomena, some biochemists launched investigations of the topological arrangements of coupled metabolic reactions that can prompt morphogenetic processes. A further important step on the way to the domain's formation was undertaken by Henrik Lundegårdh, who in the mid-1940s suggested that cytochrome pigments might provide an electron-conducting pathway across plant cell membranes so that oxygen could be reduced on the one side while hydrogenated substrates were oxidized on the other side. The spatial anisotropy in the movement of metabolites across the cell membrane was a guiding theme in the work of J.F. Danielli in physical biochemistry.[15]

[14] Elsewhere I elaborate on this episode as a case study entitled to show how the hermeneutic philosophy of science works in the historiography of science. See Ginev (2014c).

[15] Fritz Lipmann is usually not counted (in the historiography of biochemistry) as a forerunner or a supporter of vectorial metabolism. He was one of the founders of the chemical theory of oxidative phosphorylation, which opposed the anisotropic models of cellular and trans-membrane metabolism. But the view Lipmann advanced (in the early 1950s) that the group-potential gradient is transmitted between coupled reactions was of prime importance for several later studies in the domain. Lipmann's attention was concentrated on phosphate derivatives arising in the process of group activation through phosphoryl transfer from ATP, which would become in the 1960s a paradigmatic topic in vectorial metabolism. Another important event that anticipated the domain's

The basic focus within the novel context of biochemical inquiry was the interplay of metabolism and transport situated in and spatially arranged by the membrane. This interplay was at stake in Mitchell's initial research work. After studying the bacterial cytoplasmic membrane qua "osmotic barrier" and the role played by enzymes on the outside and on the inside of the membrane, Mitchell did experimental research that specified essentially the whole context of inquiry I refer to. This research led him to the conclusion that a reorganization of the protein in the membrane is responsible for the transport of phosphate. The mechanism of transport proceeds like an enzymatic reaction, and the reorganized protein is capable of providing a way through the osmotic barrier in the same manner in which enzymes lower the energy barrier to metabolic reactions. It was the analogy between the transport of phosphate across the membrane and the mechanism of enzyme catalysis within the context of research practices devised to study the vectors in the transfer of energy and molecules that opened a new leeway for doing research. Along with the completely new possibilities, there were in this leeway possibilities that have been excluded within the contexts of inquiry set up by the established research programs in biochemistry, microbiology, cell physiology, and other biological disciplines. Roughly, the tendency to choosing, appropriating, and actualizing these newly opened possibilities within the novel context of inquiry disclosed the domain of vectorial metabolism. Mitchell's chemiosmotic theory arose from actualized possibilities within this tendency. The theory provided models for saving spatially organized metabolic phenomena. By having such phenomena theoretically saved, one was able to reveal the reality of vectorial metabolism and to represent it by means of contextually objectified factuality within the facticity of inquiry.

The chemiosmotic theory is a theory about the respiration chain coupled to the synthesis of adenosine triphosphate (ATP, a molecular unit that transports energy for intracellular metabolism) and leading to oxygen reduction to water. (The synthesis of ATP is from adenosine diphosphate, and it is catalyzed by the enzyme ATPase. Experimental research measures the coupling of the respiratory chain and the synthesis of the molecular unit of energy in terms of the ratio of the number of ATP molecules and the number of atoms of oxygen reduced.) The investigations of the process of coupling redox reactions and dehydration reactions, known as oxidative phosphorylation, were launched in 1930 by Vladimir Engelhardt. He described for the first time the mechanism of oxidative phosphorylation as a link between the oxidation-reduction reactions and the synthesis of ATP. (It is worth mentioning that the theoretical model of the phosphate bonds of ATP serving the function of the basic source of energy in cellular metabolism was developed several years later by Fritz Lipmann.) A decade after Engelhardt's pioneering work, a series of experiments demonstrated that cellular respiration using one oxygen atom can form two ATP molecules. Thanks to the work of Albert Claude it became clear in the same period that mitochondria can be isolated (from cell fractions) and experimental research of the synthesis of ATP can be conducted on them alone. Experiments with

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formation was the introduction of spectrophotometric measurements that indicated the existence of anisotropic proton motive forces.

slightly damaged mitochondria showed that the latter can carry out respiration but fail to synthesize ATP. In due course biochemists identified substances that inhibit the coupling mechanism between the respiratory chain and the synthesis of ATP. These "uncouplers" would play a prominent role in the construction of theoretical models for saving biochemical and physiological phenomena exhibiting spatial directedness.[16]

Upon these investigations, a research trend predominated that aimed at discovering chemical intermediates responsible for the link described by Engelhardt. It was supposed that the mechanism whereby the transfer of electrons through the oxidation reduction is coupled to the synthesis of ATP operates via high-energy intermediates. This supposition (made originally by Fritz Lipmann) became the kernel of the chemical theory of oxidative phosphorylation, whose initial version was developed in 1953 by Bill (E.C.) Slater. According to this theory, there is no privileged directedness of the synthesis of ATP (as specified by a certain gradient across the membrane), and the link between respiration and that synthesis consists in chemical substances. The long quest for substances—running from the model for substrate-level phosphorylation of succinyl coenzyme A in the early 1950s to the late 1960s when more than a dozen mechanisms of chemical transfer were under scrutiny—capable of transferring energy from molecule to molecule turned out to be an unsuccessful enterprise. Douglas Allchin (1996, 32) nicely summarizes the wrong assumption of those biochemists who stressed the possibility of identifying stable high-energy compounds in the phosphorylation of ATP: "Chemists wanted to isolate and identify a set of high-energy intermediate molecules, but found the task unduly difficult. They began to suspect that the compounds might be tightly bound to membrane proteins. That, at least, could account for their persistent failures."

The chemical theory of oxidative phosphorylation might be combined with theories about the stereochemical transformations of enzymatic polypeptide chains. This combination potentially enhances the explanatory power of the chemical theory. Yet it does not make the latter empirically more plausible. The combination does not create new chances for empirical verification of the chemical theory. Thus, the conformation of ATPase as necessary for ATP synthesis was verified and widely accepted as a phenomenon that is to be saved through a theory of molecular biology, i.e., as a phenomenon independent of the success or failure of the chemical theory. It is worthwhile mentioning, however, that the conformational changes in enzymes (as initially studied by Paul Boyer in the 1960s) would be regarded in the 1980s as indispensable for the synthesis of ATP. During his lifetimeMitchell (1920–1992) did not accept the conformational model, and insisted on his idea that the proton passes through the active side of the enzyme. (In his argument, the conformational model is not able to specify the actual mechanism of coupling.)

[16] The uncouplers do not affect the activities of electron flow and ATPase, but ATP synthesis cannot occur. In particular, studies in protonophoric uncouplers that allow protons to cross lipid bilayers revealed mechanisms of induction of biological activities by modification of the state of a specific membrane protein. Such results subsequently promoted the extension of the domain of vectorial biochemistry to cover studies in molecular and cellular morphogenesis.

To set the stage for my further discussion, I will tentatively argue that Mitchell's principal contribution to the new domain consists in the demonstration that the coupling of respiration and ATP synthesis is mediated by an electrochemical gradient of protons across the mitochondrial membrane. The emphasis was placed on the causal link between the flow of electrons through the respiratory chain enzymes and the translocation of protons across the inner mitochondrial membrane. This account was deliberately forged as an alternative to the chemical mechanism of oxidative phosphorylation, which appeals not to anisotropic flaws but to enzyme-bound chemical compounds (Griffiths 1965).

Mitchell's chemiosmotic theory was prepared within the new context of research practices by experimental discoveries of patterns of anisotropic metabolic and physiological processes.[17] Within this context it was realized that the distinction between vectorial chemistry and vectorial physiology is a matter of degree. A paradigmatic example was a muscle contraction, whose directionality in cellular space expresses a joint chemical-physiological spatiality. In addressing the question as to which are the prime movers in metabolically coupled translocation reactions, the search for patterns of spatially extended chemiosmotic proton circulation became a focal topic. The experimental work of Mitchell and Jennifer Moyle on this topic in the late 1950s demonstrated that enzyme systems are the conductors of membrane transport and that metabolic energy is converted to osmotic work by the formation of covalent links. More specifically, Mitchell and Moyle (1958) were able to discover a transfer of phosphate group vectorially through an enzyme. The idea of metabolic directionality was introduced with respect to the different directions from which the substrates are approaching the active site of an enzyme. Another possible instantiation of this idea came from the supposition that the membranes of mitochondria act as chemiosmotic links between the media that they separate. In investigating the group translocation as a form of trans-membrane transport, Mitchell and Moyle managed to integrate the metabolic inter-conversions and fluxes across the various cellular membranes into a single mechanism. This was a decisive step in the formation of the chemiosmotic theory. Parallel to Mitchell and Moyle's research work, Robertson carried out investigations of gastric acid secretion which were also guided by an anisotropic spatial model of reactions. He assumed that the act of

[17] To take up a motif already mentioned, Mitchell came to the scenario of "chemiosmotic coupling in energy transduction" (the technical expression he proposed) by following the particular scientific practice of drawing analogies. In his case, the analogy was between the osmotic translocation reactions (for instance, the coupling of phosphate translocation against arsenate translocation) and the enzyme-catalyzed group-transfer reactions (Mitchell 1972). There was nothing unusual in pursuing this thoroughly conventional scientific practice. Mitchell's scenario was by no means an exotic hypothesis, since the "primary chemical coupling" was known as early as the 1930s when a research group reported on coupling in group-transfer reactions in studying the role of the NAD coenzyme. A particular reason for resisting the theoretical conceptualization of the chemiosmotic mechanism was the plethora of theoretical objects this conceptualization introduced. Cases in point are "the trans-membrane electrochemical potential powering the enzyme of the mitochondrial ATPase", "the anisotropic enzymes requiring two aqueous phases separated by a membrane", "the phosphorylation reactions driven by proton motive force", and most of all "the electrochemically based physiological processes".

secretion depends on the separation of positive and negative charge in the electron transport system.

In trying to find a way beyond the wrong assumption and the persistent failures of the chemical theory, Mitchell specified further the idea that the membrane plays a "topological" role in oxidative phosphorylation: The removal of a molecule of water in the synthesis of ATP from ADP follows two opposite directions: The hydrogen ion (proton) and the hydroxyl ion are removed to the opposite side of the membrane. The osmotic potential provides the energy for ATP synthesis. The respiratory chain in turn drives the flow of ions in the opposite direction. The reactions of this chain also act vectorially. On this account, the enzyme ATPase that phosphorylates ADP to ATP is responsible for the return of the protons, thereby enabling the energy currency of the cell. The initial version of the chemiosmotic theory was formulated in 1961 by unfolding (but not yet experimentally verifying) the hypothesis that ATP is synthesized by membrane-bound ATPase through removal of a proton from one side of the membrane and the removal of the negatively charged hydroxyl ion to the other side (Mitchell 1961). In this version, the coupling between oxidoreduction and phosphorylation systems is due to the channeling of translocation of protons which could play the part of the donor/acceptor intermediate between the oxidase and ATPase systems.[18] The initial version of this theory required a complex experimental verification that included investigations of mitochondrial membrane impermeability to protons, the "proton pump" created by the respiratory chain, the rate of proton translocation during oxidoreduction, the magnitude of the total proton motive force across the membrane, and the identification of proton-coupled porter systems in the membrane that regulate the internal pH, thereby maintaining osmotic stability. In fact, Mitchell's (1962) ambition was not restricted to this verification, but to developing a unifying framework for addressing the processes that underlie metabolism, transport, and morphogenesis. With the rise of the chemiosmotic theory the "vectorial mystery" of the cellular space became the new domain's kernel problematic. By the late 1950s it was a matter of belief in this mystery, a belief that abstractly denied that there are unidentified molecules with a high-energy bond (as was postulated in the chemical theory of oxidative phosphorylation).

The structure of the initial version of the chemiosmotic theory combined the physiology of the mitochondrial membrane with the chemistry of moving ions

[18] The story of the chemiosmotic theory's formation might be told as a story of transforming a hypothesis into a theory. The hypothesis in this case was that mitochondria ejected protons and that proton gradient drives ATP synthesis. This hypothesis challenged the view that transport and metabolism were essentially separate processes. The chemiosmotic theory (as a theory about the process of energy conservation in mitochondrial and bacterial respiration and in photosynthesis) conceptually unfolded the initial hypothesis, but it remained in need of experimental verification. The theory's postulate that the linkage between the coupled reactions catalyzed by two osmoenzymes depends on the electrochemical potential gradient generated by one reaction and consumed by the other was for a long period without sufficient empirical support. Nonetheless, the initial version of the chemiosmotic theory suggested conceptual resources and possible theoretical models for the articulation and objectification of the already disclosed domain of vectorial metabolism. John Prebble (2001, p. 447) nicely argues that "the notion of vectorial metabolism is given its most fulsome treatment almost concurrently with promulgation of the chemiosmotic theory."

across the membrane. In 1966 Mitchell proposed an extended and elaborated version of his theory. The new version was at the same time conceptually simpler than the original one. According to it, the synthesis of ATP is driven by a proton that passes through the ATPase. The models of this theory are entitled to save experimentally measurable phenomena by explaining patterns of data as being caused by a gradient of protons resulting from pumping protons from one side of the membrane to the other, thereby creating an electrical potential. In the extended version, the electron-carrying arm of the redox loop could include a photoelectric reaction so that the potential of this reaction could be transformed into a proton motive force. In the context of inquiry related to the new version, a focal topic became the issue of how the conformational mobility of the translocation catalysts is associated with their normal group-translocation and solute-translocation functions. Addressing this issue in terms of chemiosmotic theory was consonant with several principal new research trends in biochemistry and enzymology from the early 1960s, like Koshland's induced-fit interpretation of enzyme kinetic data, the hypothesis that the activation energy for group transfer may be lowered by the balancing of stress-strain relationships, and Perutz's elaborations on conformational changes in hemoglobin molecules during oxygenation. It was the association of the chemiosmotic theory with these trends that enabled the integration of issues of morphogenesis in the domain of vectorial metabolism. This is why many years later an outstanding biochemist would remark: "Mitchell bade us to look upon cell growth as a grand symphony of transport" (Harold 1991, 365). The idea had gained currency that the cellular morphogenesis is a function of vectorial metabolism.

The focus of my discussion here is the role of chemiosmotic theory in the articulation of the domain of vectorial metabolism. However, the prime impact of this theory was upon the domains of bioenergetics and enzymology. The new conceptualization of the link between the respiratory chain and ATP synthesis radically changed the research work in these domains. This is why for several authors the emergence of the approach to biochemical phenomena which emphasizes a gradient of protons by pumping protons was a revolutionary paradigm shift in biochemistry.[19] Yet it is hard to forge a simple historiographical narrative about this shift.

Though the chemiosmotic theory was (in the mid-1970s) a conceptually coherent and complete construction, several historiographical case studies demonstrate that one is not able to single out a particular historical moment at which the "oxphos controversy" could be counted as resolved in favor of this theory. As Marcel Weber (2002a, b) shows, it was the change of the situation (thanks to the emergence of new research practices) in 1975 which brought decisive arguments for the acceptance of the chemiosmotic theory. He analyzes the reasons why several experiments in the 1960s and the early 1970s (including the earlier experimental search for reconstituting oxidative phosphorylation in Racker's laboratory) failed to resolve the controversy (or failed to play the role of a crucial experiment), and reaches the

[19] See, in particular Prebble and Weber (2003, 3), Weber (2002b), Gilbert and Mulkay (1984), and Skulachev (1987). This view is supported even by Slater (2003), one of Mitchell's major opponents.

conclusion that while the role of the membrane was highly ambiguous around 1970 and impeded an independent test that can resolve the controversy, the experiments with "cellular chimeras" (creating cellular artifacts from isolated components) in conjunction with new knowledge about the membrane functions provided a sufficient basis for ruling out the chemical theory and accepting the chemiosmotic one (Weber 2002a, 43–45). In another historical case study, John Prebble (2001) lays particular emphasis upon the research community's "implicit knowledge" which resisted the search for designing appropriate experiments for checking on whether mitochondria ejected protons, whether a proton gradient would drive ATP synthesis, and whether the mitochondrial inner membrane was impermeable to protons. More specifically, the community's implicit knowledge prevented (or at least restricted the leeway for) the elaboration on research scenarios uniting chemical with physiological mechanisms.[20]

With this conclusion in mind, I turn now to the characteristic hermeneutic situation of articulating and objectifying the domain of vectorial metabolism as it has been disclosed in the initial context of inquiry. Let me reiterate that such a situation is the hermeneutic fore-structuring of the domain's objectification as specified by a tendency to choosing, appropriating, and actualizing possibilities in the process of inquiry. This tendency keeps its effectiveness in the proliferation of contexts of inquiry. The research process in a characteristic hermeneutic situation constitutes meaningful objects and structures related to the phenomena being saved in the domain's objectification. The hermeneutic situation characteristically manifests itself through the triad of fore-having, fore-seeing, and fore-grasping these objects and structures within the ongoing interplay of practices and possibilities.

Fore-having is the orientation toward constructing experimental phenomena that show the way of being of objects like proton motive forces and trans-membrane transport systems. This being as projected upon possibilities is approached within

[20] The search for patterns of morphogenesis on the level of cellular physiology became a "natural continuation" of the inquiry into the topology of enzyme-catalyzed reactions. Thus, the problematic of the spatiality of growth, morphogenesis, and self-organization is intimately related to the domain of vectorial metabolism. The contemporary studies in vectorial metabolism are dealing with spontaneous emergence of regular spatial patterns. The notion of a morphogenetic field consisting of diffusible molecules acquired a special importance. The spatial and temporal features assure the passages between molecular biology and physiology. The ions play the role of cellular morphogenes (i.e., genes dedicated to the task of cell shaping). A promising trend of inquiry in the domain's articulation is the investigation of how ionic currents localize morphogenetic events (Goodwin and Trainor 1985). The latter are mediated by diverse enzyme activities (Harold 1990). In this regard, one should point out experimental practices with "morphogenetic mutants" whose aim was to establish the patterns of transition from molecular morphogenesis to cellular growth and morphogenesis. To be sure, Prigogine's dissipative structures—and more generally, the doctrine that thermodynamic consequences of metabolism are responsible for the spatial organization of physiological processes—provide patterns and models in this regard. However, there is no configuration of scientific practices that constitutes objects of inquiry through which nonlinear, autocatalytic chemical reactions might be connected to cellular morphogenesis. The integration of the paradigm of self-organization at a chemical level in the domain of vectorial biochemistry remains a desideratum. The same conclusion is to be drawn with regard to the study of the genetic specification of biochemical topology.

the horizon of investigating the topologically arranged osmotic processes and ionic currents. The contextual actualizations of these possibilities (including the possibilities of exploring morphogenesis) transform these—initially introduced as hypothetical—objects into meaningful entities (i.e., amenable to being read and represented) within the domain's articulation. The fore-having as orientation also contours the scope of possible practices of inquiry whereby what is meaningfully articulated might factually be objectified as the objective reality of proton circuits and group translocation. The fore-having of the new biochemical and physiological objects in the formation of the domain was informed by a configuration of practices that provided readable technologies for making sense of molecular anisotropy in the cellular space. Granted that the aqueous environment of the cell cytoplasm is an isotropic medium, the fore-having of "anisotropic objects" oriented the research work toward what may causally create molecular anisotropy. The fore-having operates via pre-judgments about the way of being of the hypothetical objects which the process of inquiry has to determine by saving experimentally constructed phenomena through theoretical models. As stressed above, even before the formation of the domain of vectorial metabolism, pertinent pre-judgments—typically illustrated by those involved in models of membrane semipermeability—were at work in the conceptualization of anisotropic processes in cell biology and physiology. The pre-judgments can only be effective if the initially hypothetical objects—as gradually revealed by means of saved phenomena—are properly envisioned in spaces of scientific representation.[21] In saying this, I reach the next moment in the domain's fore-structuring as specified by a characteristic hermeneutic situation.

Fore-sight consists in the ways of making the hypothetical objects visible as their way of being is projected upon the newly opened possibilities. Though these objects may never become visualized entities, they are constantly envisioned in the process of inquiry by various representational devices, signs, and symbols. Franklin Harold provides a wonderfully picturesque description of how the believers in the chemiosmotic theory (as supplying a comprehensive framework for all bioenergetics) have intuitively apprehended the reality of biologically important molecules: The "protein molecules are regular and shapely bodies, not blobs. They come with clefts, cavities and sometimes channels, undergo ordered changes of conformation and possess intrinsic asymmetry or polarity. This is a commonplace today, colourfully illustrated in every textbook, but in the 1950s it was a speculative and pregnant notion" (Harold 1991, 348–49). This statement documents the fore-seeing of what will be inquired after the inception of the domain of vectorial metabolism. The new fore-sight was instrumental in the evolvement of normal scientific research guided by the intention to single out conditions under which scalar reactions (like most

[21] Ron Naylor (1989) coins the appropriate expression "pre-empirical episteme" when dealing with Galileo's orientation toward the possible outcomes of experiments. Such an episteme is neither informed by background knowledge nor is it stemming from the inquirer's "personal knowledge". In Galileo's case, the pre-empirical episteme sets the stage for the process of experimental reading of the "Book of Nature" as it is written in mathematical language. More generally, the pre-judgmental episteme is a particular horizon of reading objects of inquiry through saving experimentally constructed phenomena.

enzyme reactions) would become vectorial with regard to the reactants arriving on one side of the membrane and the products left on the other. This was a routine research in the horizon of expectations of obtaining semiotic representations of the vectorial properties of the catalysts of the respiratory chain inlaid in the lipid membrane. Initially, the fore-sight within the horizon of expectations was confined to simple electrostatic envisioning of the electric potential difference caused by the migration of ions. Later on, the domain's normal scientific work brought into being more sophisticated devices of envisioning and representing topological arrangements of coupled reactions. Within the new spaces of representation the objects which have been initially introduced as hypothetical objects (like proton motive forces and trans-membrane transport systems) also gradually became envisioned. More generally, the fore-sight guided the search for envisioning and representing all objects hypothetically presupposed in approaching enzyme-catalyzed group transfer reactions in terms of topological translocations of ions.[22]

The most decisive step in envisioning vectorial metabolism's theoretical objects was the emergence in the 1970s of experimental practices of producing "cellular chimeras" (a mosaic of components stemming from different organisms that is entitled to demonstrate how the cell production of ATP comes into play). Douglas Allchin (1996, 34–36), who is the author of the philosophically most interesting historical reconstruction of the "experimental and conceptual chimeras" in biochemistry, draws attention to the fact that it was the failure to provide in vitro envisioning of oxidative phosphorylation (as was the case with the experimental visualization of the citric acid cycle, for instance) that brought into being the creation of "surrogate reality" in the attempts at identifying hypothetical objects. The practices of production of "chimeras" (composed of fragments stemming from evolutionary divergent groups like bacteria, plants, and animals) were designed to provide experimental envisioning of plots described by chemiosmotic theory. (The artificial chimeric composition had to demonstrate how the mitochondrial vesicle transfers the energy necessary for generating ATP.) At stake was the experimental envisioning of how cytochromes create a proton membrane gradient.[23]

[22] There is a pre-normative function of the fore-sight that poses requirements to the ways of reading/representing theoretical objects: Given that the envisioning of these objects takes place in spaces of representation, the objects' treatment within the configuration of practices has to incorporate the topological arrangements of electron-carrying and hydrogen-carrying catalytic components in the spaces of representations that envision the objects. The objects and structures introduced by the chemiosmotic theory have a way of being that certainly has a counter-intuitive character, which additionally strains their envisioning (see in this regard Orgel 1999). Interestingly enough, for Mitchell, it was the quest for high-energy intermediate molecules that came into conflict with intuitively seeing and grasping the biochemical reality. This is why he, in a sense of recapitulation, notes that what he has done is "a self-consistent research process based on simple principles" (Mitchell 1991, 298).

[23] This was an envisioning that broke the borderline not only between in vivo and in vitro experiments, but between the factual and the artificial too. Eventually, each of the theoretical elements of the chemiosmotic hypothesis was visualized by the artificial chimeric mitochondrial vesicles. Yet this visualization would have been impossible without the fore-sight operating in the constitution of vectorial metabolism's objects.

At the end of the 1960s the domain of vectorial metabolism was characterized by several spaces of representation and envisioning, such as equations representing types of transfer mechanisms, flow diagrams representing the transpositions of ubiquinone couples, diagrams representing the topology of proton motive forces, electron spin resonance measurements, spectrophotometric measurements representing stability constants, data models representing various types of mitochrondial cytochrome systems, measurements of miniscule electric fields generated by single cells in the surrounding medium, measurements of potential differences in the nanovolt range, patterns of trans-cellular electric currents providing clues to the mechanisms of generation of spatial order, etc. The fore-sight in the domain's articulation operates in all spaces and devices of representation, constantly prompting an integral envisioning that affords several theoretical images of vectorial metabolism: transport systems that are linked through the thermodynamic parameters of substrate concentration and electrical potential; slow diffusion of ions through cytoplasmic space; transducting proteins of bacterial chemiotaxis; microtubules and microfilaments as polarized structures due to intrinsic asymmetries; molecular polarity conferring physiological direction; enzyme kinetics based on molecular anisotropy and coupled activities of osmoenzymes; sodium fluxes that support ATP syntheisis; potential gradient as a driving force for the uptake of amino acids; ATPase that expels potassium ions in exchange for hydrogen ions; and complementarity between molecular asymmetries and cellular vectors.

Fore-conception of the domain's meaningful articulation and objectification is the anticipation of further possible contextualization of what has been articulated and objectified in the initial context of inquiry. Thus considered, the fore-conception refers to what I will later regard as a "textualization" of a scientific domain. In another definition, the fore-conception is the anticipation which informs changes of current agenda in the research process due to the implementation of new readable technologies in new spaces of representation. Such changes imply revisions and extensions of what has been articulated in the domain. The fore-conception operates by fore-grasping the contexts in which the newly opened possibilities might be actualized. A typical example of an early extension of the domain of vectorial metabolism is the instituting of the context of inquiry—already fore-grasped in the experimental work of Moyle and Mitchell—in which the focal topic was the difference between primary and secondary transport systems. By means of this research a more resilient view about the balance between anisotropic and isotropic transmembrane transport was gained. The former was attributed to actions catalyzed by osmoenzymes that create transport systems whose mechanism is based on covalent bonds. Such a transport system is characterized by a mutual reinforcement of chemical reactions and osmotic processes. By contrast, the secondary transport systems do not involve covalent bonds and mediate the translocation of solutes isotropically (Mitchell 1967).

Mitchell's (1975) introduction of the model for the Q cycle provides another illustration of an extension of the domain's meaningful articulation. (This cycle is a mechanism whereby protons, due to oxidation of ubiquinol to ubiquinone, move across the membrane; or a mechanism by which the third complex in the electron

transport chain [the respiratory chain] pumps protons and generates a pH gradient.) Fore-grasping the context in which the Q cycle is to be inquired and articulated was almost impossible at the beginning of the 1970s because of the lack of evidence for its existence in the established contexts of inquiry. Nonetheless, its way of being was projected upon possibilities. (Even in the mid-1980s there still had not been a general acceptance of the Q cycle. In fact, it was not Mitchell's model of this cycle, but a modified version of it that received the desired acceptance.) Thanks to the fore-grasping of further re-contextualization—to note another important role of the fore-conception—of the research process fore-conception, the transition from vectorial biochemistry to molecular and cellular morphogenesis became possible. Here are some prominent examples in this respect.

The first one is the contextualization of the chemiosmotic mechanism within practices of studying systems of biochemical reactions as dissipative structures by means of appropriate mathematical models and computer simulations. At stake are the discovery of stable patterns of chemical reactions that arise in systems far from thermodynamic equilibrium. A second contextualization (starting with Wolpert (1969)) is achieved through practices of exploring diffusible morphogen gradients and positional information that include transplant experiments and experiments on intercalation. Practices of studying morphogenetic fields (like endogenous electric fields, see Nuccitelli (1988)) provide a third example of contextualization in which spatial order is paralleled with a timeframe, and the whole time-space of morphogenesis is related to new conceptions of the cytoskeleton's functions. However, one should not ignore the skepticism which this kind of contextualizing of the chemiosmotic mechanism has provoked. Thus, Davies (2005, 8) argues that "the idea of morphogenetic gradients and fields is very useful for providing a high-level view of events, but it cannot be a part of a molecular-level explanation because a gradient is, by definition, non-local and cannot be sensed directly by a single molecule." It is a controversial issue as to whether accounts of the shape changes at the scales of cells and tissues are to be given in terms of events that take place only at the scale of individual molecules.

The continuous contextual reading of the hypothetical objects involved in the mechanisms of vectorial metabolism is accomplished through readable technologies and spaces of representation that constitute three-dimensional objects of inquiry. Cases in point are the "morphogenetic mutants" which are defective in the cell division cycle. They are used in experiments in which growth is arrested at a particular morphological stage. Some of them generate grossly aberrant shapes. Quite pertinent to the passage from vectorial metabolism to cellular morphogenesis are those mutants which are defective in enzymes (like adenylate cyclase) that catalyze reactions at metabolic branch points (Harold 1990). Yet the identification of "morphogenes" that are dedicated to the task of cell shaping is still a trend of research in the domain as well as in all domains of developmental biology without significant success. What is certain for the moment is only that molecular morphogenesis is directly gene-controlled.

It is quite possible that the task bridging the gap between vectorial biochemistry and topological physiology is not to be resolved within the present characteristic

hermeneutic situation. A turn in the domain's articulation that will open a new horizon of possibilities for doing research will also change the fore-having, fore-seeing, and fore-grasping of the articulation and objectification. To sum up, the "external observer" receives the impression that the domain is waiting for a new configuration of scientific practices in which a "text" will be constituted capable of uniting the topology of the biochemical autocatalytic reactions systems characterized by self-organization with cytological mechanisms of the ways in which cells can translate commands to make shapes into that shape itself. These mechanisms which operate on a physiological level belong supposedly to the repertoire of morphogenesis. Indications that the new configuration will arise provide the interrelatedness of experimental and theoretical practices of studying phenomena of vectorial metabolism in terms of adaptive self-organization. A configuration of practices that will be capable of appropriating the possibilities projected by it, and of reading and representing the objects of inquiry it constitutes still does not guarantee that it will bridge the gap I mentioned. Yet in revealing the mechanisms in question, it will integrate in a unitary "text" supramolecular complexes and morphogenetic processes in individual cells. This is an indispensable step in the transition from vectorial biochemistry to topological physiology. Undertaking this step promises to give meaning to the concept of emergence of a topological arrangement that runs through molecular, cellular, and supracellular-physiological levels.

In concluding this section, let me take up a claim I formulated in the beginning of this study: The hermeneutic realist does not try to single out a particular class of entities as having (exclusive or privileged) existence in physical reality. Her task is to address the existence of entities—regardless of whether they are empirically identifiable or not—as meaningfully articulated. Put alternatively, the hermeneutic realist is preoccupied with the modes of existence of meaningful entities within the reality of interplaying practices and possibilities. Regardless of whether they can factually be identified, the meaningfully constituted entities of scientific inquiry have a being in the facticity of interplaying scientific practices and possibilities for doing research.

At a further stage, after elaborating on the distinction between factuality and facticity, I will generalize this claim by putting forward the thesis that hermeneutic realism is a realism about facticity as fore-structuring the procedural production of objectified factuality. While the objectification of factuality is an epistemological issue, the revealing of facticity in its continuous (re)contextualization is to be attained by means of hermeneutic ontology. Thus considered, factuality and facticity are split between two supposedly incommensurable enterprises. The hermeneutic realist does not try to hold a coherent position by finding a way out of the dramatic divergence between epistemology and hermeneutic ontology. The unity of factuality-within-facticity—the being of the empirical in the perspective of hermeneutic realism—is not achieved by removing the existing tension between the two enterprises. The task is rather to conceptualize this unity beyond the existing tension.

3 The Empirical in the Interspace Between Epistemology and Hermeneutics

3.1 Do Scientific Facts Have Genesis and Development in the Facticity of Inquiry?

The thesis that scientific facts have genesis and development in the facticity of scientific inquiry can easily be misconstrued and confused with the epistemological claim that the historical destiny of scientific facts hinges on the historical dynamics of scientific theorizing. From a post-empiricist point of view, the rebuttal of a discovered fact as related to a saved phenomenon and the subsequent rehabilitation and/or modification of the same fact is a paradigmatic example of such a destiny. The way of thinking along the lines of post-empiricist historicism would imply that the historical dynamics of theorizing—involving proliferation of competing theories that allegedly refer to the same factuality because they share the phenomena they are trying to save—enables in the first place the discovery of scientific facts, and subsequently justifies, authenticates, refutes, disproves, restores, modifies, revises, and generalizes, etc. what has been discovered. Admittedly, this dynamics determines the "destiny" of scientific facts. Thus considered, however, the "destiny" has nothing to do with the meaningful constitution of facts, as this constitution is taken to be inherent in the reality qua empirical unity of facticity and factuality. One has to differentiate clearly between the epistemological issue of putting the normatively designed theories-factuality relationship in a diachronic framework and the hermeneutic issue of the articulation and objectification of scientific factuality. (Thus, for instance, the refutation of established scientific facts through new theories is not to be confused with the event of emptying scientific facts of their meaning—or making them meaningless—within the interplay of practices and possibilities of inquiry. As a rule, scientific facts losing importance have not been procedurally refuted or invalidated. They have become rather meaningless within the facticity of inquiry. Phrased otherwise, accepted scientific facts often become meaningless within inquiry's interplay of practices and possibilities not because they are extinguished by refuting procedures, but because they do not fit the articulation of meaning within contextually opened horizons.)

The hermeneutic realist argues that the genesis and development of scientific facts is an integral part of reality as an empirically manifested difference-within-the-unity of facticity and factuality. A genuine defense of realism cannot avoid addressing the "factogenesis" of reality. In raising this claim, the hermeneutic realist further develops the view that scientific factuality is always situated in and transcended by the facticity of inquiry, and that the objectified factuality never represents something that has a "mere presence". The genealogy of objectified factuality is inherent in scientific inquiry's mode of being. Accordingly, objectified factuality is generated and developed in and through textualizing the domains of inquiry. It is my contention that the methodological relativization of factuality—as promoted by

such theses as theory-ladenness, underdetermination, and incommensurability—does not pave the way for looking at the being of factuality in facticity.

More generally, the post-empiricist philosophy of science did not do enough justice to the articulation of objectified factuality within the facticity of scientific inquiry.[24] One can assume that Feyerabend's claim that there are only contextual norms of scientific inquiry paves the way for approaching the facticity of inquiry. The defense of contextual ("Kierkegaardian") normativity (and rationality) was the kernel of the position of epistemological anarchism. Yet this position is by no means that antipode of normative epistemology which might enable the quest for the production of objectified factuality within the facticity of inquiry. Paradoxically enough, Feyerabend's (1977) way of approaching the contextuality of inquiry does not cast the ontic primacy of the facts-theories relationship into doubt. De-mythologizing the philosophical images of science by denouncing the myth of normatively warranted progress of scientific knowledge and the myth of normative scientific rationality does not automatically open the avenue to the facticity of inquiry. Feyerabend's internal criticism of normative epistemology had never abandoned the epistemological paradigm of reasoning. Indeed, in his later work—when treating "science as art"—Feyerabend (1984) injected in his philosophical doctrine elements that approximated the treatment of scientific facts as "facts in the making" within the changing contexts of inquiry. However, he again did not manage to spell out his quite heuristic vision of science's Kierkegaardian rationality—a vision already contained implicitly in Feyerabend's (1958) brilliant paper on complementarity.

Once treated as conforming to epistemological normativity and methodological codes, the scientific facts are exempted from their interpretive fore-structuring within the facticity of inquiry. Post-empiricist normative epistemology exclusively focuses on methodologically determined diachronic dynamics of scientific facts. (I am using quite deliberately the expression "diachronic dynamics". In structural linguistics a diachronic analysis deals with the evolution and changes over time of linguistic systems from the viewpoint of how the historical development has constituted the structures which the synchronic analysis manages to determine. In other words, the diachronic analysis can work when structures are already theoretically determined. Without intending to overexploit the analogy with structural linguistics,

[24] When stating this, I refer to post-empiricism as a tradition of historicist-epistemological theories about the rationality of science that are distinguished either by descriptive (structuralist, functionalist, or evolutionary) approaches or by normative-reconstructive methodologies. This remark is necessary, since in recent years the view has gained currency that post-empiricism is a post-war intellectual movement that includes conceptions leading to the "end of epistemology" and conceptions that enter into "a still-fulminating compound with poststructuralism" (Zammito 2004, 273). It is my contention that this view does not do justice to the historical tasks and specificity of post-empiricism as the tradition of the "angry young generation from the late 1950s" in the philosophy of science. Generally speaking, the internal plurality of post-empiricism has been elicited by the different ways in which the logical-empiricist view of confirmation of intratheoretical logical relation has been replaced by alternative historical views of confirmation in which the historically established background knowledge plays different roles (Musgrave 1974).

I would say that the historicist dimension of the normative-epistemological versions of post-empiricism strongly resembles the diachronic analysis of linguistic systems: One is able to unfold a rational historical reconstruction of disciplines, domains, research programs, etc., only when one normatively determines the structures which will be submitted to such a reconstruction. The history of science has to be read from the viewpoint of synchronic normative rationality as it is incorporated in the present scientific structures.) Indeed, the authors of the Wittgensteinian brand of post-empiricism—without denying that science is a rule-following activity—rule out the picture of science as an activity governed by normative codes. For them, the Lakatosian way of historicizing already normatively codified structures is unacceptable.[25] These authors tend to replace normative codification with a kind of cognitive hermeneutics.

Mary Hesse has a historical priority in this regard. Her views show that a consequent development of (Wittgensteinian) post-empiricist theses leads to a cognitive hermeneutics of science. By the historical end of the post-empiricist philosophy of science, Michael Arbib and Hesse (1986) put forward an elaborated version of a hermeneutics that essentially draws on Piaget's genetic epistemology. In further developing Mary Hesse's classical conception about the universality of double hermeneutics, the authors suggest the unfoldment of a continuum between strongly objectifying and strongly interpretive types of inquiry: a continuum that bears a resemblance to "a continuum between a literal and metaphorical meanings" (Arbib and Hesse 1986, 171). In fact, the arrangement they advance is settled in accordance with the degrees of constructability characterizing the role of the epistemic subject

[25] No doubt, Lakatos's methodology of scientific research programs "dynamizes" and historicizes the facts obtained in scientific inquiry without jeopardizing their objectivity. In this conception, factuality is not predicated on a "mere presence", but nonetheless it is not treated as something that approximates features of facticity. Lakatos was after a methodological construction of factuality that does not dogmatically rest on an "empirical psychology of perception". He addresses the objectified factuality as resulting from processing theoretically laden data in accordance with codices of rationality. In the "sophisticated version of methodological falsificationism" (as a brand of conventionalism), factuality (qua the "empirical content" of rivaling and superseding theories or research programs) might only be achieved via a historical reconstruction of the empirical theories' rivalry in the development of a scientific domain. More specifically, factuality is the theoretically laden facts that meets the criteria for excess of empirical content of a new theory over its predecessors, and for verifiability of this excess content (the criterion of theory's independent test). The excess content consists of "novel facts" predicted by theory, and enabling one to perform an independent test of the theory's validity. Though existing only potentially, the novel facts are part and parcel of factuality. This potentiality-for-facts involved in factuality makes it *methodologically* different from a mere factual presence. Being a methodological construction, factuality is not entitled to falsify theories. A theory can only be falsified by means of a rival theory. This version of falsificationism accepts the conventionalist postulate that as science conceptually grows, the adjudicative power of the empirical diminishes since the empirical becomes transformed into conventionally constructed factuality. Yet, again, this transformation does not go far enough to take into account the facticity of inquiry. Regardless of the radical historicism of his methodological conception, Lakatos has never resigned from the view that there is no other but normatively epistemologically codified factuality. As already pointed out, *Proofs and Refutations*—the work that has recourse to the facticity and historicity of mathematical inquiry—is a significant exception.

in each particular type of inquiry. The closer the inquiry to the pole of total objectification, the less the objectified factuality hinges on constructability. Since the aforementioned degrees depend on the interpretive leeway for inquirers, the whole continuum of the types of inquiry might be addressed in terms of a (constructive) cognitive hermeneutics. The epistemic subject in all types of inquiry is distinguished by different forms of inter-subjectivity. Generally, Arbib and Hesse's integration of principles of philosophical hermeneutics in the philosophy of science (grounded upon genetic epistemology) does not cross the threshold of cognitive constructivism combined with the replacement of subjectivist epistemology with a theory of knowledge based upon communicative inter-subjectivity.

Stephen Toulmin's orientation to hermeneutics—as compared with Arbib and Hesse's program—resulted in much deeper innovations: Post-empiricist theses were recast in terms of a theory about reflexive historicity and reflexive rationality of science. In his later work—in treating Kant's first *Critique* as a "preparatory move toward a hermeneutics of physics"—Toulmin even tended to develop his position in terms of a hermeneutic theory of science. The rational reconstruction of science's development and change—so his argument goes—ought to be concentrated on differences among the hermeneutic situations of doing research and constructing factually interpretable competing theories.[26] At the same time, Toulmin's commitment to an interpretive theory of scientific inquiry's facticity is not to be exaggerated, since he more or less equates the hermeneutic situations with epistemic positions.

The hermeneutic realist makes the case that the whole factuality constituted in a domain of inquiry constantly stands on "shaky ground" because it is being interpretatively fore-structured (not by theoretical frameworks and models, but) by domain's meaningful articulation. Due to its constant hermeneutic fore-structuring, scientific factuality is immanently historicized. In stating this, I am not trying to deny that scientific facts are always discovered facts. Yet the point is how the word "discovered" in this expression should be understood. My proposal is that one has to apprehend this word with regard to its etymology and literary meaning: Something that is otherwise covered becomes—within a certain mode of meaningful articulation (mode of being)—un-covered and procedurally exposed. A scientific fact is discovered within the meaningful articulation of a domain of inquiry. *A prerequisite for dis-covering a scientific fact is a dis-closure of a domain*. From the viewpoint of hermeneutic realism, a scientific fact—as situated within the interplay of practices and possibilities—belongs to a factuality that is incorporated in a relatively autonomous "text". When this "text" becomes isolated after retrieving it from the domain's ongoing articulation, the discovered fact can be presented as existing per se.

According to a tacit stipulation of scientific realism, if one were not willing to sacrifice the objectivity of factuality, one should not admit that scientific facts have their own "genealogies". They also do not have proper historical developments.

[26] Fortunately, Toulmin (2002) left a short paper about his vision of a hermeneutic philosophy of science. It is my contention that this paper attests Toulmin's commitment to the idea that such a philosophy ought to be developed as a theory of the facticity of scientific inquiry.

Post-empiricists who profess the view that scientific facts are theory laden—and observation reports are semantically prefigured—share this stipulation. For those who believe that the status of factuality is normatively codified and fixed by a codex governing—logically and historically—the factuality-theories relations, only the intellectual process of discovery (involving the vindication and the acceptance) of a scientific fact might be distinguished by a development that can be rendered by a certain historiographic narrative. This narrative would include attempts at discovering the fact in the past, the formation of the background knowledge that proves to be a necessary condition of the discovery, competing theories that reject the discovery by prohibiting the fact's existence, series of successful and failed experiments, other discoveries that call into question the existence of the discovered fact, debates about what should be counted as experimentally verifiable predictions of the theory supposedly assisting the discovery, and so on. Constructing such a historiographic narrative assumes that "the scientific fact" is a Platonic entity out there, and the "dramatic history" of the intellectual process of its discovery is (or should be) rendered by a narrative plot. By implication, only historiographic narratives about discoveries of scientific facts might be "emplotted".

To ascribe an inherent plot to the facticity of dis-covering inquiry—and to the factuality fore-structured by this facticity—would not make sense in both the context of discovery and the context of justification. (To reiterate, the talk of scientific inquiry's facticity makes sense only in the "context of constitution".) True, any "drama" of a scientific discovery refers to something that can be captured by a genre of intellectual history. The facticity of inquiry cannot be captured in this vein, and a dramatic development cannot be ascribed to inquiry's mode of being. But is it reasonable to distill the intellectual history of discovery from approaching inquiry's historicity/facticity when what is at stake is the issue of the interpretive fore-structuring of dis-covered facts? In addressing this question, the hermeneutic realist raises the claim that the dis-covered facts are undetachable from the facticity of their dis-covering. Since scientific factuality is immanently historicized, she holds the view that the objectified-factuality-within-the-facticity-of-inquiry is distinguished by a kind of pre-narrativity, i.e., by "emplotted" organization that (*pace* Hayden White and Frank Ankersmit) exists before any descriptive historiographic narrative or normative rational reconstruction of how factuality has been theoretically received and transformed into theory-laden facts. What then becomes "emplotted" is the historicized factuality-(fore)structured-within-facticity.

3.2 Steps Beyond the Normative Codification of Objectified Factuality

To be sure, Kuhn's engagement with hermeneutics is much deeper than the description of it he offers in the introduction to the German edition of *The Essential Tension*. Historians (consciously or not) are—Kuhn's leitmotif in this description—all

"practitioners of the hermeneutic method". Hermeneutics deals with the many ways of reading texts and the "plasticity of texts". What Kuhn has in mind is the correct understanding and interpretation of the (textual) works of important thinkers. In this regard, he faces the central problems of the traditional (methodical) hermeneutics, such as the role of historical distance, the balance between external contextualizing and immanent interpretation of the received work, the ways of decoding apparent absurdities and "obscuritas" in the work, the rhetorical structure of the interpreted texts, the "emancipation" of the work from the author's intention, the accumulation of secondary meanings in the history of the work's reception, and so on. *The Essential Tension* adduces strong evidence of how Kuhn copes with such problems. In his efforts to understand the texts of past thinkers, Kuhn seems to be committed to a position that is not far from Gadamer's (1989, 269) argument that the interpreter projects a meaning for the text as a whole as soon as some initial meaning emerges in the text. And like Gadamer, he seems to believe that the text's initial meaning—during the exegetical work—emerges only because the interpreter approaches the text with particular expectations in regard to the work she wants to understand in a proper manner. Each interpretation of a text begins with a fore-conception of the text's meaning that in the course of interpretation is replaced by a more suitable one. Generally, "the movement of understanding and interpretation" (Gadamer) in the constant projection of the text's meaning characterizes Kuhn's work as a historian studying classical texts of the past.

Yet, again, Kuhn's engagement with hermeneutics exceeds the scope of textual exegesis. A preliminary exemplification of this statement is the way in which Kuhn implicitly does justice to the idea of the fusion of horizons in the history of science. The hermeneutic doctrine of the fusing horizons is the strongest antipode of the semantic/epistemological doctrine of incommensurability. It is hard to trace a defense of the former in Kuhn's philosophical work. Yet different kinds of fusing horizons are addressed in his historiographic studies. Thus, for instance, the main function of the practice of thought experiments is twofold: On the one hand, it interprets previous interpretations incorporated in an accepted conceptual apparatus, and on the other, it helps one to comprehend contradictions in past conceptual strategies. Thought experiments are performed with the aim of understanding what is handed down as interpretive tools in the process of inquiry. In analyzing Salviati's thought experiments in Galilei's *The Dialogue concerning the Two Chief World Systems*, Kuhn (1977, 250–256) actually demonstrates how the structure of this work presupposes fusing horizons of different traditions. I would say that Sagredo is the character who specifically expresses the processes of understanding by being able both to ask questions within the horizon of Salviati's thought experiments and to comprehend Simplicio's misunderstanding of these experiments. Now, the main argument for the claim that Kuhn is engaged with hermeneutics that exceeds the scope of textual exegesis concerns the concept of normal science.

In admitting that scientific factuality is a paradigm-dependent construction, produced by normal scientific practices, and exposed to essential change through the scientific revolution's *Gestalt*-switch, Kuhn's doctrine proves to be not on a par with the epistemological doctrines that enclose the production of factuality in the

relations between the empirical and the theoretical. More specifically, he convincingly shows that scientific factuality is not methodologically and conventionally constructed by means of pertinent demarcation criteria, but is constituted (in a sense close to that of phenomenology) within scientific communities' routine work, where tacit factors of collective mentality play a significant role. In coupling the construction of factuality with the research work's everydayness, Kuhn manages to put his views in a hermeneutic context (Ginev 2004). Thus, in contrast to Lakatos's purely methodological constructivism combined with conventionalism, Kuhn—who was characterized by Lakatos (1999, 30) as "a rather ad hoc footnote to Polanyi and Merton"—admits that the factuality of inquiry is produced in accordance with paradigmatic rules of interpretation accepted by the members of a community.[27] In view of this admission, Kuhn's position should be titled "interpretive constructivism". The image of normal science as a tradition-bound work guided by "exemplars" (solutions of concrete problems that do not call into question the existing horizon of expectations) belongs to the achievements of his constructivism about factuality. It is this image that makes Kuhn's idea of scientific rationality close to that of *phronēsis*-rationality. With the concept of disciplinary matrix Kuhn intends to show that the stress he lays on the role of particular exemplars is not in conflict with the use of general models and structures in the process of inquiry. The practical rationality of scientific inquiry mediates between the general and the particular. The disciplinary matrix does justice to this mediation precisely, and not to any kind of factuality's normative codification. In this regard, Kuhn's view of normal scientific rationality resonates the claim—raised by a celebrated hermeneutic philosopher—that given "a community in which there is a living, shared acceptance of ethical principles and norms, then *phronēsis* as mediation of such universals in particular situation makes good sense" (Bernstein 1983, 157).

In a well-known thesis advanced in Kuhn's later work, the natural scientific inquiry has a "hermeneutic base"—the conceptual vocabulary in which the construction of factuality is rooted—but is not itself a hermeneutic enterprise, i.e., a critical inquiry that is able to escape a routinization in the form of normal science. If I am understanding Kuhn correctly, the "hermeneutic enterprise" succeeds in escaping such a routine due to its reflexivity and reflexive problematization and defamiliarization of the accepted hermeneutic base (Kuhn 1991, 22–23). For him, the human sciences provide the model for a critical-reflexive inquiry that avoids a conservative stabilization of the normal scientific work. This is the key to understanding Kuhn's (1970, 209)—otherwise apparently disprovable—claim about the

[27] To be fair, there is a prominent case in which Lakatos is unfaithful to his methodological normativism. It is to be found in the lectures on the demarcation problem he gave at the London School of Economics in 1973. Lakatos observes that the inability of Darwinism to conform to norms for a good theory does not make it a bad theory (i.e., a pseudoscience similar to, say, the theories of Soviet Marxism or the post-Freudian theories of psychoanalysis). Lakatos subscribes to the well-known position of Popper regarding the status of Darwinism. Yet there is also an essential nuance. In contrast to Popper, he is not stating that Darwin's natural selection is a "metaphysical research program". He is rather drawing attention to the special character of the factuality in this theory. The factuality of Darwinism is always in the making, and cannot normatively be codified.

absence of competing schools in the developed natural sciences. In normal science, the number of schools is drastically reduced, ordinarily to one, and a more efficient mode of scientific practice becomes established. Conversely, reflexivity that prohibits normal scientific routine creates schools, which is illustrated by the interpretive-human sciences' "permanent revolution" and "conflicts of interpretation". Kuhn tends to supplement the interpretive constructivism about scientific factuality with a kind of "collective conservatism" that prevents members of the scientific community from practicing destructive reflexivity in normal science.

Yet, in spite of Kuhn's belief that objectifying inquiry cannot turn into interpretive activity—and scientific education is designed to cultivate (what Markus calls) "hermeneutic naïvité"—one might object that normal scientific research (as described in *Structure of Scientific Revolutions*) is a hermeneutic enterprise in a truly Gadamerian sense. In operating within a horizon of expectations that only serious anomalies can destroy, scientific research becomes normalized by being bound to constitutive pre-judgments (as informed by the metaphysical presumptions involved in the disciplinary matrix). Kuhn's kind of "collective conservatism" is thoroughly a hermeneutic phenomenon, and not a socio-psychological state of mind, as his Popperian opponents admit (Ginev 2006, 116–120). Being restricted by some leeway for expectations, the process of inquiry constantly keeps open the opportunity to transcend this boundedness thanks to reformulations of ideas and concepts within the normal scientific research. Such interpretive reformulations that are entitled to eliminate deeper anomalies might be called non-revolutionary changes in normal science. They usually shift focus from one to another cluster of problems or topics, but do not call into question the anticipatory horizon of expectations. By the same token, they do not induce a reflexive position that may cast the constitutive pre-judgments into doubt. The non-revolutionary changes in normal science are rather a mechanism for preventing a crisis, and work in full agreement with the kind of conservatism mentioned. The interpretive reformulations taking place in normal science operate under the condition that the scientific community is able to discriminate between "good" and "bad" pre-judgments.

In taking issue with some views of Kuhn, Feyerabend has argued on various occasions that normal scientific inquiry is guided by the same practical experience which guides the routine everydayness of the non-scientific socio-cultural activities. In so doing, Feyerabend wanted to stress the lack of invariant (non-contextual) normativity in all human activities. Combining this conclusion with two other phenomena already discussed—the belief in non-observable entities as this belief is cultivated within the everyday experience and the kind of "collective conservatism" Kuhn deals with—brings us close to a Gadamerian doctrine of "hermeneutic experience". (In opposing the restrictedness of Heidegger's discussion of historical hermeneutics, Gadamer elaborates on this doctrine in order to do justice to the "historicity of understanding". By his account, reflecting upon hermeneutic experience amounts to revealing the truthfulness of knowledge before it becomes methodologically schematized.) It is the phronētic-practical coexistence of conservative commitment to prejudices (pre-judgments) and openness to innovative breaking with the routine status quo that makes Kuhn's concept of normal science "more

hermeneutic" than his basic position of interpretive constructivism. Notoriously, the imagery of the "prejudices-openness nexus" is worked out—by Gadamer, in particular—in the hermeneutic philosophy of the effective-historical being. In having adopted a phronētic-practical concept of normal research that is in line with this philosophy, Kuhn could have used it against his own insistence on the (semantic and anti-hermeneutic) thesis of incommensurability, thereby extending interpretive constructivism to a hermeneutic theory of science's facticity.

Unfortunately, this was not the case, and an "essential tension" between the (basically hermeneutic) concept of normal science and the mainstream thinking of conceptually framed factuality remained in Kuhn's philosophy of science. In laying emphasis upon semantic issues related to the incommensurability thesis, Kuhn tries to relieve this tension in favor of the conceptual schematization of factuality. (Alexander Bird cogently expresses the standard view that the lack of common measure that would make conceptual structures commensurable is the kernel of the incommensurability thesis. In distinguishing incommensurability from non-comparability, he shows that Kuhn [unlike Quine] admits the existence of meaning. This conclusion requires explaining Kuhn's appeal to Quine's translatability in terms of a semantic theory that addresses the issues of how intensional changes imply changes in reference that do not preclude the possibility of successful reference both before and after them. Engaging such a theory demonstrates "Kuhn's commitment to an incommensurability that is more than merely a change in intension" (Bird 2000, 168). I agree with this conclusion. Yet Bird, like many others, does not take into consideration that before investigating commensurability between theories on a semantic level, Kuhn defines normal science, puzzle solving, expectations, anomalies, crisis, revolutionary changes, etc., on the level of rule-following scientific practices imbued with Polanyi's tacit knowledge. On this level of analysis, Kuhn is a hermeneutic constructivist about factuality. Reading Kuhn's work in a manner that puts the level of scientific practices first allows one to reformulate his analysis on a semantic level in hermeneutic terms whereby incommensurability would take a back seat in favor of the fusion of various kinds of horizons in the process of inquiry (Ginev 1997, 53–70). Indeed, such a reformulation would transform Kuhn's hermeneutic constructivism into a hermeneutic theory about the constitution of meaning in scientific inquiry.)

Be that as it may, the foregoing considerations about Kuhn's engagement with something more than textual exegesis might be countered by showing that there is in his work enough evidence for treating hermeneutic constructivism about scientific factuality as a position that does not cross the threshold of the post-empiricist quest for interpretive relations between facts (of the reality-out-there) and theories. This evidence is not to be denied. Interestingly enough, however, Kuhn unfolds the hermeneutic aspects of his constructivism about factuality more consistently—at the same time paying little attention to the semantic problematic of incommensurability—in his historiographic work, especially the book on black-body theory and quantum discontinuity. The whole study is centered around the analysis of the historical protagonists' interpretations of phenomena related to the quantum conditions as these interpretations incrementally pave the way for the emergence of non-

classical physics. Kuhn is highly successful in showing how the texture of interpretations is crossing various research traditions, programs, and projects. The logic of question and answer, and the fusing horizons constantly overcome the semantic boundaries between conceptual frameworks.[28]

In contrast to the ontological approaches to interpretation, Kuhn's position is tied to the collective-mentalist picture of shared rules of interpreting facts that a community of inquirers encounters through employing certain *Gestalts* of envisioning reality. Thus considered, interpretation is not a part of facticity. It belongs rather to an extended framework of conceptualization that involves practical elements. Kuhn defines (what he calls) "normal research projects" by the conjunction of two epistemic processes: an adjustment of existing theory or existing observation in order to bring the two into closer agreement, and an extension of existing theory to areas that it is expected to cover. Interpretation operates in the adjustment and extension; i.e., it is enclosed in (and not transcending) the epistemic processes of theory-determined conceptualization. Consequently, interpretation is deprived of the capability to forestructure the relationship between facts and theories. To reiterate, what Kuhn suggests is a doctrine of the interpretive construction of factuality (within scientific community's work) that avoids any preoccupation with the production of factuality within facticity. This is why his hermeneutic view about science's constructed factuality does not go beyond the repertoire of relativism. (Any kind of interpretive constructivism that ignores the facticity of inquiry—as this is fore-structuring the relations between theory and facts – is doomed to end up in semantic and/or epistemic relativism.)

In prioritizing the semantic analysis of incommensurability, Kuhn victimizes his analysis of inquiry on the level of scientific practices. Accordingly, paradigm-guided normal science becomes a process of inquiry not within an interpretive horizon, but within an interpretative framework. Kuhn tends always to replace hermeneutic interpretation (as appealing to facticity of practices within horizons of normal science) with semantic interpretation (dealing with translatability, stability of references, and intensional and extensional shifts). To sum up, like other post-empiricists, Kuhn only touches occasionally upon the facticity of scientific inquiry. Being constructed on a "hermeneutic base" (i.e., constructed within a conceptual framework of interpretation), objectified factuality represents the presence of something that exists out there in itself. Like the factuality in methodological falsificationism and conventionalism, Kuhn's scientific factuality is not predicated on a mere presence, but refers to (or represents) something that is an essence in itself characterized by a variety of actual manifestations. In leaning on this observation, one has good reasons to countenance the Kantian reading of Kuhn's approach to factuality (Hoyningen-Huene 1993, 35).

For Kuhn, scientific factuality becomes re-conceptualized and semantically reinterpreted after periods of crisis and revolution. But the empirical facts do not cease to be conceptually and semantically determined. He attributes interpretative

[28] For a more detailed analysis of the clash between Kuhn (as a philosopher of incommensurability) and Kuhn (as a historian of physics), see also Klein et al. (1979).

historicity to science's "theoretical worlds", but strongly denies that this might be assigned to the factual level of scientific inquiry which he always conceives of as fixed within conceptual and semantic frameworks. (Scientific facts are changeable only because their constitution is a function of theoretical worlds' historical dynamics.) Kuhn is convinced that his characterization of the physical sciences' nature approximates the Kantian ways in which Max Weber and Ernst Cassirer describe the construction of unique "individual wholes" in the cultural-historical disciplines. To be sure, he has good arguments for this conviction. In commenting on Charles Taylor's way of drawing demarcation between the human and natural sciences, Kuhn renounces the view that entities like rock patterns and snow crystals have no meaning—nothing that they express. When these entities becomes constituted—so Kuhn's argument goes—as objects of inquiry, then they gain the character of entities that are meaningful for the community of inquirers who have procedurally accomplished the constitution.

Kuhn even sharpens this argument by arguing that there are no culture-independent (not only social, but also physical) entities. Thus, he writes that "no more in the natural than in the human sciences is there some neutral, culture-independent, set of categories within which the population—whether of objects or of actions—can be described" (Kuhn 1991, 21). Though rejecting a "brute data vocabulary", he is committed to the view that there is an absolute presence of the reality represented by "pure factuality" which scientific communities make—each of them within the horizon of its own research work—a meaningful reality by endowing meanings to meaningless (pre-constructed) factuality. By the same token, looking through different "conceptual spectacles" upon the same pure factuality constitutes different objects of inquiry. Accordingly, what Kuhn has always in mind is semantic meaningfulness (of a conceptually constructed factuality) and not hermeneutic meaningfulness in its ongoing articulation within interplaying practices and possibilities. In his *Denkweg* Kuhn has been hovering between cultural relativism and a soft version of scientific realism. Only a Kantian framework (in the broadest sense) might have assured a peaceful coexistence of such extreme positions whose common denominator is the hypostatization of the subject-object relation—the same framework in which the post-empiricists rehabilitated the synthetic a priori once officially forbidden by the logical empiricists.

Before concluding this section, I have to note that—unjustifiably enough, but for completely understandable reasons—post-empiricism outshone a tradition where what was at stake was the study of scientific factuality in a historical-epistemological manner that takes into account the facticity of inquiry and the historicity of scientific objects. The champions of this tradition are Francophone phenomenologists like Gaston Bachelard, Jean Cavaillès, Georges Canguilhem, and Jean Ladrière. Michel Foucault (1991, 8) differentiates between "two modalities according to which phenomenology was taken up in France"—one typically represented by the early work of Sartre and Merleau-Ponty, and another by the constitutional analysis of discourses, historical entities, normative fields, and forms of rationality, etc., suggested by Cavaillès, Koyré, Bachelard, and Canguilhem. Various aspects of science's historicity (historicized facticity) are at issue in this analysis. The authors

supporting this "modality of phenomenology" were preoccupied with the constitution of discrete structures of factuality within the continuity of practical facticity. (Of course, Foucault's earlier work belongs to this tradition as well.)[29]

In contrast to the post-empiricist scenarios for rational reconstruction of the history of science, the authors mentioned do not predominantly regard the historicity of scientific entities as a function of science's cognitive dynamics. Foucault also underscores another dimension of their work that helps one to look at science's factual entities from the perspective of a historicized phenomenology of "factical life". According to him, these French followers (and critics) of Husserl "brought the history of science down from the heights (mathematics, astronomy, Galilean mechanics, Newtonian physics, relativity theory) toward the middle regions where knowledge is much less deductive, much more dependent on external processes (economic stimulations or institutional supports) and where it has remained tied much longer to the marvels of imagination" (Foucault 1991, 13). An illustration in this regard provides Canguilhem's historical analysis of the "discontinuities" in the history of science through which new objects of inquiry emerge. The discontinuities in the stream of practices of inquiry create emergent levels in the constitution of objects in inquiry. Following this idea, Canguilhem (1994, 203–217) focuses in particular on the constitution of new biological objects (as distinguished by the special quality of "the normality of living things") in the non-mechanistic, organic scientific discourses of the early nineteenth century.[30] Rheinberger (2010a) has good reasons to associate the work of Ludwik Fleck more with this tradition of historical epistemology than with a certain trend in post-empiricism.

3.3 The Facticity of Scientific Inquiry and Ludwik Fleck's "Cognitive Stylistics"

The quest for "genesis and development" of scientific facts is strongly prohibited by Kuhn's doctrines. All that is allowed is the study of conceptual genesis and development of the discoveries of scientific facts. For Kuhn, the constitution of conceptualized factuality by and large coincides with the semantic interpretation of vocabularies. Conceptually schematized factuality is a product of semantic interpretation. In his final work he often makes a point of lexical taxonomies (in which sorts of natural, artifactual, and social kinds are specified) when discussing issues of realism, thereby underscoring his favored thesis that the ability to learn a language "does not guarantee the ability to translate into or out of it" (Kuhn 2000, 92). The process which

[29] On the role of the constitutional analysis in the Francophone historical epistemology, see also Hyder (2010), Rheinberger (2005), and Rheinberger (2010b).

[30] The programs of historical epistemology—Canguilhem's program in the first place—pose the question of the historical genesis of the (epistemic) norms. It is this question that transgresses the frame of historicized normative epistemology, and puts the study of historicity—in the form of genealogical studies of normativity—on the agenda.

permits understanding creates bilinguals, not translators. Incommensurability—understood as an untranslatability that rests on unsurmountable differences between lexical taxonomies—is not a threat to rational evaluation of theories' truth. Both bilingualism and untranslatability assume (what might be called) the adjudicating function of preexisting objective factuality. It is the mutual reinforcement of the view about the conceptual schematization of factuality and the incommensurability thesis that brings into play the later-Kuhn's program of quasi-Darwinian Kantianism, or—to use another qualification he puts forward—the program of "non-naturalized evolutionary epistemology". In drawing an analogy between biological speciation and epistemic revolutionary change, he concludes that scientific development is driven from behind, and is not to be regarded as a teleological process. The reproductively isolated population as a unit of biological evolution corresponds to the community of intercommunicating experts sharing a lexical taxonomy (or a conceptual scheme) as a unit of scientific development. Lexical categories unlike Kantian schemes can and do change.

Why all this? It is hard to resist the compelling impression that the program of quasi-Darwinian Kantianism is artificially added to the scenario of *The Structure of Scientific Revolutions* in order to eliminate the tension between incommensurability and factuality's adjudicating function. Nevertheless, the impression is wrong. The program is more than ornamental addendum. Quasi-Darwinian Kantianism should compensate for the ahistoricity of reality existing statically in itself as is assumed by the postulation of preexisting objective factuality. There is a drastic discrepancy between the earlier theory of scientific development—marked by the cyclic change of stages of normal science, paradigm's distortion caused by anomalies, and revolutionary change—and the hypostatization of an essence in itself, completely independent of science's cognitive dynamics. Classical Kantianism does not suffice to dispose this discrepancy. By contrast, quasi-Darwinian Kantianism should enhance the plasticity of the picture of scientific development by detailing the evaluation and justification of theories. The evolution of science (and not the cycling change of stages) is bestowed on serving the function of a liaison between reality-out-there and the development of incommensurable theoretical representations of reality, granted that this function is also predicated on evolution. Finally, quasi-Darwinian Kantianism is Kuhn's negative response to the "bold hypothesis" that he is "the American Heidegger" before this hypothesis was even formulated. The hypothesis was inspired by the observation that "the disappearance of (post-empiricist) history and philosophy of science is akin to the disappearance of existentialism, and Kuhn's status in science studies is comparable to Heidegger's in postmodern philosophy" (Fuller 2004, 111). If Kuhn's portrait is restricted to his hermeneutic constructivism (cum "collective conservatism" as depicted in the preceding section), then there is a rationale for the analogy to Heidegger. Yet interpretive constructivism-conservatism remained essentially underdeveloped, and (as already discussed) was not on a par even with the earlier Kuhn's philosophical intentions. The quasi-naturalist completion of the theory of scientific development is much more adequate to his metaphysical assumptions.

Anticipating my further discussion, Fleck's starting point is completely different: There is no factuality that "lies behind" facticity of the meaningful articulation of a research domain. Fleck addresses—needless to say, without using the expression—the facticity of inquiry as a "whole of skills, customs, practices, and opinions" that offers enduring resistance to anything that contradicts the facts articulated within the whole.[31] (Put alternatively, facticity is the ways in which thought collectives articulate scientific facts within the complexity of their thought styles.) What does not fit into this facticity remains unseen. The unseen is not simply something incongruent with established Gestalts. It is rather something not "insertable" in reality-as-facticity. On this reading, the facticity of scientific inquiry is the dynamic unity of the socio-practical and the cognitive in the production of scientific facts. Objective reality might send "signals of resistance"—as a prerequisite to having a scientific fact—only via this facticity. Assuming the existence of reality beyond facticity is an improper hypostatization. Against the background of these claims, one has to understand and evaluate Fleck's (1979, 35) famous dictum that "in science, just as in art and in life, only that which is true to culture is true to nature."

Factuality produced within the whole of skills, customs, practices, and opinions is in line with the intellectual interests of a thought collective, and is expressed in the thought style of this collective. There is a divergence of thought styles accompanied by partial untranslatability, but neither the former nor the latter violates the dialogical-interpretive openness of inquiry's facticity. Situating objectivity within this facticity and admitting that all scientific factuality originates from the "factical life" of inquiry redundantize the quest for a quasi-naturalist evolutionary epistemology. For Fleck, it is science's factual level—and not only the level of conceptualization—that is exposed to interpretive re-contextualization. Accordingly, the scientific facts are not only conceptually constituted in different ways, but characterized by "genesis and development" within facticity of scientific inquiry. This is why he invokes hermeneutic (and not semantic) interpretation in his conception of the genesis, development, and historicity of scientific facts. For Kuhn, to reiterate, though the natural sciences constantly require a base for conceptual and semantic interpretations of factuality, they can never have a being in interpretation. By contrast, starting from inquiry's facticity, Fleck (tacitly) admits that natural science is thoroughly interpretative in its being in "thought styles" and "thought collectives".

The great breakthrough whereby the being of scientific facts in the interplay of practices and possibilities became a subject of investigation in its own right was Fleck's socio-historical-epistemological case study of the antibody test for syphilis (the Wassermann reaction) as a test that establishes a scientific fact: a breakthrough that for many decades remained unrecognizable.

Essentially ignored by the post-empiricists—though quite relevant to their debates—and rehabilitated by the cognitive sociologists at the end of the 1970s, Fleck's views have been for a long period received as an earlier form of social

[31] Fleck is convinced that quite often the complexity of this whole gains its homogeneity through (what he calls) a kind of "harmony of illusions". The latter is not a particular mental state. It is rather an inherent feature of science as a cultural life form.

constructivism. Patrick Heelan (1986) was the first author who opposed this reception, and suggested a construal in terms of hermeneutic phenomenology. In this construal, the constitution of scientific facts within the horizons of thought styles is not an empirical (in the sense of empiricism) process of social construction, but an event that should be considered on the model of interpretation led by fore-structures of understanding. (Heelan demonstrates why attempts at construing Fleck by combining the historically established versions of [social and/or methodological] constructivism with versions of [holist, non-representational, structuralist, and standpoint] epistemology are doomed to failure. His reading shows that a thought style is more a mode of being of a thought collective than a dimension of socially determined cognition.) After touching upon issues important for hermeneutic realism that have been forgotten in the tradition of post-empiricism, I will delve into a hermeneutic construal of Fleck's work with the intent to show how he manages to investigate the empirical as a processual unity of factuality and facticity.

Fleck advances an essentially different image of scientific inquiry as compared with the post-empiricist portrayals of it. In his basic tenet, scientific facts have a historical life (and "destiny") of their own. Scientific factuality as reported in scientific papers (and much more in textbooks and handbooks) is always de-contextualized (petrified) facticity of scientific inquiry as existing through its re-contextualization. In contrast to Kuhn, Fleck does not follow the theses of theory-ladenness and semantic incommensurability, which more or less reduce hermeneutic interpretation to semantic interpretation.[32] For Fleck, it is not the scientific lexicon of natural kinds' terms that determines what one can count as meaningful factuality. In his conception of the genesis and development of scientific factuality, he departs from a sort of interpretative constructivism (akin to that advocated by Kuhn) only to move to a hermeneutics of scientific inquiry's trans-subjectivity as a kind of hermeneutics of facticity. As I will argue in the remainder, Fleck is interested not in the conceptual relativity of scientific factuality, but in the interpretive re-contextualization in scientific inquiry that also defines the ongoing constitution of inquiry's empirical basis as part and parcel of a certain kind of historicized facticity. Accordingly, scientific facts are addressed in their interpretive flexibility and resilience. Addressing scientific facts as produced in inquiry's facticity provides him with good arguments against cognitive/conceptual relativism.

Stephen Toulmin nicely comments on the issue of how for Fleck scientific factuality has a life of its own. Factuality is produced by *Denkkollektiven* but cannot be explained by referring to the cognitive and non-cognitive characteristics of scientific communities. In its anonymity the life of scientific factuality alienates from the social milieu of its production, and no social constructivism is able to restore the process of production in a manner that would be prone to accounting the epistemic specificity of the produced factuality. In this regard, the life of scientific factuality (within the facticity of scientific inquiry) has not only a super-individual, but also a super-communal status. For Toulmin, the insistence on scientific factuality's

[32] Regarding the advantages of Fleck's conception over that of Kuhn when what is at stake is the issue of scientific factuality's historicity, see Babich (2003).

autonomous life is a distinctive feature of a form of internalism that amounts to advocating the independence and the primacy of a kind of science's intellectual history (Toulmin 1986, 272). It is a form of internalism that takes the being of scientific inquiry as a cultural-historical life form, and does not draw a demarcation between internal and external in terms of normative epistemology. (This estimation sharply contrasts with the established view on Fleck as a founding father of that externalism which culminates with recent STS. Toulmin resists a construal of Fleck's internalism in terms of the theory-ladenness thesis, though in several respects the former resembles views of Norwood R. Hanson and Feyerabend. In my opinion, each conception that regards the "genesis and development" of scientific factuality within the facticity of inquiry is committed to interpretative internalism.)

Fleck's study of the interpretative genesis and development of scientific facts is to be distinguished from the forms of cognitive hermeneutics (as pioneered by Michael Polanyi) that focus on the role of tacit, implicit, and personal knowledge in scientific inquiry. Unfortunately, in his most ambitious attempt to address the problematic of the hermeneutics of the natural sciences—offered in a lecture from 1983—Gadamer bypasses Fleck's approach to the interpretive being of scientific facts. This omission is much to be regretted, since the Fleckian way of working out the "genesis and development" is also an inquiry into the effective-historical being of scientific facts. Instead, Gadamer entirely focuses on developments of cognitive hermeneutics of the natural sciences.[33]

The way in which Fleck radicalizes sociological approaches to factuality leads to a conception of scientific inquiry's facticity. In Durkheim's central methodological argument for the theoretical autonomy of sociology, the delimitation of the subject matter of that discipline amounts to revealing the *sui generis* status of the sociological facts. The latter are not reducible to material things, but they have to be methodologically approached as scientific facts whose reality is independent of the observer's subjective experience. The sociological facts reside in the trans-individual conceptual frameworks (the "collective representations" and "systems of ideals") of individual action. These are frameworks which transcend individual representations, motives, and interests. By implication, the empirical character of theoretical sociology hinges on the social agents' collective mentality. The latter provides the factual basis for building theories. Fleck was impressed precisely by this methodological argument (for a disciplinary autonomy). Durkheim's argument constitutes one of the cornerstones of Fleck's study of the social being and historicity of

[33] Gadamer (1991, 434) recognizes a line in the philosophy of science that tries to capture the "hermeneutic dimension of the natural sciences". The main stations of this line are Moritz Schlick's attack of the "dogmatism of protocol sentences", Polanyi's displacement of normative methodology in favor of the "logic of questioning", Kuhn's stress on scientific inquiry's presuppositional character, and Toulmin's analysis of the concept of phenomenon. One should regret that the author of *Truth and Method* has not been acquainted with Fleck's work, especially because in this lecture (held in English and entitled "Natural Science and Hermeneutics: The concept of nature in ancient philosophy") he—in criticizing Popper—deals with the irreducibility of the natural sciences' hermeneutic dimension to the "psychology of invention". He uses the same type of argumentation against psychologism which Fleck employed in his work.

scientific facts. His Durkheimian position is most typically manifested in the way in which he seeks a proper delimitation of a new discipline, the comparative sociology of scientific knowledge. Fleck's image of the epistemic subject of scientific inquiry greatly resembles the Durkheimian *homo duplex*: It is an image of the individual scientist inextricably involved in the sociality of a thought collective. Any attempt at dissolving the unity of this *homo duplex* would destroy the integrity of sociology of scientific knowledge's subject matter. The individual creativity in scientific inquiry is by no means to be ignored. Yet it ought to be explained sociologically. (It remains to be seen to what extent Fleck leaves Durkheimian essentialism about the relation between collective representations and sociological facts behind when he deals with the "genealogy" of factuality.)

Along with his admonition about the risk of reifying phenomena revealed by natural scientific research, Fleck is acutely sensitive to the threat of a hypostatization of social phenomena. In a hypothesis I will follow in this section, in order to avoid this threat, he unfolds lines of argument that in their conceptual unity can be referred to as a "hermeneutics of trans-subjectivity"—a program that remains implicit in Fleck's work, but plays a crucial role in bringing together "the cognitive" and "the social" in his delineation of what the "comparative cognitive sociology" should be. I have to specify right away what is being said, lest my study be seen as an attempt at making Fleck a hermeneutic philosopher: The hypothesis thus formulated can only be partially validated. Though there are plenty of hermeneutic ideas in Fleck's work, the reconstruction of a full-fledged hermeneutics of trans-subjectivity from his published and unpublished texts only is an impossible mission. This is why Fleck's program should be extended with hermeneutic motifs that do not stem from the intrinsic logic of his theorizing, albeit they have correlates in his work and are congruent with the tenets of his historical epistemology and cognitive sociology. Integrating these motifs in his program complements the reconstruction of Fleck's implicit hermeneutics with a critique that aims at reclaiming the missing links between thought styles and practices of scientific inquiry. Such a critique serves the program's goal of demonstrating how stylized practices disclose and constitute fields of research. It is my contention that the aforementioned missing links are to be spelled out in terms of a trans-subjective—as opposed to inter-subjective—interpretative experience. In questing for these links, I will follow the thread of Fleck, who alludes to several interpretative aspects of scientific inquiry that might mediate between the cognitive and the social. Making these aspects explicit in a coherent way is a prerequisite for a critical extension and modification of Fleck's program.

For Fleck, the unfoldment of the sociological program he aims at must be achieved through radicalizing the existing sociology of knowledge: a radicalization that would allow one to study the genesis and development of scientific facts. With regard to this radicalization Fleck reaches the conclusion that the pioneers of this discipline (Emile Durkheim, Lucien Lévy-Bruhl, Ludwig Gumplowicz, and Wilhelm Jerusalem) "commit a characteristic error. They exhibit an excessive respect, bordering on pious reverence, for scientific facts" (Fleck 1979, 47). By his account, the sociology of knowledge should study the articulation of norms and

standards (within the whole modes of existence of thought collectives), and not established forms of inter-subjective normativity. The genesis and development of scientific facts do not conform to the normativity that preexists these processes. The aforementioned "signal of resistance" can only be received by a thought style that changes its normative shape resiliently enough. Scientific facts are generated (and expressed) by thought styles in close cooperation with the articulation of styles' norms and standards. It is a task of cognitive sociology to conceptualize the mutual reinforcement of facts' development and epistemic norms' articulation. This claim can be regarded as a crucial argument against normativist versions of post-empiricism before the latter was even born.

Let me now formulate some claims whose appropriate qualification will be accomplished later. Scientific facts are distinguished by a potentiality-for-being (i.e., a being "inscribed" on a horizon of possible changes, re-readings, and re-descriptions), and not by an actually given presence at hand. Due to the radicalization of *Wissenssoziologie*,an interesting expansion of the Durkheimian concept of sociological facts takes place in Fleck's work. The facts achieved by the sociological analysis of the social production of (scientific) knowledge are obviously sociological facts in the Durkheimian sense. However, this analysis assigns to the facts discovered in scientific inquiry itself—so Fleck's radicalization goes—also a quasi-Durkheimian status: Entangled with the cognitive life of the thought collectives, scientific facts exist, as it were, in their interpretive openness. Stated alternatively, there are no scientific facts beyond the purview of thought collectives' styling of what is under investigation. This styling is to be conceived in terms of hermeneutic constitution rather than regarded as an outcome of social construction.

It is my contention that Fleck is more interested in the stylizing constitution than the social construction of scientific facts. In stating this, I do not intend to downplay the constructivist elements in his program. My aim is rather to argue that his methodological position manages to avoid the kind of "sociological naturalism" typically advocated by constructivists: the claim that one should not explain nature through society, but should give accounts of how nature exists socially by revealing the causal social factors for the construction of natural scientific knowledge. Cartesian dualism becomes specified in social constructivism (most typically, in the Strong Program) as a dualism of the totality of nature (in David Bloor's generalized sense that includes the social) and the (normatively organized) inter-subjectivity. It is the rehabilitation of this dualism on the grounds of sociological naturalism that prompts the cognitive sociologists to devise causal explanations about the construction of nature (not in the above-mentioned generalized sense, but as a subject matter of natural science) within the social being of scientific knowledge. Instead of scrutinizing the contextual engendering of subject-object cut in the different forms of knowledge, which should be the central task of cognitive sociology, the Strong Program postulates a special version of this cut in order to advocate the tenets of sociological naturalism.[34]

[34] It is no accident that Bloor (1999, 82–83) insists (in his criticism of Latour) on the preservation of (a version of) the subject-object relation in science studies. It is this residual Cartesian dualism

The assumptions that scientific facts are predicated on a potentiality-for-being and existing in interpretative openness are hardly to be supported with texts from Fleck's historical-epistemological and cognitive-sociological writings. Strangely enough, these assumptions play a crucial role in some of Fleck's scientific papers. They are related to a distinction between facts and phenomena that—though not approached by him in philosophical terms—seems to be of prime importance to his microbiological and immunological work. This conclusion is most typically exemplified by Fleck's lasting research of the phenomenon of leukergy: the agglomeration of white cells in the peripheral blood of patients with inflammatory diseases. He is interested in the "specifically serological nature" of this phenomenon (Fleck 2011b, 419).

Tentatively, leukergy consists in a texture of interconnected experimental data and contingent "facts" such as: the percentage of leukocytes agglomerated correlates with the clinical severity of the infection; the leukergic agglomeration results from cellular rather than humeral activity; the agglomeration takes place due to passive clashes of leukocytes; the leukergic blood corpuscles are more active in their phagocytic activity than the non-leukergic corpuscles; leukergic leukocytes transferred in normal plasma agglutinate like they do in their own plasma; certain kinds of clinical treatment of infectious diseases return the leukergy value to normal; not every adhesion of leukocytes is a leukergic agglomeration; there is a change of the normal proportion between leukocytes, granulocytes, and monocytes in the leukergic agglomeration; the use of antibiotics does not guarantee the reduction of the leukergy value to normal; the leukergic agglomeration is a reliable indicator of disease activity and is always observed when an inflammation occurs; the successful treatment of bacterial disease and the reduction of the leukergy value are independent processes; leukergy accompanies an accelerated leukopoiesis. All these contingent "facts" create the texture of a slightly articulated factuality.

The components of this texture are idiosyncratic to experimental situations and they are not to be regarded as scientific facts (in the sense of Fleck's opus magnum). The phenomenon of leukergy is represented by such "facts"/data, and revealed by scientific practices that are organized by a community and configured in accordance with a thought style. Yet leukergy has never become fully represented by a finite set of interconnected observable data and contingent facts. This is why the phenomenon might become recast in coming research situations. There is no criterion for an ultimate saving of the phenomenon of leukergy. Accordingly, leukergy might be represented by a potentially infinite amount of observable data and "facts". Once

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that Fleck's trans-subjective epistemology—as a kind of criticism of constructivist SSK before it was even born—strongly denies. Indeed, Fleck does not offer a Heidegger-like scenario for the existential genesis of the epistemic subject-object cut. Nonetheless, what he suggests is congruent with the hermeneutic approach to epistemological objectification. According to him, the subject-object relation is ineluctably stylized; i.e., it is circumscribed by interests, values, norms, and constraints. By implication, the epistemic relation is normatively constituted by the ways in which the thought styles operate. The normative fixation of this relation—resulting in the formulation of a normative criterion of objectivity—takes place within the horizon of a thought style. All processes of inter-subjective cognitive construction are always already situated within such horizons.

identified in a certain situation as represented by a class of data and contingent "facts", the phenomenon can always be re-described in a new situation with regard to a new research interest (for instance, a novel clinical research), and by a new configuration of practices, thereby becoming represented by a new texture of data. Yet there is also a countertendency to a growing reduction of the chaos of experimental observations within the plurality of research situations: a tendency that Fleck precisely addresses as a "signal of resistance".

Against the background of the distinctions discussed so far, and with regard to Fleck's epistemological tenets, a scientific fact refers to a phenomenon as represented by a contextually changeable multitude of contingent "facts" and data. Thus considered, a scientific fact is about a phenomenon that is always revealed in configured and stylized scientific practices. A phenomenon is inevitably perceived in light of a collective thought style. The scientific fact about a phenomenon thus perceived and revealed retains its dependence on stylized cognition and practices of inquiry. Yet it is formulated in a manner that allows other thought collectives to verify its existence, not necessarily by repeating the same observations that already represent the phenomenon to which it refers. In an alternative formulation, a scientific fact is about a phenomenon in its changeable representation by classes of interconnected data and contingent "facts" that show repeating patterns crisscrossing the situations in which the phenomenon becomes approached with respect to particular interests. In the scenario of Fleck's case study developed in his book, the Wassermann reaction is the phenomenon which should be constituted as a scientific fact. It is a phenomenon of how certain antibodies react with certain lipids. As Fleck makes clear, this phenomenon has been revealed by accident through experimental practices entitled to discover antigens in syphilitic organs.

The case study about the discovery of the antibody test for syphilis he unfolds demonstrates how a phenomenon offering a resistance to its free interpretation in the cognition of a thought collective has become represented in different situations by different groups of experimental data corresponding to different configurations of practices. In this scenario, the relation of the phenomenon (the Wassermann reaction) to the diagnosis of syphilis is a scientific fact *in statu nascendi*. It is interpretatively open since there is no criterion for final revealing and representation of the phenomenon. Placing the latter in a new situation would not only recast it, but also open new possibilities for (re)constituting the scientific fact related to this phenomenon. Fleck (1979, 72) argues that the relation of the Wassermann reaction to the diagnosis of syphilis "became a fact only because of its extreme utility owing to the high probability of success in concrete cases." Following the characteristics singled out in *Genesis and Development of a Scientific Fact*, scientific fact is what (a) can send "a stylized signal of resistance in thinking", (b) can exist as fixed and proven only in "vademecum science", (c) can meet the Durkheimian requirement of irreducibility to a single combination of observable facts/data,[35] (d) can take the form of a "thought-stylized

[35] A scientific fact is supervenient upon a non-fixed number of actual and potential combinations of contingent facts and data. If it were only supervenient upon a single combination, it would also be a contingent fact.

conceptual relation" which might be cast in historical and psychological terms, but "cannot be substantively reconstructed in toto" from historical and psychological viewpoints (Fleck 1979, 83), (e) can be expressed through the means of communication of a thought collective (Fleck 1979, 102), (f) can react upon other facts constituted in the same field, thereby participating in the interwoven texture of the field's facts, and (g) can be characterized by certain patterns displayable by all classes of interconnected contingent facts and data corresponding to the situations in which the relevant phenomenon has been revealed. The "factuality" (Fleck's expression) of the investigated phenomenon never becomes a mere presence. It comes forward as a "maximizing thought constraint" (Fleck 1979, 98).

The scientific fact related to the Wassermann reaction (and its relation to syphilis) refers to a phenomenon revealed by practices of "chemistry, physical chemistry, pathology, and physiology" (Fleck 1979, 52). Nonetheless, none of these disciplines is entitled to constitute the scientific fact in question. This fact is to be seen—so his argument goes—by the "serological touch", which is much more important than (and irreducible to) any procedural identification under laboratory conditions that represents the phenomenon by experimental results, measurements, calculations, and controlled observations. *Prima facie* the "serological touch" resembles what phenomenologists call "the intuition of essence" (*Wesensschau*): Only the thought collective of serologists is able to grasp the "factual essence" of a phenomenon represented by a multitude of observations. However, this analogy is not quite apt, since the descriptive-phenomenological ideas behind the intuition of essence are completely alien to Fleck. The touch he is interested in is predicated on interpretative experience capable of recognizing patterns. (In this regard, the serological touch has much to do with the *phronēsis* of practical experience. Fleck refers often to this experience in the research work by ascribing to it a meaning similar to what it has in philosophical hermeneutics. He opposes practical experience to the narrow epistemological notion of experience related to isolated experiments. The texture of practical experience in science consists of "many successful and unsuccessful experiments, much practice and training, and—epistemologically most important—several adaptations and transformations of concepts" (Fleck 1979, 98). Fleck's term of experience also connotes the stylization of the routine everydayness of a thought collective.)

It is the "serological touch" that might put into play the unity of the seven [(a–g)] characteristics. The way in which observations (contingent "facts" and data) represent the phenomenon in changing situations makes the meaning of scientific facts variable.[36] Yet this conclusion is not to be confused with a version of theory-ladenness of observation. As I pointed out in the preceding chapter, the very formulation of a theory-ladenness thesis assumes a static relation between theoretical framework and "empirical content". By contrast, Fleck's approach to the depen-

[36] Fleck's case study shows the varieties of observable (experimental) representations of the scientific fact about the relation of the Wassermann reaction to the diagnosis of syphilis. The study takes into consideration "all fields related to the Wassermann reaction until, with disregard for theoretical questions and the ideas of individuals, the reaction became useful" (Fleck 1979, 73).

dence of the constitution of scientific facts' meaning on interpretative experience and thought styles assumes a cognitive dynamics of the research process that cannot be finalized and fixed by means of normative-epistemological criteria.

To sum up, scientific facts have genesis and development because they become constituted within the ways of interpretative dealing with phenomena through scientific practices. No doubt, this aspect of Fleck's work—the interpretative saving of phenomena as scientific facts—anticipates essentially the approach to phenomena in the recent versions of experimentalist realism and interventionism which oppose all kinds of realism based on representational epistemology.[37] Fleck would have subscribed to the claim that the "cut between measuring and measured systems is an actual material configuration that composes a phenomenon" (Rouse 2002, 283). For Fleck, stylized practices do not preexist the meaningful articulation of scientific facts. Such practices are part of the phenomena to which the facts are related. Like philosophers who put experimental intervening in the world first, he assumes ontological priority of phenomena over particular entities. Yet Fleck adds an interpretative dimension to this picture that is not palpable in the versions of realism being mentioned: It is the stylizing (and stylized) interpretative experience which manages to establish a balance between the signal of resistance and free thinking, thereby opening some leeway in choosing the proper way of constituting scientific facts (Fleck 1979, 101).

Accordingly, resistance is possible only where there is a struggle in attaining a goal. In the same vein, the priority he assigns to phenomena in the constitution of scientific facts appeals to the primacy of interpretation which starts to operate on the level of perception. The phenomenon being explored is on the borderline between (what Fleck calls) "passive and active associations". Phrased differently, the phenomenon becomes factually revealed when the resistance is effective within the thought collective. It is not the experimental intervening or the causal interaction but the reflexive interpretation that takes into consideration the demarcation between passive (not dependent on the established normative inter-subjectivity, the tools of cognition, and the communicational characteristics of a thought collective) and active (dependent on choices dictated by the thought style) connections, granted that the demarcating edge is floating and situationally conditioned. Due to the reflexive interpretation, the researchers are in a position to decide "which passive connections follow of necessity from a given set of active assumptions" (Fleck 1979, 64).

Since the very demarcation is informed by the thought style, it is the anonymous power of the latter (rather than the investigators' personal and collective dispositions) that enables the reflexive interpretation through which active assumptions are employed. A thought style in science is distinguished by reflexivity that is not to be

[37] It is not by chance that Ian Hacking (2009, 85) asserts that with regard to the balance between contingency and stability in science "mon Fleck est plus clair, plus élégant et plus net que tous ses successeurs."

disentangled from the way in which phenomena are revealed.[38] (In fact, thought style and investigators' dispositions are not separated in Fleck's reasoning. He succeeds in bridging the style's anonymous power with the investigator's dispositions precisely by means of reflexivity operating in scientific inquiry.[39] In this regard, one is to find in his views motifs anticipating reflexive sociology. Fleck's thought style might be read as an open system of dispositions in the same way in which Bourdieu reads the concept of habitus. In all cases in which Fleck invokes the idea of a sociology that—in a comparative perspective—has to deal with the thought styles in scientific inquiry, he assumes a reflexive mediation between the stylistic constraints and the investigators' dispositions. Thus, the investigators are determined by a thought style only to the extent that they reflexively determine themselves as agents who make the choice to work in this style. Like habitus, Fleck's thought style is a structuring and structured structure. Accordingly, interpretive experience in inquiry is stylizing and stylized.)

Among the functions which the thought style is entitled to serve is that of constraining the possibilities for revealing phenomena and constituting scientific facts. At the same time, the style sanctions the choices and the ways of decision making. A thought style imposes on the particular members (of a scientific community) restrictions in choosing possibilities of doing research. Fleck is inclined to unfold the concept of thought style by laying more emphasis upon its negative, inhibiting function. A thought style serves this function, but not in a normative-epistemological manner. It constrains the thought collective's research work by integrating its members in a "mood of thought" (*Denkstimmung*) as a prerequisite for their "mental readiness" (*Denkgewohnheiten*) for producing knowledge and constituting scientific facts of a certain kind (Fleck 1986, 66). Thus considered, a thought style (starting from the stylization of observations through Gestalts) shapes the routine practices of a thought collective, and sanctions the directedness of the research process. Stated alternatively, a thought collective (as characterized by its mood of thought) comes into being when researchers become immersed in practices whose routine performance is specified by a directedness of inquiry and a tendentious restrictedness of the choices of possibilities for doing research.

The commitment of a thought collective to the truth about scientific facts is not to be disentangled from the communal belief in the existence of certain theoretical objects. Only through this belief are the thought collective's members able to observe and describe the facts they claim to be true. Furthermore, the communal belief in the existence of theoretical objects is of central importance for a domain's

[38] At the very outset of his book, Fleck (1979, xxvii) argues that in the lack of reflexivity "we feel a complete passivity in the face of a power that is independent of us."

[39] Claus Zittel (2012) astutely observes that Fleck's concept of thought style is not akin to Wölfflin's morphological concept of style as a general characteristic of an epoch in the history of art. Like the structuralist notion of style, the morphological one has a being in itself. In morphological perspective, a certain style as embracing a firm configuration of historical and cultural phenomena and events is something like a quasi-natural kind. (For an example of such a configuration, see Wölfflin (1908, 195–225).) By contrast, Fleck's thought styles have a being non-detachable from the practices of inquiry and the dispositions of inquirers.

identity. To put it quite cautiously, the belief in these objects bears resemblance in several respects to religious faith. The members of a religious community try to make (by means of ritual practices and exegesis of sacral texts) the transcendent authority immanent in community's everydayness. Although the Transcendent never becomes an actual presence in the everyday life, it "participates" in all of the community's activities, thereby endowing them with sacral meaning. In this regard, the Transcendent becomes the most immanent authority in the day-to-day comportment of a religious community. By the same token, the "believers in theoretical objects" try to make these transcendent objects the most immanent entities in a scientific community's everydayness. This is why the thought collective's everydayness of inquiry seems like (from an external viewpoint) a variety of ritual practices that are performed in accordance with the belief in the existence of theoretical objects. The thought collective resists to a great extent changes in its thought style because this belief plays a leading role in the community's stylization of knowledge and inquiry.[40] At the same time, however, the articulation of scientific domains (like those which Fleck investigates: bacteriology, immunology, or clinical biochemistry) progressively rationalizes the communal belief in the existence of theoretical objects. It is this rationalization of belief during the domains' articulation that sets clear limits on the agenda of questing for analogies with religious faith: In contrast to scientific belief in unobservable entities, religious faith does not need rationalization in order to be effective. The more this faith resists rationalization, the stronger it consolidates a religious community.

In agreement with this observation, Fleck stresses important differences when juxtaposing thought collectives in science with religious communities. Thus, he makes the case that the "religious thought collectives" are normally in a situation in which "secretiveness and dogmatism" (*Geheimtun und Dogmatik*) dominate because there is no democratic pressure on the elite from outside (Fleck 1979, 105–106). By contrast, scientific communities manage to obviate rigidity in the research work (despite the intrinsic conservatism of their thought styles) thanks to the exoteric circles and the laymen's public opinion, which prevent the elites from following the tendency to self-isolation. Nonetheless, the quasi-religious belief in the existence of objects that can be seen only through the eyes of the initiated in a thought style remains a distinctive trait of science's thought collectives. As I pointed out, the belief in theoretical objects is by no means based on a metaphysical contemplation or intuition. It is rather a belief that constantly requires the procedural "transference" of these transcendent objects in the everyday situations of research as they are circumscribed by interrelated practices and spaces of representation.

Like scientific fact itself, scientific truth is predicated on a genesis and it undergoes a development that depends on contextual interpretations in the research process as well as on the forms of re-stylization of knowledge. Yet scientific truth's genesis and development do not provide a rationale for holding epistemic relativism.

[40] From the viewpoint of philosophical hermeneutics, a thought community is conservative because of its extreme unwillingness to abandon its prejudices (both as *Vorurteile* and *Vorverständnisse*) of interpretation.

The analysis of scientific inquiry's stylization shows that scientific truth is an "event" in the constitution of factuality. To put it in terms of hermeneutic realism, scientific truth is an event in the facticity of inquiry. In studying the contextual meaning of scientific factuality, Fleck discards the idea that there is a diversity of scientific truths about one and the same fact, each of which is forged within a particular thought style. Had he subscribed to a claim of incommensurability of thought styles as assigning specific truth-conditions, he would have supported a consistent version of epistemic relativism. In insisting on the constant inter-collective circulation and migration of scientific knowledge, Fleck brings the generalized claim of epistemic/semantic incommensurability to naught. (I will return to this point later.) Being in a constant state of becoming, scientific truth is not enclosed in normatively codified epistemic positions.

Fleck's elaborations on the concept of truth also oppose all epistemological doctrines that by maintaining the historical relativity of scientific knowledge try to "maximize the objectivity" of (supposedly critical and value engaged) scientific research. Following this line of reasoning, I am in a position to shed more light on the decisive reason one can use against any attempt at construing Fleck's program in terms of (a version of) standpoint epistemology. Notoriously, the champions of standpoint epistemology make use of transcendental arguments in their efforts to divorce objectivity from the requirement of value-neutrality without falling into epistemic relativism. Put differently, these are arguments that support the efforts of overcoming the alleged dichotomy between value-free objectivity and judgmental relativism. According to standpoint epistemologists, objectivism (as a basic form of cultural absolutism) and judgmental (epistemic) relativism are mirror-linked twins because these positions share the conditions of possibility for their main claims. In particular, a common condition is the denial of the relationships between the sociohistorical situatedness of knowledge production and the maximizing of knowledge objectivity. Accordingly, both doctrines accept only value-free and disinterested objectivity. Thus, judgmental relativism perfectly complements the objectivists' claim that the commitment to objectivity requires the elimination of all sociocultural values and interests from the research process and the outcome of research: If this elimination does not take place, then the concept of objectivity proves to be superfluous.

Standpoint epistemology is characterized by the strange combination of a rejection of epistemic relativism and a support of cultural, sociological, and historical relativism. With this combination only the relativization of objectivity can take place. The very idea that objectivity might be maximized presupposes that the degrees of objectivity hinge on the epistemic positions' potentiality of reflexivity: The more critically reflexive an epistemic position, the greater the objectivity of knowledge produced from this position. In drawing a parallel with the Strong Program's requirement of reflexivity (as expressed by the symmetry principle), Sandra Harding (1991, 149) argues that standpoint epistemology goes further in requiring "causal analyses not just of the micro processes in the laboratory but also of the macro tendencies in the social order, which shape scientific practices." In carrying out such analyses, one would realize that some of the social locations of

knowledge production are better than others as starting points for devising strategies to maximize objectivity.

From the perspective of standpoint epistemology, the observation that all scientific knowledge is socially situated serves as a chief argument for the thesis that cognition is inevitably determined by socially located epistemic positions as they are distinguished by special interests and values. What this perspective fails to take into consideration is the open horizon of possibilities that always already transcends each particular kind of knowledge production's situatedness. Consequently, the philosophical assumptions of standpoint epistemology prevent one from coping with the complexity of knowledge's situated transcendence, and more generally, with the facticity of knowledge production. The champions of this program are not able to overcome the fixation of the subject-object relationship. Multiplying the social loci of knowledge production pluralizes the forms of existence of this relationship, but does not undo the fixation in determining social structures. The epistemic relation (in its pluralism of socially determined forms) of standpoint epistemology is a strongly Cartesian one. In relativizing this relation, the supporters of standpoint epistemology posit a plurality of fixed Cartesian cuts. They address the "objective truth" by attributing it to the epistemic position distinguished by the highest critical reflexivity and capacity to maximize objectivity. Unlike Fleck, standpoint epistemologists replace the facticity of objectifying inquiry with a relativist plurality of social locations of knowledge production.

Fleck stresses the priority of the "event of truth" over the statically defined objective truth. His concept of "creative human truth" is not epistemological in the first place. Since there is a tacit appeal to the open horizon of scientific research, it is rather a hermeneutic concept.[41] Truth takes place in the cognitive life of a thought collective as a result of the interplay of revealing and concealing possibilities for doing research and the way this interplay is regulated by confronting the resistance in choosing possibilities. As already pointed out, Fleck assigns to the phenomenon of resistance a decisive role in the constitution of a scientific fact. He (1979, 95) writes that at first "there is a signal in the chaotic initial thinking, then a definite thought constraint, and finally a form to be directly perceived." Thus considered, truth is an "event in the history of thought", and not a relation between an epistemic position and reality out there (as this relation is devised by the proponents of

[41] No doubt, this statement is an exaggeration. Yet by committing the "event of truth" to the thought styles' trans-subjectivity, Fleck tends to recast truth in terms of *aletheia*: an event of revealing and concealing phenomena that can be constituted as scientific facts. One may assume that Fleck's purported cognitivism compels him to admit that the event of truth takes place in the cognitive life of thought collectives. However, the scenario of his case study about the Wassermann reaction contradicts in several respects the strongly cognitivist attitude. In fact, the extended interpretation of the event of truth in terms of the interplay of revealing and concealing—interplay that transcends the scientific communities' cognition, thus obviating the narrowness of cognitivism—is completely in line with his social epistemology. The latter implies that truth is not a dynamic relation of correspondence between "beliefs" (in the sense of analytical epistemology) obtained from an epistemic position and what one assumes (from this position) to be the reality out there. Truth also has nothing to do with the relativization of a cognitive product to the circumstances and conditions under which it is created.

"standpoint epistemologies"). Therefore, truth has nothing to do with the relativization of a cognitive product to the circumstances and conditions under which it is created. Indeed, Fleck insists that his concept of truth is a sociological one. However, the concept has this character because it is bound up with the motif of situated transcendence, and not because truth (as an event in the history of thought) is socially constructed.[42]

The truth about a scientific fact is achieved by a progressive reduction of the dissonances in the intra-collective communication. In *Genesis and Development of a Scientific Fact*, the emergence of this event is described as the outcome of two intertwined processes. On the one hand, this is the process of introducing effective rules for the selection of the best solution among a plurality of alternative solutions to a problem (or the process of "maximizing thought constraint"). On the other hand, the event of truth is conditioned by the process of minimizing the range of interpreting what is under inquiry. This second process also shows the way in which a scientific fact becomes constituted by a thought collective. Again, the fact comes to the fore originally as "a stylized signal of resistance" sent to the investigatory cognition. This resistance is the most extreme point in the correlation of maximizing of thought constraint and minimizing the range of interpretation. Furthermore, it is a resistance that takes place in the horizon of possibilities disclosed by a thought style. The theoretical formulation of a fact (in a domain of research) which captures the styled signal of resistance (recast in terms of the epistemic conditions of fact's existence) is the event of truth. The fact is revealed because the horizon conceals possible "alternative facts" (or possibilities of constituting such facts).

Fleck (1979, 100) argues that truth is the only "stylized solution" of a problem formulated by a given thought collective. The truth-about-a-fact is the extreme minimizing of the horizon's possibilities, thereby reducing them to only one which becomes actualized in the final solution. However, reaching such a solution does not imply a finalization of a process of inquiry. The actualization of a maximally specified/stylized possibility would open a new leeway for possible interpretations of the fact constituted by this actualization. A scientific fact is never statically given, and the truth about it never becomes a pure presence at hand. Truth is maximal resistance but only within a certain context and with regard to possibilities of doing research already chosen. Regardless of how firm the fact is situated in configured

[42] Standpoint epistemologies have unfolded certain motifs of Karl Mannheim's sociology of knowledge. The basic attitudes and orientations of the collective thought of a social group can be derived from the group's life conditions. More specifically, the champions of these epistemologies adhere to Mannheim's argument that the view of relationism (relating forms of knowledge production to social positions) does not imply epistemological relativism. In trying to answer the question of how is it possible that Fleck at once proposes a relativist interpretation of truth and denies that truth is relative, Markus Seidel (2011, 224) reaches the conclusion that "Mannheim's description of his purported relationist solution is not just similar to but in its basic idea nearly the same as Fleck's treatment of the issue." In my opinion, there is a difference between the programs of Mannheim and Fleck that has to be conceived as a matter of principle: Mannheim tries to overcome cognitive relativism by means of epistemic relativization, whereas Fleck develops his argument against relativism by referring implicitly to different sorts of hermeneutic circle of knowledge production.

practices (context) and appropriated possibilities, the chance of its re-contextualization by placing it in new possibilities for doing research always exists. In other words, the situated fact (the outcome of resistance within a configuration of practices) is always open to be transcended, and accordingly revised. This is why all scientific facts are amenable to further development. Against this background, the transcendental aspect of the constitution of knowledge, scientific facts, and objects of inquiry comes into being in Fleck's socio-historical epistemology through the reflection upon the situated transcendence of knowledge production.

Fleck's sketchy criticism of logical empiricism seems to be the place where he spells out most clearly not only his rejection of foundationalism, but first and foremost the way in which he adopts the idea of situated transcendence of scientific knowledge. His argument against the protocol sentences assumes that nothing in scientific knowledge is merely given. In anticipating Sellars's attack on the "myth of the given", Fleck argues that even the elementary, contingent "facts"—like those he observes in studying leukergy—are contextually situated in a manner that allows one to re-contextualize them. (The statements about these "facts" are items of empirical knowledge that are incapable of serving the function of a given.)[43] The controlled observations are inescapably made within a mood that guides the direction of the investigation, and they are inextricable from the milieu of "active associations" characterizing the thought collective's creativity. It is precisely this situatedness of the observed facts that shows why is it impossible to privilege the "protocol statements based on direct observation" as an ultimate epistemic foundation. Since re-contextualization of observable facts in the course of scientific inquiry proceeds in accordance with a thought style, the observable facts (and the sentences about them) are unavoidably stylized. Accordingly, Fleck (1979, 89) argues that "every statement about First Observations is … also a thought-stylized assumption."

Fleck's engaging with situated transcendence should be analyzed from a broader perspective—as a kind of engaging not only with an idea or a conceptual figure, but with a line of argument as well. As already indicated, he addresses—not exactly in hermeneutic terms—the interpretative character of research by paying attention to heuristics in revealing the phenomena that presumably have to be constituted as scientific facts. Fleck refers on several occasions to the "harmony of illusions" as the initial medium in which the genesis of a scientific fact is situated. It is this medium in which the thought collective receives "a signal of resistance in the chaotic initial thinking, then a definite thought constraint, and finally a form to be directly perceived" (Fleck 1979, 95). The three stages of the fact's genesis—as stages of the articulation of a phenomenon that sends the signal recognizable by measurable data—are vaguely characterized as stages of an interpretative process.

[43] An inferentional interpretation of Fleck's concept of thought style in terms of inferentionalism has its raison d'être. In this interpretation, all states of mental activity (as distinguished by moods of thinking) are inferentially dependent within their respective thought styles. There is no foundational cognitive state in any thought style. All states and moods of thinking are inferred or inferable from other states.

They can be scrutinized in hermeneutic terms, but this would be an overinterpretation of his scenario of "factogenesis". One should not forget, however, that Fleck is interested not only in the genesis but also in the development of scientific facts. With its identification through (say) discovered patterns in a sufficiently large set of observable data—a troublesome identification that is necessarily situated in a "mood of thinking and active associations"—the scientific fact begins its own development which occurs (not only upon but also) with the help of the initial harmony of illusions. The development itself consists in a re-contextualization of a scientific fact in the changing situations of scientific inquiry (or, as is instantiated by the Wassermann reaction, in socio-political situations in which the developed fact becomes received and utilized in public life).

This claim implies that a case study about the genesis and development of a scientific fact cannot reach a definite final point. What such a study would present as an accepted scientific fact should remain open to future investigations that will deal with re-contextualization taking place in the aftermath of the story told in the initial study. The new investigations will document the further development of the established fact. Thus, a continuation of Fleck's story of the discovery of the Wassermann reaction would attest to the developmental potential of this scientific fact. Fleck ends his story about the diagnostic specificity of this serological test with comments on events from the mid-1920s. The most important re-contextualization of the fact that the Wassermann reaction is a diagnostic test in the post-war period constitutes the subject matter of Ilana Löwy's (2004) study of the transformation of the antibody test for syphilis into a legally significant fact. At issue is the interpretation(s) of the test in contexts of legal and administrative-regulative measures like the introduction of mass screening for syphilis via legislation. Indeed, this is a re-contextualization that makes the objectified factuality studied by Fleck a kind of medical technology regulated by the state and incorporated in legal dispositions. But one should not forget that from the very outset the fact about the Wassermann reaction is generated in semi-scientific context. The relation of this reaction to syphilis became a fact-in-development "because of its extreme utility owing to the high probability of success" in concrete cases of public life (Fleck 1979, 72).[44]

Notoriously, Fleck anticipated all significant ideas of Kuhn's conception with the exception of the idea of scientific revolutions as being predicated on a *Gestalt*-switch and provoking semantic incommensurability between pre- and

[44] Fleck nicely characterizes this context by citing a fragment of Wassermann's memoir about his discovery. Wassermann describes the input which the head of the Ministry has been provided at the start of his research on syphilis. The competition between French and German research institutions in finding diagnostic devices and a therapy of this disease has been a crucial factor for supporting the research on syphilis. In analyzing these historical-political circumstances, Fleck (1979, 68) concludes that "from the very beginning the rise of the Wassermann reaction was not based upon purely scientific factors alone." He additionally stresses "the special moral emphasis on syphilis". In comparing the research on syphilis with that on tuberculosis, Fleck observes that the latter "simply did not receive as powerful an impulse from society. There was no corresponding social tension seeking relief in research" (Fleck 1979, 77).

post-revolutionary thought worlds.[45] In Fleck's socio-historical epistemology, such revolutions are most definitely excluded. More specifically, despite Fleck's insistence that the divergent thought styles might constitute different cultural worlds, he rules out a revolutionary change that prohibits interpretive mediation. This stance does not exclude the semantic incommensurability between thought styles. Moreover, Fleck pays special attention to the untranslatability of clinical descriptions governed by past thought styles into modern medical language. Unlike Kuhn, however, Fleck is not looking for shared natural kinds that should enable the communication between communities committed to semantically incommensurable theories. The changes in scientific development leading to new thought styles preserve elements of that complexity of skills, customs, practices, and opinions which is Fleck's concept of inquiry's facticity. Incommensurability and untranslatability do not exclusively concern linguistic taxonomies and conceptual schemes.

Semantic incommensurability and linguistic untranslatability take place within the facticity of inquiry, which is too complex to foreclose all possible ties between thought styles (shaped by alternative regimes of practices). However minimal it could be, there is always a shared horizon of understanding between two allegedly incommensurable thought styles in science. Any thought style actualizes possibilities projected upon its particular horizon. Among them are supposedly possibilities for understanding lexically incommensurable thought styles. Needless to say, this consideration is not an argument against the revolutionary breaks in scientific development. But it gives direction to forging such an argument. In the perspective of "genesis and development" of scientific facts, the phenomenon of incommensurability refers to what Fleck calls "style-permeated structures". In any of these structures possibilities projected on the style's horizon are actualized and incorporated. Taken out of contextual facticity, two style-permeated structures might be addressed as being enclosed in their incommensurable conceptual schemes. Because of the horizons' openness, however, there are always possibilities whose actualizations may enable transitions from one to another style-permeated structure. Phrased differently, scientific development is sufficiently resilient to avoid Kuhnian revolutionary changes because different kinds of interpretative commensurability underlie the semantic incommensurability between isolated style-permeated structures.[46] Fleck hints at such a scenario for scientific development when commenting on the functions he ascribes to the pre-ideas taken to be the most significant ingredient of that whole which for him constitutes the facticity of inquiry. For the sake of making Fleck's view about the historicity of scientific facts intelligible, it is very important to clarify his "idea of the pre-ideas" in a proper manner.

[45] It is another question that Fleck (1979, 179–180) emphasizes the significant role of the changing *Gestaltsehen* ("the mood-conforming gestalt-seeing") in the process of scientific discovery: Due to the different Gestalt-seeing and the switch of mood, "one can no longer even understand how the previous form was possible and how features contradicting it could have gone unnoticed. The same situation obtains in scientific discovery, only translated from excitement and feverish activity into equanimity and permanence."

[46] For a view about how hermeneutic commensurability and dialogicity play a crucial role in the development of scientific knowledge, see Kiss (2006).

In anticipating motifs of Gerald Holton's conception of themata in science, he makes the case that the constitution of scientific facts is linked to ideas, intuitions, and even whole worldviews whose cultural-historical genesis is to be traced back to epochs without socially and cognitively institutionalized scientific activity. Pre- or proto-ideas are both analogues to Holton's themata and archetypical imagery antedating the concepts of modern science. Unlike Holton, however, Fleck is not interested in unfolding a structuralist view about science's historicity. For him, there is no finite list of binary coded structural categories expressible as proto-ideas. Fleck's case study shows how a certain proto-idea—that of "befouled blood"—operates in the constitution of the scientific fact about the diagnostic validity of the Wassermann reaction. It is a "developmental rudiment" (Fleck 1979, 25) that mediates between pre-scientific thought styles and modern theorizing. The re-description of this proto-idea in terms of experimentally verifiable theories opens up possibilities of making sense of the expression of "syphilitic blood" from a serological viewpoint. It is this re-description that revives "extinct" thought styles: a revival that comes into being through opening special possibilities for doing research. Every thought style as constraining rules may cease to exist, but "rests of the style" in the form of pre-ideas that open up possibilities in a new style's horizon still remain. Long-term proto-ideas constantly migrate (mix) in living thought styles, thereby ensuring a macro-historical plasticity and transitions between thought styles in scientific development. Appealing to the notion of proto-ideas requires taking into consideration the interpretative openness of the constitution of scientific facts. The way in which Fleck makes use of this notion concretizes his implicit idea that the development of a scientific fact is potentially ceaseless.

Fleck's elaborations show that the proto-ideas do not preexist—much less determine—the thought styles' horizons. They operate within the possibilities projected on these horizons, thereby facilitating the "dialogue" between—otherwise completely divergent—thought styles. Pre-ideas are not discrete structural modules. To put it in Gadamerian terminology, pre-ideas have but an effective historical being in the fusing horizons of scientific thought styles. They are transmitters not only (and not in the first place) of past conceptual schemes. Pre-ideas transmit first and foremost past forms of facticity.

Fleck would not deny that the lack of common linguistic taxonomies leads to communication breakdowns. What he denies is that the stress on these breakdowns provides an argument against the interpretive continuity in scientific development. To reiterate, Kuhn holds that the bilingual state is a usual state in science, but this state does not provide an opportunity for translatability. In rejecting bilingual coexistence but further developing the quasi-Darwinian tendency of Kuhn's final work, Mario Biagioli (1990) argues that incommensurability should be perceived as offering important clues about how new paradigms emerge from previous ones. (As pointed out, Kuhn did not give up the idea that bilingualism combined with a series of ostensions might offer a way around incommensurability.) According to Biagioli, Kuhn—in treating incommensurability as resulting from non-homology of linguistic grids—overestimates the chance for a restoration of communication across incommensurable paradigms offered by bilingualism. Incommensurability is to be

treated not as a purely linguistic but as an anthropological phenomenon. It is a phenomenon that conditions—so the argument goes—the construction and preservation of cultural identities. Incommensurability enables a community to figure out the collective response to the competitive other. Due to this response, a community's members may legitimately act as representatives of a "new species" properly situated in a new socio-cultural niche. This is a non-trivial radicalization of Kuhn's view. Furthermore, Biagioli insists on an important asymmetry in understanding.

I mention Biagioli's approach to incommensurability since Fleck's view about the divergence of thought styles contrasts it in an interesting manner. A thought collective gains its emancipation through recasting pre-ideas stemming from archaic thought styles. Thus, the process of emancipation and the construction of identity of a thought collective are interpretively situated within the effective history of receiving "developmental rudiments". It is the overcoming of semantic incommensurability in the facticity of inquiry that conditions the emancipation. This view is diametrically opposed to Biagioli's conception that without incommensurability (defined with regard to the competitive other's theory, moral, and ideology) there is no community's authentic ethos. Biagioli's conception specifies mechanisms of "speciation" (of socio-professional groups in science) by instrumentalizing incommensurability, while Fleck's comparative analysis of thought styles draws on an implicit macro-historical hermeneutics when what is at stake is the issue of the thought collective's emancipation.

3.4 Facticity and Factuality, and the Realism Debate

For scientific realists, the theoretical statements about objective factuality of unobservable entities must be taken at face value, regardless of whether future scientific theories—supposedly approximating the truth more closely—might disprove the existence of facts discovered or predicted by contemporary theories. Standard scientific realism is a position that can consistently be defended by appealing to the actual status and achievements of theories. It is the belief in the capability of successful theories to yield knowledge about objective factuality that underlies all variants of scientific realism. This factuality stands for reality-out-there. Conceding that objective factuality results from objectification within the practices of inquiry runs against this belief. The standard realists assume that scientific theories—as distinguished by their degrees of success or degrees of truth approximation—differ in their capacity to catch the objects in themselves. The introduction of a distinction between the facticity of inquiry and the factuality produced within this facticity poses crucial questions that challenge the reasonability of making the concept of realism dependent on the status and achievements of theories. In contrast to scientific realism, hermeneutic realism is not a position that primarily deals with the nature of scientific knowledge. Even less can hermeneutic realism be described as

an epistemic attitude.[47] In particular, the constellation of issues related to the production of objectified factuality within facticity is first and foremost an ontological problematic that cannot be approached by scrutinizing what is described by "our best scientific theories". Nonetheless, at the end of this section I will try to show that the hermeneutic realist is capable of suggesting (ontological) solutions to some of the main (epistemological) problems which scientific realists are preoccupied with.

The distinction between objectified factuality and inquiry's facticity should not be construed as an attempt at weakening the metaphysical assumptions of standard realism by making concessions to various antirealist positions. Hermeneutic realism is not to be located somewhere in the spectrum between the poles of stubborn realism and extremist antirealism. Rather, hermeneutic realism is a position predicated on assumptions that, taken as a whole, provide a radical alternative to the assumptions through which the realism debate becomes a clash between epistemic attitudes. (In line with this conclusion, Sankey and Ginev (2011) replace the realism-antirealism spectrum with one between the poles of scientific realism and hermeneutic realism.) By implication, hermeneutic realism opposes all positions (including the natural ontological attitude, NOA) involved in this debate. I stress again that the "genesis and development" (in Fleck's sense) of scientific factuality is repudiated not only by scientific realists but by instrumentalists, conventionalists, and other antirealists as well. For them, having scientific facts is a matter of invention, construction, and/or convention. Scientific factuality does not have its own life. Only what supposedly precedes the social recognition of a new factuality's reality—inventions, constructions, negotiations, processes of settling controversies, processes of reaching a consensus, and so on—can enjoy cultural autonomy and proper historicity. Admitting a "genealogy" and a way of being of factuality within the reality-as-facticity of practices and possibilities is at odds with the tenets of any sort of antirealism: Though antirealists are reluctant to acknowledge a special status to any form of constitutional analysis, the constitution of meaningful facts cannot be addressed by procedures that conceive of scientific factuality in terms of invention, construction, and convention.

It goes without saying that dis-covering a scientific fact in its genesis and development within the interplay of practices and possibilities has nothing to do with

[47] Defining scientific realism as an epistemic attitude is the source of an essential uneasiness. The realist should regard the epistemic relation as that part of reality (the natural world) which circumscribes the place within which reality becomes factually revealed. (Otherwise, this relation must be treated as a "transcendental condition" for defending scientific realism, which is hardly in line with any doctrine of scientific realism.) Naturalizing the epistemic relation in accordance with the epistemological requirements of scientific realism is a second-order naturalism. More generally, casting the subject-object relation as part of the natural world is an explicit or implicit ingredient of any program of naturalizing epistemology. Yet even the most stubborn scientific realist ought to concede that this relation evolves both in the social history of mankind and in the culturally dependent development of the individual cognitive faculties. Only a highly evolved form of the epistemic relation may reveal reality scientifically. But if so, the scientific realist has to admit that a socially, culturally, and historically constructed form of the subject-object relation grounds the belief in the reality-out-there. It remains an open question as to whether the coherent version of scientific realism should appeal to a naturalized socio-cultural history of the epistemic relation, or perhaps to (what Kuhn calls) a quasi-Darwinian evolutionary epistemology.

constructing a scientific fact by means of negotiations (such as negotiations of what should be accepted as positive or negative evidence for a unobservable entity's existence, or negotiations of the conditions under which the outcome of an experiment will be regarded as fitting a theoretical model).[48] Indeed, one can assume that the "genealogy of scientific facts" is a classical theme of social constructivism. Yet Martin Eger (1997) cogently shows the wrongness of such an assumption. Social constructivists are unjustifiably replacing—so his argument goes—the meaning-constituting interpretive circles of scientific inquiry with different maneuvers of reaching a consensus and different sorts of "black-boxes". The constructivist scenarios are devised to demonstrate that scientists are busy un-making science by sacrificing—through negotiations—those parts of science's cognitive body which are no longer instrumental in pursuing their socio-political interests, granted that putting the social fabrication of acceptable results first makes science a thoroughly political enterprise. For Eger, what constructivists are wittingly ignoring—for the sake of treating scientific inquiry as a politics of reaching agreements—is the free play with possibilities within the open horizons of saving new phenomena, on the one hand, and those within the horizons of understanding of what the historical experience has handed down in the actual process of inquiry, on the other.

I will extend this criticism by raising the thesis that in social constructivism the facticity of the objectifying scientific practices—where scientific facts come into being and have a life of their own—falls prey to the imposed dichotomy between networks of constructive activities and constructed entities. Scientific facts obtained through social construction might be considered as constructed artifacts, if one were to divorce them from reality-as-facticity. And vice versa, such a divorce would be excluded, if one were not to place the construction of scientific factuality beyond reality-as-facticity. It is the distorted view of reality in social constructivism that more or less leads to equating scientific facts with artifacts. (Indeed, etymologically a fact is something done. But that *facere* which is inherent in *factum* is precisely the "genesis and development of facts" as part and parcel of reality. *Facere* is not external to reality-as-objectified-factuality.)

There is a special focus in Eger's criticism of social constructivism that is of particular importance to hermeneutic realism. He makes the case that in avoiding the issues of free play and hermeneutic circling, social constructivists describe certain interpretive features of inquiry by using their own vocabulary, thereby

[48] At this point I have to mention again the special case of methodical constructivism as represented by Erlangen-Konstanz school. Instead of scrutinizing particular processes of reaching consensus about scientific facts, the adherents of this school address the constitutive role of life-world's practices. Contra this form of constructivism I argued that the "methodical order" is always already fore-structured by facticity. But the methodical constructivists could object by stressing that the so-called proto-sciences they put forward are precisely dealing with the facticity of inquiry. I would not agree with this rejoinder. The proto-sciences are entirely concerned with normative factuality, and not with facticity. They develop normative theories of measurement that - in connection with the construction of scientific (measuring) instruments – take into account the determinative force of normativity embedded in the life-world's practices.

conveying an entirely non-hermeneutic meaning. Harry Collins's "experimenter's regress" as a regress that constantly increases the indeterminacy in the interpretation of experiments is a typical case in point. Generally speaking, the social-constructivist conceptuality is entitled to displace the facticity of inquiry, and to transform the interpretive phenomenality of facticity into events that can be studied as sociological factuality. Phrased differently, in repudiating the assumption of reality's static presence, constructivists do not become engaged with reality-as-facticity predicated on a potentiality-for-being. All schools of constructivism dispute the approach to scientific facts as antedating scientific inquiry, preexisting scientific objectification, and having a being beyond the "scientific construction of reality". Yet all constructivists admit that the factuality of scientific inquiry—however it is methodically, instrumentally, and socially constructed—is something that (by being accepted through negotiations) hides the story of its construction. (Latour and Woolgar's (1979) classical constructivist case study is typical in arguing for the view that facts once constructed in scientific inquiry become surrounded by rhetorical strategies that veil the ways in which the controversies about them have been settled. The authors extend this view by claiming that the veiling strategies are also effective in blurring the dividing line between facts and artifacts, which will be discussed below.)[49]

To sum up, in criticizing standard realism, constructivists make use of the same metaphysical concept of reality which their opponents invoke. Overcoming this concept requires elaborating on the crucial difference between (social and/or methodical) construction and (phenomenological) constitution.[50] The "social

[49] Latour and Woolgar (1979, 176) argue that the process of construction involves devices whereby the traces of production are made extremely difficult to detect. For them, using such devices belongs to the way of stabilizing scientific facts. As a result of the process of stabilization, an important new event begins to take shape: The statement about a stabilized fact becomes a "split entity" that contains, on the one hand, words referring to something out-there, and serves the function of a correspondent to an object in itself, on the other. The stabilization of scientific facts invokes the duality of objects and statements about objects within the laboratory life. Latour and Woolgar pay special attention to the inversion that takes place: "the object becomes the reason why the statement was formulated in the first place." Thus, stabilization (of constructed facts), hiding the story of construction, singling out "split entities", and inversing of the process of construction are moments of the discovery of scientific facts. But where are these moments and the whole process of construction—the question which the hermeneutic realist poses—to be located? Within the reality of laboratory life's social dynamics would be the answer of the authors of *Laboratory Life* (*The Construction of Scientific Facts*). Though there is nothing wrong with this answer, it triggers a serious aporia for those who ignore that social construction is always already within the constitution of meaning. Latour and Woolgar are highly inventive in studying the splitting of objects and statements about objects within the laboratory life. Yet they do this at the expense of admitting an initial split of reality into reality-as-processes-of-construction and reality-as-something-pre-constructed. There is in their study no answer to the question of how both realities are united or entangled. In contrast to their view, Fleck starts with the "united reality" of the ways in which thought collectives articulate scientific facts by being involved in their thought styles.

[50] In saying this, I am not trying to downplay or underestimate the long tradition of attempts at bridging forms of constructivism with phenomenological conceptions of constitution. Hugo Dingler, Hermann Weil in his earlier work, Oskar Becker, Paul Lorenzen, Carl Friedrich Gethmann,

construction of reality" is a complexity of factual processes, each of them describable by producing sociological factuality. Yet these processes always already take place in endogenous horizons of meaningful articulation whose facticity is (*pace* Peter Berger and Thomas Luckmann) non-transparent to the empirical sociology of knowledge. Indeed, the sociology of knowledge's approach to the social construction of reality does not neglect the primacy of the everyday life as the place of generating meaning within routine practices enacting and enacted by the "natural attitude". This is why the champions of this sociology try to integrate phenomenological analysis in their approach. Yet paradoxically enough, they place this analysis—strictly restricted to subjectivity and to the view of temporality as an intrinsic property of consciousness—in the production of sociological factuality, thereby making it a part of the machinery for sociological objectification (Berger and Luckmann 1966, 40–42). The phenomenological analysis should objectify subjective knowledge that is the primordial layer in the social construction of reality. (Thus, objectified subjective knowledge becomes a dimension of the sociological factuality.) The facticity of meaningful articulation in which the social construction is always already situated remains unnoticed by Berger and Luckmann. This is why the sociology of knowledge's approach is unable to specify the hermeneutic situations of the social construction of reality.

In contrast to the Scheler-Mannheim approach to the sociology of knowledge, the programs of SSK are chiefly inspired by Wittgenstein. Because of this inspiration, these programs tend to merge constructivism with instrumental (pragmatic) semantics, which makes their initiatives consonant with positions in analytical philosophy. Through integrating such semantics into constructivism, the question of how to handle meaning becomes an "internal question" of SSK. A distinctive feature of the implementation of Wittgenstein's work in cognitive sociology is the insistence on the separability of meanings attached to utterances, thoughts, and gestures taking place in particular settings under given circumstances from what practitioners recognize "as a matter of course" in rule following. (Notoriously, non-explanatory strategies of rule following in practices—strategies typically represented by programs like ethnomethodology oppose such a separability.) Meanings are contingent and contextual, whereas rule following avoids contingent interpretations, thereby being capable of explaining—when separated from meanings—what one is doing when one proceeds "as a matter of course". The separation is indispensable for having a kind of Wittgensteinian approach that can serve an explanatory function in treating the social production of knowledge. The kernel of this approach consists in finding "the rules guiding the rule followers". Rule following assumes normativity that by taking the form of consensus and convention might account for particular phenomena of social interaction and dynamics (Bloor 1992, 270). On the social-constructivist-Wittgensteinian approach, meanings are constructed discrete units. Furthermore, they are effects, not causes, and—as Bloor claims—do not possess intrinsic agency. Separating

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and several members of the Erlangen school belong to that prominent tradition. Examining the unended dialogue between forms of philosophical constructivism and hermeneutic phenomenology of science requires a separate study.

meanings as discrete units (causally) generated within contextures-of-equipment from habitual rule following effaces the basic difference between construction and constitution. Here again mainstream SSK and mainstream analytical philosophy of language seem to be bedfellows.

In comparing social constructivism with van Fraassen's constructive empiricism, André Kukla (2000, 61) argues that, for the supporters of the former, "constructive activities constitute the fact." This statement is symptomatic for most of the analytical philosophers of science who fail to distinguish between construction (of facts, artifacts, and knowledge) and constitution (of meaning). According to them—regardless of which stand they take in the realism debate—the constitution (equal to construction) of scientific facts runs across the metaphysically assumed division between out-there-ness and social production. Furthermore, construction (constitution) can always be represented as discrete processes. Because it equalizes a dimension of facticity with a sociological factuality, constructivism fails to avoid the postulation of a starting opposition between the natural and the constructed. (In this regard, constructivists face the same methodological problems which created severe troubles for many schools of thought in cultural anthropology: The starting point from the opposition between culture and nature is obligatory for having a comprehensive anthropological theory, but the very opposition is undoubtedly a cultural artifact.)[51] Ascribing a character of actants and actors to nonhumans does not help one to cope with the ambiguous status of natural-constructed opposition. Anticipating a further discussion, I would state that actor-network theory also suffers from a philosophical deficiency in treating subject-object contextuality.

There are in social constructivism two proposals for coping with the problems following from the initial postulation of the natural-constructed opposition. They suggest accordingly a second-order naturalism and a deconstruction of the natural within the unfoldment of the constructivist approach. If the "construction of reality" should not be reified itself through the constructivist study of science—so the second proposal goes—then this study has to be supplemented with an approach to the way in which the laboratory everydayness of scientific inquiry puts forward the "deconstruction of reality" by relativizing the border between facts and artifacts (Latour and Woolgar 1979, 179). In the perspective of this kind of deconstruction, the claim that all facts are artifacts at the end of the day means that the very "independence of reality" becomes revealed as socially constructed. (On an additional aspect of the sociological deconstruction, the constructivist has to tell the story of the de-historicizing of what has been constructed in the laboratory life. The investigation of the social construction of scientific facts has to be accomplished by means of this deconstruction. The main flaw of this approach is that it deconstructs—or better destructs—the horizonal continuity of facticity as interplaying practices and

[51] The radical-constructivist thesis that there are no natural facts but only cultural artifacts does not escape having to spell out the opposition. Otherwise, the thesis would be meaningless. The hermeneutic realist as a realist on facticity copes with this predicament by addressing natural kinds and constructed artifacts as two kinds of objectified factuality. The opposition between the natural and the artificial (the constructed) makes sense by being introduced with regard to the production of factuality within facticity. This opposition is not to be regarded as a primary one (i.e., as preexisting the facticity of meaningful articulation).

possibilities, reducing it to the factuality of discrete entities and processes. One should not mistakenly think that the ethnographic study of the "laboratory life" automatically implies a recourse and access to the "factical life" of inquiry. Even the ethnographic studies which are most strongly committed to interpretive methods remain objectifying studies that are lacking resources for coming to grips with facticity. Accordingly, they only deal with objectified factuality, even if this factuality stands for whole contextures-of-equipment. Studying the laboratory life ethnographically produces no more than factuality about the construction of facts.)[52]

As already discussed, the split between a newly discovered entity and the statement about this entity never precedes the resolution of the controversy about its existence. Reality is formed as a "consequence of stabilization". Stabilized reality is unavoidably constructed as a pure presence. But, to repeat my question: What about the reality in which the process of stabilization takes place? True, "out-there-ness" is the consequence (and not the cause) of the process of inquiry. In order to deconstruct "out-there-ness", constructivists are compelled to admit a dubious division between the process of construction and the state of having reality-out-there. Does deconstruction need this division? By no means, if one has in mind the kind of deconstruction inaugurated by Derrida's philosophy. This philosophy aims at deconstructing all alleged oppositions between purely natural and entirely constructed. In its perspective, the interplay of facts and artifacts—and the continuity (as contrasted with discrete factuality) that results from this interplay—belong to reality. This interplay is part of the play of differences. Deconstruction employed as a strategy for the derivability of "out-there-ness" from social construction requires recasting sociologically objectified factuality by having recourse to a *différance* that operates on the level of producing-factuality-within-facticity. In hermeneutic realism, deconstruction—as a constant re-contextualization of "texts" within the intercontexuality of meaningful articulation—is a constituent of reality-as-facticity.

Now, consider another line of argument in early SSK: The very process of construction—as a passage from the natural to the artificial—takes place within the whole of the natural universe. In other words, the process of (social) construction is a natural process. The kind of "moral neutrality" on which the Strong Program rests demands naturalism about studying social construction (Bloor 1976, 9–10). It is this conclusion that commits most of the constructivist programs to two—at first glance conflicting—doctrines that might be called a second-order naturalism and a reversed

[52] Latour and Woolgar use the term "anthropology" as denoting the importance of bracketing the familiarity with what is studied. Anthropological study must make strange those aspects of scientific activity which are readily taken for granted. Creating anthropological strangeness, however, unveils "exotic" factuality but does not break with the paradigm of objectification. Indeed, Latour and Woolgar try to go beyond this paradigm by integrating reflexivity in their study: The methods they implement for creating de-familiarization are dependent on the methods of the practitioners they study. Thus, the factuality about the scientific activity studied ceases to be pure presence and becomes contextualized in accordance with the way of exercising reflexivity. This is a necessary premise for approaching facticity. Yet it can be made effective if the integration of reflexivity in the anthropological study leads to double hermeneutics, which is not the case of the ethnographic studies of the construction of scientific facts.

naturalism. They respectively state that all artifacts are to be viewed in the final reckoning as compounds of natural entities,[53] and that—from a methodological point of view—the social has to replace the natural and to occupy the place of *explanans* in the social-constructivist explanations. Reversed naturalism is restricted to the methodological code of cognitive sociology, and entirely refers to the logic of explanation, while second-order naturalism is an ideological (*weltanschaulich*) doctrine that should revoke the accusations of sociological essentialism (and ontological primacy of the social) one can make against the explanatory strategy of social constructivism.

To a great extent, the constructivist annihilation of facticity follows from the adoption of these naturalist doctrines as necessary for having an explanatorily comprehensible and empirically tenable form of social constructivism: If the reality of the natural is explanatorily derivable from the reality of the social, and the transformation of the natural facts into social artifacts is a second-order natural process, then there is no room for facticity that transcends the naturalized sociological factuality and the second-order factuality that refers to the global natural status of the social. A possible rejoinder to this claim would be the statement that the position of second-order naturalism is no more than a decorative ornament adopted by some schools of constructivism for conventional reasons. Yet this is not true. In basing the reality of scientific entities on processes of construction—in particular, social processes of negotiation—one already commits oneself to a position of objectivist naturalism: In order to be used for constructivist purposes, these processes are to be naturalized (objectified as factual processes). Processes of construction involved in the constructivist scenarios are only to be caught by objectifying their factual manifestations. Consequently, a coherent version of constructivism has to address the specificity of the natural scientific factuality in terms of another kind of (naturalized) factuality, which is the kernel of objectivist naturalism. Both kinds of factuality appearing in this statement are on a par with the empirical as understood from the viewpoint of empiricism, and are irrelevant to the empirical as the processual unity of facticity and factuality.

At this point, I briefly have to tackle a further disclaimer. The preceding discussion may give the impression that in criticizing the way in which the subject-object relation is introduced—through an epistemological justification that normatively fixes this relation—in the realism debate, the hermeneutic realist adopts a conception that is (if not the same, at least) similar to the conception of the Natural Ontological Attitude. Yet this is a wrong impression, because Arthur Fine's NOA is quite effective in discarding the externalist epistemologies of realism and antirealism,

[53] Second-order naturalism does not legitimate, however, explanatory scenarios in which natural processes explain social phenomena. This doctrine rather admits that the social *en bloc* is explainable in terms of a global naturalistic theory of human life like, for instance, the theory of gene-culture coevolution. Thus, there is from the constructivist viewpoint an asymmetry between both doctrines: While reverse naturalism legitimates the sociological explanations of the scientific construction of nature without admitting ontological primacy of the social over the natural, the second-order naturalism legitimates the ontological primacy of the natural over the social, at the same time prohibiting naturalist explanations of contextualized social activities.

but like all parties in the realism debate it completely ignores the facticity of inquiry, and starts with the hypostatization of a "minimalist" (de-contextualized) subject-object relation. But before developing this criticism, a few words about what will be criticized are in order. Fine argues that NOA is the common core of all epistemic attitudes involved in the controversy about the acceptance of the best theories and the best ways of saving phenomena. These (secondary) epistemic attitudes are characterized by epistemological and metaphysical "additives" which are alien to the stance taken by the participants in scientific inquiry. By contrast, NOA is scientists' interpretive stance without "additives". Following this line, one might state that NOA is that "natural" stance to the reality under investigation which the inquirers take when they become involved in the facticity of scientific inquiry. In an extended formulation (that Fine definitely would not accept), NOA commits the inquirers to the reality of a domain as it is disclosed in a characteristic hermeneutic situation.

Notoriously, earlier interpretations of the concept of NOA focused on its compatibility with scientific realism (Musgrave 1989). Yet Fine himself not only opposes such interpretations, but raises the claim that a "hermeneutic understanding has to be gained *from the inside*. It should not be prefabricated to meet external, philosophical specifications. There is, then, no legitimate hermeneutical account of science, but only a hermeneutical activity that is a lively part of science itself" (Fine 1996, 148). Despite the fact that the adjective "hermeneutic" is mentioned three times (and attributed to three different substantives) in this statement, Fine's concept and conception of the natural ontological attitude is by no means a version of philosophy of science guided by the primacy of interpretation in the process of inquiry.[54] However, he most definitely advocates—in the context of analytical philosophy—the same tenets of interpretive internalism which were discussed earlier. For this reason, the conception of NOA and hermeneutic realism share important views and (most of all) the quest for a radical anti-essentialism (Ginev 2012).

NOA is first and foremost an anti-essentialist approach to the philosophy of science that alludes to the model of immanent literary criticism. Fine (1984) draws attention to another parallel: In the same way in which minimalist art is an immanent criticism of art, the conception of NOA (worked out as a series of critical case studies) is an operative criticism (of tendencies and choices) within scientific inquiry. The minimalist philosophical encroachment upon science's own leeway should be instrumental in settling long-standing methodological debates—an option typically illustrated by Fine's excellent studies in the history of quantum mechanics. In his provocative dictum, the work on NOA is a non-realist immanent criticism of science for post-realist times (Fine 1996, 254). Fine's core conviction is that to possess the natural ontological attitude toward the natural world amounts to interpreting

[54] Though Fine has never touched upon the work of any author from the tradition of the hermeneutic studies of science, he is quite clear about why he is not willing to subscribe to that tradition: It is too elaborated philosophically and threatens to burden the intrinsic analysis of scientific inquiry with undesired "additives". By the same token—this time, however, explicitly—he rejects any proximity and commensurability of NOA with the phenomenological characterization of *die natürliche Einstellung*.

reality-out-there in a "natural manner", i.e., in a manner that is presumably "homely true" for all agents who are preoccupied with saving phenomena. NOA is imported in scientific research from the originary instrumental-practical experience with the world. (Again, one has to suspend any allusion with Husserl.) Fine tacitly admits the cultural universality and the trans-historical character of NOA as a core stance towards the natural world that involves minimal epistemic assumptions and no scenario for justifying assumptions.

The kind of minimalism Fine pleads for implies the redundancy of (external, normative) epistemological justification: Scientists lend universal credence to primary (homely) truths. They do not call into question these truths when—in admitting more sophisticated ontic models of what they study—they unveil "non-familiar truths". The production of knowledge in scientific research always presupposes the homely truths. The conception of NOA is to a certain extent a radicalization of that undoing of representationalism which Rorty undertook with his epistemological behaviorism. NOA refers not to minimal assumptions for having a passive contemplation of the natural world, but to the practical-instrumental assumptions necessary for intervening in the world and saving phenomena by means of scientific inquiry. The natural ontological attitude is an active stance that is not to be isolated from the practices of inquiry. However, it remains unclear what the predicate "natural" exactly connotes in Fine's celebrated expression. Doubtless, it is completely understandable and acceptable in a commonsensical context. Yet the conception of NOA argues that this attitude is congruent with the natural world, and it is resilient enough to allow one the construction of sophisticated theoretical models. These are philosophical claims that can hardly be advocated in a commonsensical context. Moreover, there is an essential ambiguity in Fine's conception: NOA is, on the one hand, a universally valid core position. But as a practical-interpretive attitude it is, on the other hand, always contextualized in practices. To be sure, there is no logical contradiction between these two assertions. But their relationship should be unfolded philosophically.

It is this demand that marks the starting point of my criticism. In a nutshell, Fine's conception does not license an investigation of how the contextualization of NOA and the contextuality of the epistemic relation are intertwined. Moreover, this conception rests on the assumption that a certain—however epistemically elementary it might be—attitude takes precedence over all scientific practices, and invariably persists in all configurations of such practices.

To be fair, several elaborations I put forward do indeed leave the impression that hermeneutic realism is grounded upon an interpretive attitude within-the-world that—being close to Heidegger's "circumspective deliberation"—has a pre-epistemological (or an epistemologically not specified) character. On a slightly better formulation, to the facticity of scientific inquiry there belongs an interpretive attitude held by those who are involved in the interplay of practices and possibilities for doing research. I agree that this attitude resembles the profile of (what Fine calls) natural ontological attitude. Yet it is by no means an epistemic attitude that preexists the configurations of scientific practices. The interpretive attitude I have in mind consists in deliberating circumspectively about the articulation of meaning in

scientific practices. If there were no scientific practices, this attitude would not exist either. It is an interpretive attitude that belongs to the whole of having-meaning-in-scientific-practices, and to the way in which scientists form "beliefs about the reality-out-there". In this regard, the interpretive attitude I am speaking about is neither a pre-epistemic nor a non-epistemic state of scientists' mindset and intellectual activity. It is rather a characteristic of the very process of meaningful articulation.

To defend this view requires a critical revision of Fine's conception that I am going to adumbrate.

In the main point of this revision, the natural ontological attitude is not a minimal epistemic stance toward the (natural) world—this is still a rudimentary essentialism—but a practical interpretation of what becomes disclosed within configured practices. NOA is the interpretive attitude which comes into being when practitioners (researchers in a domain) reflexively appropriate (and become aware of) the characteristic hermeneutic situation of their mode of being. This attitude accompanies the research work in all contexts of inquiry (thereby operating in all readable technologies and spaces of representation) in a domain's articulation, and is incorporated in all "texts" constituted by the process of inquiry-as-textualizing. In borrowing a distinction introduced in ethnomethodology, one may state that the natural interpretive attitude mediates between reflexivity of practices (as interplaying with possibilities) and practitioners' endogenous reflexivity. In playing this mediatory role, it exists ecstatically—within practitioners' "thought style" (Fleck) and outside practitioners' mental life (within the contextualized practices of inquiry). Without such a practical-interpretive attitude that warrants the "naturalness" of the disclosed domain, there would be no unity of reading, representing, and textualizing as was depicted in the previous chapter.

Accordingly, something is natural when the hermeneutic situation allows one to read and constitute it as natural within the ongoing articulation of meaning. The naturalness does not preexist the natural scientific inquiry. And vice versa, there is no naturalness and natural attitude of inquiry if the inquirers' stance toward what is disclosed in their practices becomes detached from the characteristic hermeneutic situation of the process of inquiry. Detaching the former from the latter would inevitably lead to a cognitivist reductionism. Fine's conception still suffers from such a reductionism. Minimizing and eventually undoing the "epistemological additives" is not a remedy against it, since this minimization does not open avenues for studying the constitution of the very epistemic relation.

In my revisionary reading of NOA, due to the mediation between practices' reflexivity and practitioners' reflexivity, the interpretive-practical attitude is informed by the fore-having, fore-seeing, and fore-grasping (as specified by the characteristic hermeneutic situation) of a domain's meaningful articulation and objectification. Thus, not "homely truths" (Fine) but instead a reflexively formed attitude toward the appropriation of possibilities for doing research is the core of NOA. Being informed by the ontological presuppositions (of fore-having, fore-seeing, and fore-grasping), the interpretive-practical attitude is the source of pre-normative reasonability and *phronēsis* in the research process. Though it has factual

manifestations—the manifest expectations, anticipations, and orientations exhibited by the research work in a domain—the interpretive-practical attitude basically belongs to the facticity of inquiry. By the same token, this attitude is more an ontological state—a state of hermeneutic fore-structuring—than a cognitive or epistemic position. Indeed, once the characteristic hermeneutic situation has reflexively been appropriated, the interpretive-practical attitudes gains a cognitive status as well. Yet the crux in this observation is the accent on reflexivity. Since the latter is attributed not only to the accountability of inquirers as they spell it out in their routine work, but also to the practices of inquiry, reflexivity has to be treated as an existential phenomenon (though such a conclusion runs against the existential analytic).[55]

It is time now to return to the motif with which I started this section. The realism debate within the analytical tradition is burdened by issues that might be subsumed under the rubric of the "success of science". Notoriously, the initial impetus for the recent discussions of these issues came from Putnam's (1975, 73) celebrated dictum that realism is the only philosophy of science that "does not make the success of science a miracle." Since the success of science is success in making predictions, Alan Musgrave, Stathis Psillos, and other scientific realists extend this formulation by putting an additional emphasis on scientific theories' novel predictions: It is the truthlikeness of science's theoretical constituents that can explain the success of science in terms of the methodologically warranted generation of predictions. In so doing, they bring the no-miracles argument into play—an argument that structurally approximates a type of inference to the best explanation: Realism about science and the theoretically postulated objects of science is the best explanation of the success of science. Supposedly, the no-miracles argument is reliable in defending the achievability of truth of the nowadays accepted—on the grounds of methodological criteria—scientific theories. The abductive reasoning implied by this argument should legitimize (the "epistemic optimism") that realist assertions "offer not the only but the best explanation of the success of science" (Psillos 2000, 715).

I will conclude this chapter with a provisional answer to the following question: Does hermeneutic realism as discussed so far provide an alternative position concerning the main issues in the realism debate? As a tentative answer, hermeneutic realism also provides an account of why the success of science (in meaningfully articulating and objectifying reality) is not a miracle. It is not my aim to address the intrinsic difficulties scientific realists face when making their account(s) of the success of science the basic argument for defending their position. The tentative answer I mentioned does not mean that hermeneutic realism has resources to reformulate the questions which scientific realists ask when looking for defending arguments. Both the view of reality and the view of scientific inquiry the hermeneutic realists advance are at odds with what scientific realists advocate in this regard. Co-translatability of questions raised from these positions is impossible. Nonetheless,

[55] An analysis of Heidegger's concept of "circumspective deliberation" might justify the view that the pre-epistemic deliberative concern within-the-world is the starting point of reflexivity (Ginev 2015a, 153–158). Such an analysis would resonate motifs of Helmuth Plessner's conception of "ex-centric positionality".

I will argue that the main issue involved in scientific realism's strategy based on the no-miracles argument has a counterpart in hermeneutic realism.

In contrast to scientific realism, the hermeneutic realist does not admit that the growing success of science takes the form of a teleological process: a progressive approximation to a presupposed absolute truth. Yet the hermeneutic realist holds that this growing success indicates a progressive movement that has to be measured by means of increasing truthlikeness. Yet the concept of truth presupposed in this statement should not be confused with an epistemological concept defined within the framework of a correspondent, coherentist, or consensualist theory of truth. When speaking of the growing success of science, the hermeneutic realist presupposes the concept of truth as aletheia. This concept refers first and foremost to the disclosure of a domain within the interplay of scientific practices and possibilities for doing research. Yet the disclosure of a domain itself is still not aletheia. It is rather a prerequisite for having a truthlikeness within the facticity of scientific inquiry. Since the disclosure always takes place in a characteristic hermeneutic situation, truthlikeness of inquiry is unavoidably defined with regard to a tendency to appropriating possibilities that corresponds to a tendency to meaningful articulation (and objectification) of the disclosed domain. Hermeneutic truth (aletheia) is what becomes at once revealed and concealed within the hermeneutic situation of a mode of being. As a revealing of the meaningful being of a scientific domain, the hermeneutic truth manifests itself through the procedurally objectified factuality produced in the interplay of practices and possibilities. The way in which the objectified factuality is—so an alternative definition goes—interpretatively fore-structured by projected (but still not appropriated) possibilities is the hermeneutic truth. Thus defined, the hermeneutic truth of science is always contextually established—the revealing and concealing of a domain's being within a context of inquiry—but is never enclosed in a certain context.

In contrast to the epistemological notions of truth, aletheia does not refer to a discrete relation (like the semantic relation of signification, or the relation of conformity of a judgment to the "external reality", or the relation of coherence of a proposition with a specified set of propositions) but to the continuity of contextualized production of objectified factuality. By implication, the hermeneutic truth does not refer to bearers (of truth-values) that are characterized by their discrete presence. In referring to the continuous revealing and concealing of a domain's being, the hermeneutic truth never escapes its potentiality-for-being-deepened. But what does it mean to deepen aletheia as a process of revealing/concealing within the facticity of inquiry?

Revealing and concealing the being of a disclosed domain in a characteristic hermeneutic situation is on a par with the meaningful articulation of reality. Elsewhere I argue that the tendentious appropriation of possibilities is informed by the pre-normative (constraining) force of the very situation (as this force should be attributed to the fore-having, fore-seeing, and fore-grasping of the articulated meaning) (Ginev 2013a, b, 67–104). Due to its constraining pre-normativity, the hermeneutic situation conceals (pushes aside, forgets, sediments, etc.) possibilities for

doing research.[56] These possibilities are excluded from domain's articulation. Yet this does not imply that the characteristic hermeneutic situation plays a shrinking role with regard to the horizon set up by the interplay of practices and possibilities. The tendentious appropriation of possibilities constantly extends this horizon, thereby intensifying the meaningful articulation of the reality studied. Stated differently, the revealing of a domain's being in a characteristic hermeneutic situation strongly dominates the concealing of possible paths of the domain's articulation. It is this asymmetry between revealing and concealing—as induced and maintained by the characteristic hermeneutic situation—that I call a deepening of the hermeneutic truth. The process of inquiry specified by a hermeneutic situation is distinguished by this deepening. The latter takes place in the facticity of inquiry. Yet it has crucial consequences for a domain's objectification and the constitution of objectified factuality.

While the deepening of aletheia distinguishes the facticity of inquiry, the consequences I mentioned concern the truthlikeness of the procedural production of factuality. The richer is the hermeneutic fore-structure (the open horizon of possibilities) of objectification, the greater is the truthlikeness of the cognitive practices instrumental in the production of objectified factuality. It is the progressing interplay of practices and possibilities that enhances the potential of the facticity of inquiry to fore-structure the procedural objectification (or, the truthlikeness of this objectification), which is tantamount to enhancing the possibilities of revealing the meaningful being of a scientific domain. This is why the greater the meaningful articulation within the facticity of inquiry, the more objective becomes the process of inquiry, provided that the degree of objectivity is determined by the range of objectified factuality created via saving phenomena. Enriching the hermeneutic fore-structuring of objectification, diversifying the meaningful articulation in line with the interplaying practices and possibilities, and enhancing the range of objectified factuality (and

[56] To reiterate, the conception of pre-normativity is alternative to any doctrine that admits the existence of a primordial normativity. The concept of hermeneutic pre-normativity refers to the interpretive fore-structuring of normativity within facticity. There is no normativity—regardless of how stable and lasting in history it might be—that escapes from being contextualized, situated in a horizon, and interpretively constituted. Like all other innerwordly meaningful entities articulated by modes of being, what counts as norms, taboos, sanctions, standards, criteria, instructions, assignations, prescriptions, patterns, orders, and rules—to mention only a few normative matters—becomes generated by the interplay of practices and possibilities. Any attempt at treating hermeneutic pre-normativity as a variety of collective intentionality is doomed to failure. The constraining power elicited by the characteristic hermeneutic situation enables collective moods, shared patterns of envisioning, communal value orientations, and collective evaluative attitudes, i.e., the traits of inter-subjective mentality to which collective intentions belong. Hermeneutic pre-normativity is not a product of coordinately working and mutually reinforcing individual minds, but a prerequisite for having inter-subjective mentality and collective intentions. Yet hermeneutic pre-normativity is not by itself a phenomenon or a feat of inter-subjectivity. Collective intentionality is ruled by inter-subjective normativity. But the latter is unavoidably fore-structured by the world's trans-subjectivity, i.e., by the pre-normativity of the hermeneutic situation of being-in-the-world. The relationship between inter-subjective normativity and trans-subjective pre-normativity is a central topic of hermeneutically oriented social theory, which I discuss elsewhere (Ginev 2014b).

the objectivity of inquiry) are indicators for deepening the hermeneutic truth. In hermeneutic realism, deepening aletheia of a domain disclosed in a characteristic hermeneutic situation is the criterion for progress in science.

There is another issue that occupies a prominent place in the realism debate: the status of the theoretical objects. This issue is also a pivotal one for hermeneutic realism, and I will address it in the next chapter.

3.5 A Heideggerian Epilogue and the Roots of Double Hermeneutics in the Hermeneutics of Facticity

In the perspective of hermeneutic phenomenology, facticity is the horizonal totality of *Dasein*'*s* phenomenality within-the-world. A central issue in this perspective is the role which the transcendence of the world plays in the constitution of meaning. The analytic of facticity invokes (what Heidegger calls) existentiality. Existentiality is *Dasein*'*s* thrownness in the world as a state in which *Dasein* understands itself with regard to the possibilities it can appropriate. Accordingly, *Dasein* projects its being upon these possibilities. Due to this projection, existentiality can be revealed within the ontological treatment of *Dasein* as a "thrown projection". From a reverse angle, reflecting on existentiality reveals the ontological conditions of facticity, i.e., of constituting meaning and having meaningful facts/entities in *Dasein*'*s* existence within-the-world. Existentiality stipulates the conditions of having *Dasein*'*s* modes of being-in-the-world as facticity whereby existentiality expresses itself. In other words, facticity is the existentiality as the manifold of the modes of being-in-the-world manifested empirically. This is why Heidegger (1962, 225) reaches the conclusion that "facticity belongs essentially to existentiality". *Dasein* is a circular-hermeneutic unity of subjectivity and trans-subjectivity in which existentiality manifests itself as facticity, thereby becoming amenable to ontological exposition.

Facticity is specified by the hermeneutic situations of the constitution of meaning. Changing for a while the Heideggerian perspective with that of hermeneutic realism, it should be noted that in any of these situations endogenous reflexivity (of practices and practitioners) defines the tendency to interpretative articulation of what is ready-to-hand. This tendency is to be approached by examining the triad of fore-having, fore-sight, and fore-conception operating in the articulation. Let me reiterate that practices' reflexivity—as informed by the "logic of practices"—goes hand in hand with actors' referential reflexivity. The conjunction and cooperation of the two forms of endogenous reflexivity was tackled several times in this study. Now attention should be paid to the way in which the two forms specify the hermeneutic situation of projecting, appropriating, and actualizing possibilities. As already indicated, the formation of configurations of practices whereby the facticity of being-in-the-world becomes contextualized depends on the contextual compatibility of practices. It is this compatibility that is trans-subjective in the first place. The

way in which practices form configurations has little to do with individual and collective intentionality. (Yet this does not mean that the actors are passively situated in contexts of configured practices. From the viewpoint of a cultural theory based on the hermeneutics of facticity—a theory I cannot discuss in this study—the actors reflexively individualize their collective life form by being situated in shared practices.)

In rejecting the role of intentionality in configuring practices, the hermeneutic realist raises a claim that can be addressed in terms of both a cultural theory and a hermeneutic philosophy of science: In undergoing continuous reshaping manifested through changing configurations, the interrelatedness of practices in a certain domain informs a tendency to choosing and appropriating possibilities of a certain kind, thereby concealing or pushing aside other kinds of possibilities. As already indicated, this tendency "announces" the emergence of a hermeneutic situation: the anticipatory orientation in the articulation of meaning. But the hermeneutic situation takes place only when actors' reflexivity makes the corresponding fore-having, fore-seeing, and fore-grasping of articulated meaning more or less explicit. Interpretive presuppositions of constituting meaning are "always already" there when actors are situated in changing configurations of practices. Yet the meaningful articulation of reality becomes distinguished by a hermeneutic situation when the reflexivity of actors (embodied in judgments) brings interpretive presuppositions (as "active prejudices") to bear on the anticipatory orientation. At the same time, the actors might change the hermeneutic situation of meaningful articulation by having recourse to the "logic of practices". (I am not saying that this logic informs—much less determines—the hermeneutic situation. My point is that the latter results from the "cooperation" of the reflexive logic of practices and the reflexive comportment of actors—a cooperation in which the logic of practices has a preponderance.) But before discussing this claim, let me return to the Heideggerian concept of facticity.

What is important to the agenda of *Being and Time* is the "factum" that facticity is the fallen mode of being in its thrownness. In hermeneutic realism, facticity is the empirical reality of existence which, however, is not reachable through objectifying-empirical procedures, and not expressible in terms of presence-at-hand and readiness-to-hand. "The empirical reality of existence" is the potentiality for being as revealed in the interplay of interrelated practices and the possibilities upon which the interrelatedness is projected. The interpretive approach to facticity allows one to address the meaningful articulation of reality by analyzing the fore-having, the fore-seeing, and the fore-grasping of the constitution of meaning wherever a regime of re-production of routinely interrelated practices—as supporting a cultural life form—becomes established.

According to Heidegger's elaborations in the celebrated lecture course from 1923 (summer semester), facticity is the subject matter of ontology based on the "phenomenological mode of research"—a mode that in this text decisively diverges from Husserl's program. Heidegger argues for the indispensability of a non- (or a meta-) regional ontology that is the proper phenomenological ontology gained through a "hermeneutics of human being" (Heidegger 1999, 83). From the viewpoint of developing this ontology, the "field of being" is the totality of meaningful

constitution which is amenable to an analytic that provides the opportunity to disclosing the "decisive meaning of being" (Heidegger 1999, 2). Facticity is the designation for the empirical manifestations of what phenomenological ontology discloses in a non-empirical manner. These manifestations (phenomena) cannot be objectified and treated as objective factuality. The openness of the constitution of meaning in "factical life" implies that "the scope of factical understanding and interpretation" cannot be worked out in advance. The conceptual explications which grow out of the phenomenological interpretation of facticity's intrinsic interpretation are what Heidegger since 1923 began to call "existentiales". What becomes interpretively captured is "the anticipatory leap forward" which never posits an end, but reckons with "being-on-the-way, giving it free play, disclosing it, holding fast to being-possible" (Heidegger 1999, 13). The interpreter becomes "transported into a fundamental experience" at the moment of capturing this being-on-the-way. In deviating a bit from Heidegger's story, one can assume that the anticipatory leap forward generates regimes of temporalizing the articulation of meaningful entities and spatializing local environments.

Facticity in its ongoing self-constitution temporalizes and spatializes the modes of existence. Temporalizing and spatializing are dimensions of ongoing interpretive articulation of horizons of temporality and spatiality that, like the world-horizon, are transcending what becomes contextually articulated. (To re-state it, but not in a strictly Heideggerian manner, facticity becomes manifested in the ways of temporalizing and spatializing of each and every cultural life form as distinguished by proper ethos and habitus.) According to the hermeneutics of facticity, the constitution of meaning and the meaningful articulation of the world do not take place in space and time. Assuming that "space" and "time" are (somehow) pre-given to them would be a non sequitur. Such an assumption would necessarily lead to the conclusion that "space" and "time" have a factual reality that is "more primordial" than the facticity which fore-structures the production of factuality. All formally constructable and/or physically identifiable kinds of space and time have their meaningful genesis within facticity. By implication, facticity is characterized by producing space and time, or alternatively, facticity articulates meaning by constantly creating chronotopes of interplaying practices and possibilities. The production of space and time is not determined causally, functionally, or structurally. It is predicated on the same hermeneutic circularity which enables the constitution of meaning within facticity and which sustains facticity's self-sufficiency.

Heidegger tries in his hermeneutics of facticity to reveal the basic phenomena of existence first and foremost as temporalizing and temporalized events. (In the subsequent development of hermeneutic phenomenology the problematic of spatializing of spatiality will gradually gain in importance, although only after the *Kehre* will it truly occupy a central place in Heidegger's work.) The phenomena become explicated with regard to what happens in the "phenomenal sphere of facticity". The explication is guided by the observation that the events in that sphere are constantly anticipated and prepared within the interpretive horizon of facticity. These events are not to be confused with the mere occurrences taking place within (what in the lecture from 1923 is called) "the today's public realm". Hermeneutics of facticity is

always in a position of analyzing the interpretive anticipation of events that can be explicated as basic phenomena of existence. In *Being and Time* Heidegger generalizes the claim about facticity as existential phenomenality that cannot be caught through a regional ontology by stipulating that the "factuality (*Tatsächlichkeit*) of the factum *Dasein* is facticity" (Heidegger 1962, 82). In extending this formulation, one may state that facticity is the empirical manifestation of the constantly operating ontological difference. Facticity is the totality of phenomena of *Dasein* as transcending all innerwordly entities.

The existential phenomena have manifestations in existentiell/ontic facts, but the totality of these facts—as captured by the existential analytic—is the empirical envisioning of facticity that has no longer an ontic character. "The factuality of the factum *Dasein*" is to a certain extent a paradoxical factuality. The existential phenomena are visible and observable. In this sense, they have factual manifestations that can be treated as factuality. Yet when these manifestations are thematized as expressing *Dasein's* being, they no longer have the character of factuality. The factual manifestations of existential phenomena are not to be treated as having been "once and for all" temporalized and spatialized, i.e., as manifestations with fixed temporal-spatial characteristics. Like the constitution of meaning, the existential phenomena—though factually manifested—are not procedurally identifiable as a temporal and spatial presence. Their factual manifestations allude to regimes of temporalizing and spatializing, the proper treatment of which is a task of the hermeneutics of facticity.

Indeed, the factual manifestations of existential phenomena are per se amenable to—if not objectification, at least—procedural conceptualization, but at the expense of ceasing to manifest "the factuality of the factum *Dasein*". Accordingly, in its state of not being conceptualized in this way—i.e., in the state of being fore-structured and anticipated, and not procedurally fixed—this factuality resists a predication in terms of objectified spatial and temporal traits. (In view of Heidegger's construal of the concept of phenomenon, one may call it "phenomenological factuality". By the same token, it is factuality that is not fixed by the apophantic-as, but shows itself through the operative mode of the hermeneutic-as.) The factuality manifesting existential phenomena—as showing themselves and not needing explanatory efforts to be conceptually saved—is rather the empirical expressivity of the ways of temporalizing and spatializing within-the-world.[57] Since facticity's empirical mani-

[57] Heidegger elaborates on the difference between experimentally constructed physical phenomena that only gain ontic identity when becoming theoretically saved and self-sufficient existential phenomena. Scrutinizing the former leads to constructive epistemology, whereas the conceptualization of the latter provides the access to ontology. Yet his elaborations in the lecture on the hermeneutics of facticity are not quite consequent, and at one point he blurs the difference between the two types of phenomena by assuming that under certain conditions physical phenomena also show themselves in the research process (Heidegger 1999, 54). If this were the case, then hermeneutic ontology would be directly applicable to the experience of scientific inquiry. Because of the blurring of the contrast between physical and existential phenomena, the early version of the hermeneutics of facticity is not sufficiently effective in differentiating between factuality and facticity. (Interestingly enough, however, blurring this contrast is in harmony with Heidegger's con-

festations cannot be objectified (i.e., determined through epistemic-procedural means) without destructing facticity and closing the access it provides to being, the only way to thematize them as ontologically relevant is via a methodology that does not specify a relation of determination between them and what they reveal. In other words, the only way to conceptualize these manifestations—and thus, to question existence ontologically—is via analyzing how facticity is interpretively fore-structuring the empirical-as-factuality. This formulation alone implies (non-essentialist) ontological difference between facticity and factuality. The (ontological) fore-structuring does not operate behind or beyond facticity, but is the most essential dimension of it. If the interpretive fore-structuring within facticity were detachable from facticity's manifestations, then the former would have to be regarded as an independent and determining essence. Studying the way in which facticity fore-structures amounts to developing an ontological scenario of how the facticity of a particular mode of being manages to temporalize and spatialize what becomes factuality within the horizon of this mode.

At issue in dealing with the factuality of the factum *Dasein* are the "facts" of what is constantly in a state of situated transcendence. One may receive a wrong impression that, in defining facticity via a kind of factuality, Heidegger admits the possibility for accessibility of the "phenomenological factuality" by means of empirical research. His dichotomous interpretation of the ontological difference, however, prohibits this possibility. Indeed, Heidegger assumes that the totality of factual manifestations of the factum *Dasein* might be approached not only in an ontological but also in an ontic manner. Immediately after *Being and Time* he holds that the latter case is typified by the programs of philosophical anthropology as initiated by Max Scheler and Helmuth Plessner in the 1920s. However, this is a special ontic manner of approaching *Dasein's* facticity that cannot be turned into a purely empirical research, though philosophical anthropology uses the results of—and has an impact on—a wide range of (ethological, social-theoretical, linguistic, cultural-historical, and other) empirical studies alongside hermeneutic and phenomenological doctrines. (Philosophical anthropology seems to confirm Heidegger's conviction that—though all empirical studies are ontic enterprise—not every ontic approach amount to empirical research.) The ontological approach to the total existential phenomenality (existentiality) is also empirically irrelevant since it turns *Dasein's* factual manifestations into facticity that is non-transparent to any kind of empirical research.

In invoking the central motif of Heidegger's inaugural lecture (1929) at the University of Freiburg, one might state that within the thematic-positive scope of empirical research facticity has the status of nothingness or no-thing. (To be fair, Heidegger insists—especially when in *Being and Time* he discusses the ontic-ontological priority of the question of the meaning of being—on the relevance of the

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cept of formal indication as he develops it in the hermeneutics of facticity. It is my contention that this concept is a residual of Husserl's phenomenology in Heidegger's program from the early 1920s. For places in Heidegger's work from that period where formal indication plays an important role, see Vetter (2014, 234).)

phenomena revealed by the existential analytic to different kinds of empirical research. Yet this does not imply that the ontological phenomenality of *Dasein* is transformable into factuality of empirical studies. Only the reception of the existential analytic in the post-war period extended its motifs to scientific programs as well. It is the "scientification of the existential analytic"—as supplied with a weakening of the strong opposition between ontic factuality and ontological facticity—that brought into being research programs looking for kinds of "ontological factuality" [or "ontic facticity"]. Cases in point are existential psychiatry, and the non-representational ["Heideggerian"] programs of artificial intelligence which gained momentum in the mid-1980s when "the whole symbolic [orthodox] AI research program was degenerating" (Dreyfus 2007, 248).)[58]

Roughly, depriving facticity of its capacity to relate the constitution of meaning to the horizons of temporalizing and spatializing amounts to transforming facticity into a kind of factuality that (in principle) can be "naturalized" (translated into objectified factuality of scientific domains). In hermeneutic phenomenology, the existential analytic of the world's meaningful articulation prevents one from transforming (reducing, translating) the constitution of meaning into a factual process. The possibility of revealing being within the temporalizing of temporality—as existential analytic promises—makes hermeneutic ontology absolutely resistant to any attempt at naturalizing it in terms of ontic disciplines. With regard to the dichotomy of ontic and ontological, Heidegger's hermeneutic phenomenology permits two states—ontic factuality and ontological facticity—and prohibits the two other possible states—ontological factuality and ontic facticity. Notoriously, Heidegger has never been impressed by the neo-Kantian and post-Diltheyan debates on the philosophically significant differences between the interpretive human studies and the objectifying natural sciences. This is why the specificity of the interpretative factuality constituted in studying the cultural life forms and the empirical objectivations of man's spiritual-historical life (Dilthey's *Objektivation des Lebens und Lebensäusserungen*) was for him not a sufficient reason for revising his picture of permitted and prohibited states.[59]

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[58] Medard Boss tried to work out a comprehensive methodology of constituting ontological factuality in studying psychiatric phenomena as existential phenomena. According to him, the first-order factuality of the patient's constricted being-in-the-world—the deficient mode of personal existence—becomes schematized in her narratives of her stereotypical dreams. The existential interpretation of this kind of narrative translates the schematized (first-order) factuality into second-order factuality referring to certain existential phenomena. This interpretation should be rich enough to launch a therapeutic procedure. Obviously, what is translated ceases to be factuality and becomes facticity of a pathological way of being. Nonetheless, the psychiatric existential interpretation should offer procedures for objectifying what "could actually be observed in the patient" (Boss 1983, 172). In the case of "Heideggerian artificial intelligence", the goal is the constitution of the empirical basis of theorizing—the intellectual behavior of recognizing images, solving problems, etc., within the world-as-horizon—by taking into consideration the non-representational experience guided by the hermeneutic-as of the "concernful" articulation of meanings.

[59] There is an interesting exception. In *Being and Time*, there is a discussion—in fact, the most extended discussion of a human science in Heidegger's opus magnum—of the profile of an "authentic historical science" that is on a par with the concept of authentic historicity. For a discus-

Despite Heidegger's lack of substantial interest in scrutinizing the interpretive factuality constituted in the human sciences, hermeneutic phenomenology is quite definitive in arguing that the difference between facticity and factuality does not coincide with the difference between what is ready-to-hand and what is present-at-hand. The empirical manifestations of what is ready-to-hand might always be objectified thematically as a mere factuality. Heidegger explores this possibility in *Being and Time*, and reaches the conclusion that "even that which is ready-to-hand can be made a theme for scientific investigation and determination, for instance when one studies someone's environment—his milieu—in the context of historiological biography" (Heidegger 1962, 413). More often than not, whole contextures-of-equipment (*Zeugzusammenhänge*) as involved in the practices of a life form's re-production become thematically delineated (and not necessarily in an objectivist manner) and factualized in disciplines such as economics, social psychology, cultural anthropology, micro-history, social geography, social ecology, urban studies, cultural history, and so on, thereby acquiring a status of objects of inquiry without losing their character of equipment and readiness-to-hand. Heidegger's envisioning of the possibility for "naturalizing contextures-of-equipment" hints at what many decades later will become a doctrine of second-order naturalism, i.e., explanatory naturalism concerning the contextualized processes of social construction. But again, this kind of constructive naturalism—typically represented by the Strong Program—has nothing to do with the agenda of making the empirical manifestations of existential phenomena intelligible.

Existence is facticity's "ownmost possibility of being". This is a claim that Heidegger formulates in 1923, and fully develops in *Being and Time* with regard to the triadic differentiation of facticity, existence, and falling.[60] The fact that in the 1923 lecture course Heidegger insists on the need of recasting phenomenology as "hermeneutics of facticity" poses the question of what kind of hermeneutics (as theory of interpretation) he has in mind. The course's initial part offers some historical remarks that adumbrate a kind of excursus. Interestingly enough, the intended excursus in the history of hermeneutics is outlined as a prelude of the later destruction of the metaphysical tradition. In this excursus Heidegger aims at repeating the true question of interpretation by destructing the tradition in which hermeneutics

sion on the possibility to analyze this doctrine of Heidegger as allowing deviations from the forms of factuality permitted by the dichotomy between ontic and ontological, see Ginev (2015b).

[60] In the Natorp Report one is to read the following statement: "Facticity and existence are not one and the same. The factical being-character of life is not determined by existence. Existence is only a possibility that temporalizes itself within the being of factical life" (Heidegger 2005, 362). This statement merits special attention since it shows the close relation of hermeneutics of facticity to the concept of life. In the period 1919–1925 Heidegger elaborates on this concept by coping with and incrementally transforming Dilthey's philosophy of life. His transformative reading of Dilthey culminates in the Kassel talks delivered in 1925 where the concept of *Dasein* becomes sufficiently worked out to replace the concept of life (Heidegger 2002, 147–176). Parallel to this replacement, there is a critique of the principle of the ontological in-difference of life that prepares the way in which Heidegger in *Being and Time* will evaluate Count Yorck von Wartenburg's conception of the generic difference between the ontic and the historical. (Regarding the hermeneutic roots of Yorck's generic difference, see Kühne-Bertram (2015, 285–334).)

has been downgraded to a methodical enterprise. Repeating this question leads him to the conclusion that hermeneutics is to be understood ontologically as "the self-interpretation of facticity". Put alternatively, destructing the tradition of methodical (mis)understanding of hermeneutics opens the door for ontologizing interpretation as facticity's interpretative reflexivity. Ontological hermeneutics deals with facticity as something "capable of interpretation and in need of interpretation and that to be in a state of having-been-interpreted belongs to its being" (Heidegger 1999, 11). This hermeneutics should explicate the meaning of that "factical life" which constitutes itself meaningfully by understanding and interpreting itself. It is a hermeneutics that arises intrinsically in facticity and is not artificially imposed on the constitution of meaning in facticity. Since interpreting belongs to facticity, the relationship between hermeneutics and facticity is an intrinsic relationship of interpretative reflexivity.

To make facticity intelligible requires employing (a methodology of) *double hermeneutics*. (Though not using this expression, Heidegger has this initiative in mind when insisting that the task of interpreting facticity's anticipatory-interpretative constitution of meaning is not to take cognizance of something, thereby having knowledge of it, but to speak out of interpretation and for the sake of it. He makes the case that hermeneutics as interpreting facticity's interpretation is the only way of conceptualizing facticity—or, constructing concepts of "factical life"—without succumbing to any kind of anthropological essentialism.) Double hermeneutics is not a device of approaching facticity by juxtaposing the interpreter's hermeneutic circle with that of the factical life's intrinsic interpretation. It is rather a position that aims at creating a unitary hermeneutic circularity in which the continuity of interpretation is not broken by the search for an extrinsic epistemic distance for the sake of "interpretative objectivity". Thanks to double hermeneutics, phenomenological ontology should remain a "mode of knowing which is in factical life itself" (Heidegger 1999, 14). Devising a unitary hermeneutic circle does not ignore the need of distance from what is interpreted. Yet this distance remains (a) immanent in the hermeneutic circle and (b) is controlled by the interpreter's reflexivity. Being integrated in the hermeneutic circle of facticity's interpretation, the epistemic distance becomes absorbed by the ontological difference between what facticity reveals and the factual manifestations of facticity.[61] To sum up, what I call "double hermeneutics" (in this context of discussion) is Heidegger's way of thematizing the interpretative being of facticity without committing the fallacy of objectifying facticity's empirical manifestations. This is why the interpretatively revealed characteristics of facticity are not later additions resulting from external conceptualizations, but rather express the facets of facticity's interpretative-reflexive role of fore-structuring. That

[61] Stressing the controlling role of the interpreter's reflexivity is not a motif exposed in Heidegger's lecture course from 1923. This is a motif neglected also in the subsequent development of hermeneutic phenomenology. Even more, it is a motif that is at odds with the dichotomous construal of the ontic-ontological difference. In hermeneutic realism, in controlling and regulating the distance from self-interpretive facticity, the interpreter also reflexively and contextually defines the difference between ontic and ontological. Thus, the ontological difference becomes a function of the reflexively guided double hermeneutics: a thesis that will be at stake in the rest of this chapter.

facticity is accessible to (double) hermeneutics only in its role of fore-structuring of factuality provides another argument for the impossibility of reaching facticity as a "thematic object".

Heidegger makes it clear that what the ontologically oriented interpreter may firmly capture in her hermeneutic analytic is always the fore-having of facticity's own interpretative fore-structuring. In engaging with this task, the interpreter discloses facticity in its being-possible, or in its potentiality for being. Capturing the fore-having of facticity's interpretative fore-structuring is the initial hermeneutic situation of developing phenomenological ontology based on the hermeneutics of facticity (Ginev 2013e). Heidegger's idea of hermeneutics is tied with his concept of hermeneutic situation as developed in the "Natorp Report".[62] At first glance, the way of introducing the concept alludes, as it were, to an epistemological context: The concept is elucidated with regard to the objectives of producing knowledge (*Erkenntnisansprüche*). Yet this epistemological accent is only for "didactic" reasons. It should help one in understanding the kind of interpretive knowledge one ought to expect from the hermeneutics of facticity. There is a clear ontological focus in Heidegger's explication of the concept: The hermeneutic situation is spelled out against the background of the ontological view that interpretation temporalizes and unfolds itself in making intelligible the self-interpretive constitution of what is interpreted. Seen ontologically, the hermeneutic situation is to be worked out through a "hermeneutics of the situation" in which the interpreter and what is interpreted share the same event of historizing (as this event becomes later, in *Being and Time*, related to "anticipatory resoluteness").

Heidegger is only interested in the hermeneutic situation of (conceptualizing) *Dasein's* facticity. At stake is the interpretation of the factical life's interpretive self-constitution. The possibilities of interpretively appropriating this self-constitution merge with the possibilities upon which what is interpreted projects itself. This is why Heidegger argues that a feature of the hermeneutic situation is the anticipatory repeating of possibilities already appropriated. Interpretation comes back to itself and hands itself down. The hermeneutic situation engenders historicity understood as a resolute repetitive appropriation of possibilities. The hermeneutic situation invokes the necessity of a double hermeneutics to the extent to which the interpretation which should conceptualize facticity comes back to itself by repeating possibilities already appropriated. Thus considered, conceptualizing facticity through double hermeneutics guarantees the validity of the principle that factical life always moves "within a certain state of having-been-interpreted that has been handed down to it" (Heidegger 2002, 116). The movement of anticipatory repetition reveals the "fallen being in the world" in the form of an interpretive narrative. Heidegger's concepts of "fate" (the personal way in which one hands oneself down to oneself by choosing possibilities) and "destiny" (the way of historizing the communal being-with) are directly referring to the (interpretive) narrativity of facticity. Repeating

[62] This is a text composed in 1922 in connection with Heidegger's application for associate professorship at the University of Marburg, and documenting Heidegger's work on an unfulfilled book project devoted to interpreting Aristotelian philosophy in the key of the hermeneutics of facticity.

possibilities already appropriated reveals facticity-in-its-historizing that takes the form of narrativity before any procedure and process of reproductive narration. (Authors like Paul Ricoeur and David Carr rightly forge the term of pre-narrativity to refer to narrativity before any storytelling or other forms of narration.) Double hermeneutics reveals and conceptualizes facticity as interpretive pre-narrativity.

Based on these considerations concerning the roots of double hermeneutics in Heidegger's conception of facticity, I will discuss some recent developments in philosophy providing the backdrop to an appropriate integration of double hermeneutics in hermeneutic realism. The claim that facticity of scientific inquiry is to be reached only via double hermeneutics poses the question of how the design of this interpretive approach enables the access to the "factical life" of science. In extending a previous definition, I state that hermeneutic realism is a realism about facticity as conceptualized by means of the double hermeneutics. Leaning on the implicit implementation of double hermeneutics in the existential analytic, one realizes that the research strategy of interpreting the interpretive constitution of cultural life forms is not simply an "interpretation of interpretation", but rather an investigative process that proceeds on two levels on which accordingly the reflexivity of practices and the agents' interpretive self-understanding—as the two forms of endogenous reflexivity—play a central role in the constitution of life forms and the meaningful articulation of life-worlds. One is dealing on each level with specific interpretive circularity, and the task of double hermeneutics as a methodology is to figure out an integral hermeneutic circle of the research process.

Reflexivity plays a central role in setting up this hermeneutic circle. Employing the double hermeneutics requires a dialogical attitude toward endogenous reflexivity that distinguishes what is studied. This attitude can only be attended through the interpreter's own (radical) reflexivity. In what follows, I will draw on Melvin Pollner's (1991) celebrated distinction between radical (referential) reflexivity and endogenous reflexivity. Pollner is not preoccupied with a certain kind of double hermeneutics. But the way in which he introduces the distinction mentioned invites an approach to double hermeneutics. Radical reflexivity draws the inquirer's attention to the work of grounding and constituting in the research process. In resembling in a sense Rorty's edifying hermeneutics (and other post-metaphysical initiatives), radical reflexivity ought to effectuate an unsettling of "normal scientific" practices of inquiry. Radical reflexivity aims at creating insecurity regarding accepted assumptions, background knowledge, conceptuality, methods, spaces of representation, and semiotic means. The interpretive studies pursuing a "dialogical contextualization" of what is studied should constantly practice radical reflexivity in order to come to grips with the forms of endogenous reflexivity, granted that the life forms studied constitute themselves through reflexive interpretation. Contextualizing these life forms is the only way of dialogically questioning them and conceptualizing their endogenous reflexivity. It is this contextualizing that can only be achieved by constantly unsettling the inquirer's resources of questioning and conceptualizing. Pollner holds that radical reflexivity and the kind of dialogicity it implies are essential to all human studies. The integral hermeneutic circle I mentioned involves

the dialogical relation of the interpreter's radical reflexivity to the endogenous reflexivity of what is interpreted.

Since the well-known discussions (from the early 1970s) about the role of double hermeneutics in post-empiricist epistemology, on the one hand, and in critical theory, on the other, a tendency to oppose the methodological to the ontological reading of double hermeneutics has become established. The methodological standpoint is most typically represented by a long tradition of defining double hermeneutics as a *differentia specifica* of human-scientific inquiry, and respectively, of using it as a criterion for demarcating the human/social from the natural sciences. Anthony Giddens (1984, 374) suggests a concise and compact formulation of this criterion: In contrast to the natural sciences, interpretive social science is structured around the intersection of two frames of meaning related accordingly to the meaningful social world as constituted by lay actors and the metalanguages invented by the investigators.[63] The impossibility of insulating the social-scientific interpretative frame from the objects of inquiry, which are meaningfully constituted by particular actors, makes double hermeneutics unavoidable. Thus considered, the relations between the social-scientific theorizing and the modes of being of the human beings whose cultural behavior is studied become dialogical. Giddens's criterion for demarcation might be criticized either for the sake of developing more sophisticated strategy of differentiation between types of inquiry, or with the intent to transform the double hermeneutics into a means of constructing "regional ontology" of the sciences dealing with human self-interpretive comportment.[64]

In borrowing the etic-emic opposition from cultural anthropology, one can state that double hermeneutics makes the interpretive human studies distinctive by

[63] In his earlier writings Giddens repeatedly remarks that the introduction of the methodology of double hermeneutics in the social sciences follows the need of rotating "two axes simultaneously" in these sciences: In rethinking the interpretative character of human action, institutions, and their relations, the social scientists have to bear in mind at the same time the interpretative turn of the post-empiricist philosophy of science. In this regard, the "double hermeneutic of the social sciences involves what Winch calls a 'logical tie' between the ordinary language of lay actors and the technical terminologies invented by social scientists… The 'logical tie' implicated in the double hermeneutic does not depend upon whether the actor or actors whose conduct is being described are able to grasp the notions which the social scientist uses. It depends upon the social scientific observer accurately understanding the concepts whereby the actors' conduct is orientated" (Giddens 1982, 12–13). In my view, this statement heavily mixes the problematic of the double hermeneutics with that of the intertwinement of etic and emic dimensions of social-scientific inquiry. The mixture is retained in some of Giddens's later formulations of double hermeneutics. No doubt, a consistent version of the methodology of double hermeneutics cannot ignore the etic-emic distinction. Yet, however important it is, this distinction is neither *terminus a quo* nor *terminus ad quem* in the development of double hermeneutics.

[64] The first form of criticism focuses on Giddens's appeal to frames instead of figures closer to hermeneutics. Thus, some authors (like David Hoy) prefer to make the figure of the fusion of horizons instrumental in the logic of interpretive inquiry, thereby formulating an effective criterion of demarcation. Other authors (like Karl-Otto Apel and Mary Hesse) are inclined to discard the very idea of a strong demarcation between objectifying and interpretive sciences in favor of a spectrum of sciences ranged between the pole of strong objectification and the pole of the total sway of double hermeneutics.

preventing the investigators from idealizing objectification of what is studied, and creating a unitary horizon of interpretive investigation through the fusion of the "emic horizon" of the native world's interpretive articulation and the "etic horizon" of conceptualizing the life forms which constitute and become constituted within this (historical, national, ethnic, confessional, moral, etc.) world. Such a unitary horizon does not make sense in the objectifying inquiry of the natural sciences. Since the unitary horizon is constituted by the double hermeneutics, the latter distinguishes the interpretive-dialogical process of inquiry of the human-historical sciences. In what follows, I will partially agree and partially disagree with this conclusion.

There is a long-standing "demarcationist tradition" inspired by the (wrong) observation that a consistent use of double hermeneutics as a demarcational criterion requires that the natural sciences be entirely freed from double hermeneutics. Otherwise, objectifying inquiry—proceeding through experimentation and mathematizing—would not be able to provide access to "ultimate reality". Thus, the story of robust realism is back, this time as a necessary counterpart of a philosophy that in a quasi-Diltheyan manner seeks the specificity of the human sciences. The adherents of the view of demarcation through double hermeneutics supply their strongly interpretative position with extremely objectivist doctrines about the natural sciences. (Their unspoken rationale for doing so is that the universalization of double hermeneutics—by demonstrating its relevance to the objectifying inquiry as well—would compromise the very idea that the objectifying inquiry can be making progress about how things in ultimate reality work.)

For demarcationists who complement double hermeneutics with robust realism, the understanding which is relevant to the human sciences is something more than a tacit knowledge that operates qua pre-understanding in natural scientific inquiry. Understanding in these sciences—so the argument goes—has much to do with "understanding the way in which the relevant courses of action can be desirable or undesirable" (Taylor 1980, 30). Desirability characterizations require hermeneutic practices of inquiry that lie beyond the range of practices aiming at idealizing objectification. At the same time, these characterizations violate (what Taylor calls) the "requirement of absoluteness" which—as a normative principle of robust realism—postulates that the task of natural science is to approach the world-out-there, thereby giving accounts of the "world's structure". Tentatively, the requirement of absoluteness postulates that there is factuality expressing essences (features of the world's structure) that preexists—and remains intact by—the characteristic hermeneutic situations of scientific inquiry. I already discussed why those who eschew a treatment of scientific inquiry as facticity are prone to accept without reservation the requirement of absoluteness (as implying the existence of absolute objective factuality presumably corresponding to "ultimate reality"). Taylor is convinced that this requirement is a sine qua non for doing natural scientific research. If this were the case, then scientists would strongly believe that the factuality they obtain is directly taken from the world-out-there. Robust realism as a counterpart to demarcation-though-double-hermeneutics would be a tenable position if and only if the working scientists follow the requirement of absoluteness and believe in its reasonability.

Taylor's requirement is trivially disproved by the observation that scientists are completely aware of the "genesis and development" of scientific facts: They are aware that the factuality laid bare in the research process is not objective per se, but is contextually objectified. Yet Taylor's requirement also becomes refuted in a non-trivial manner when one takes into consideration scientists' endogenous reflexivity. When, for instance, scientists do not—and are not able to—remove the intervening effects of their readable technologies from the contextually constituted factuality of theoretically saved phenomena, they are forced to take a reflexive stance and to make explicit the hermeneutic situation of the research process. In so doing, they make sense of the produced factuality with regard to its contextual readability. Realizing—through exercising reflexivity—that the contexts of inquiry and the procedural production of objectified factuality are intertwined brings the requirement of absoluteness to naught. The way of refuting the requirement of absoluteness in a non-trivial manner already presupposes invoking a kind of double hermeneutics.

More generally, making the characteristic hermeneutic situation explicit integrates ingredients of inquiry's facticity in objectified factuality. The requirement of absoluteness is (non-trivially) refuted when one realizes that the objectification cannot be accomplished without studying reflexively the contextualization in which it takes place. This is why Karen Barad, in particular, stresses the non-absoluteness or contexuality (of the objectified factuality) that—in being related to a kind of interpretive indeterminacy—provokes, as a rule, alternative descriptions of the symbiosis between context and object of inquiry. Scientists cope with this situation by introducing conceptual, formal, and experimental devices that enable them to look at the alternative (contextually dependent) descriptions as complementary initiatives. Therefore, contextuality and reflexive (re)contextualization seem to be shared characteristics of objectifying and interpretive-historical types of inquiry.

The view that the objectifying inquiry is guided by the requirement of absoluteness, whereas the human sciences are dealing with interpretation of interpretations leads to the absurd position that the reflexive-contextual constitution of factuality cannot take place in any research process: The natural sciences are dealing with something that is absolutely present ("pure factuality per se"), whereas the sciences of man are preoccupied not with facts—which in their absolute presence are inaccessible to these sciences—but only with interpretations of interpretations. Consequently, neither the natural nor the human sciences are capable of studying the constitution of factuality in their own practices of inquiry. The former are merely employing "access practices" that enable them to encounter facts as absolute presence, while the factuality of the human sciences is something amorphous dissolved in the interference of interpretations.

Contra Taylor I argue that (the methodology of) double hermeneutics becomes unavoidable when one realizes that all kinds of objectified factuality are produced within (and remain fore-structured by) facticity.[65] The kinds of factuality which are

[65] Dreyfus (1980) suggests an alternative argument for using double hermeneutics as a demarcation criterion: In contrast to the natural sciences, where the constitution of the objects of inquiry is only dependent on explicit and implicit theoretical frames (including the background knowledge

at stake in both the natural and the human sciences are produced within the interplay of practices and possibilities. As facticity this interplay might be studied by making the hermeneutic fore-structuring of factuality a theme of interpretative investigation—a task that in its formulation contains the intent to implementing double hermeneutics. (Of course, this implementation is only for philosophical purposes. It still does not provide a rationale for the necessity of double hermeneutics in the actual process of inquiry.) Now, universalizing double hermeneutics with regard to the production-of-factuality-within-facticity in all types of scientific inquiry does not make it irrelevant to the search for basic differences between the research-through-objectification and the research-through-interpretive dialogue. However, the accent in this search has to be placed on the topic of reflexivity. To be sure, the interpretive reflexivity of the actors studied does not per se make the interpretive human sciences a methodologically and epistemologically distinctive enterprise. Yet, in dealing with this kind of reflexivity, one is obliged to be reflexive about one's own conceptuality and epistemic resources employed in the research process, which has profound consequences for the theory construction (Ginev 1998).

As Pollner argues, it is the inquirers' (referential) reflexivity about the employed conceptual resources that—by constantly calling into question the assumed postulates, presuppositions, and ontic premises—makes the research process an infinite dialogical contextualization that can only conventionally be finalized. The adjective "dialogical" in this formulation alludes to the implementation of the interpretive logic of question and answer. The inquirer contextualizes what she studies by asking a relevant question. At the same time, the way in which what is studied becomes (re)contextualized is the answer the interpreter receives. The research process is situated in—and formed by—interdependent and intertwined events of fusing of horizons related to diverse cultural traditions and forms of life. The totality of the events of fusing horizons institutes the effective-interpretive being of the research process. Accordingly, this totality is an ontological (and not an epistemic) complexity that properly distinguishes the historical human sciences. Note that on this account, it is double hermeneutics combined with radical reflexivity that defines a demarcation.

The discussion in the preceding considerations was centered around the link between double hermeneutics and the demarcation criterion. Martin Eger was the

involved in objectification), the constitution of objects in the human sciences depends (not only on the web of theoretical assumptions, but) also on the endogenous practical horizons within which the actors studied form through self-interpretation customs, habits, life forms, and life-worlds of their practical experience. To be sure, this argument is much more reliable than the argument advanced by Taylor. (It deserves to be qualified as more reliable not only because it discards interpretative intentionalism as a distinctive feature of human-scientific understanding, but also because it weakens the dubious requirement of absoluteness concerning natural-scientific factuality.) But, again, in order to be effective, Dreyfus's argument needs to be supplied with evidence that the process of inquiry in the natural sciences does not assume (what he calls) "practical holism". Dreyfus is not able to provide such evidence. By implication, he admits the same bad dichotomy which Taylor advocates: the dichotomy between theoretically constructed factuality that refers to the "bare objects in themselves" of the physical world and interpretive factuality mediating the practical meanings constituted by the cultural life forms studied.

first—and remains the most outspoken—author who broke in a hermeneutic fashion with the tradition of questing for the uniqueness of the human sciences as proceeding with interpretations of meanings created by self-interpretative actors. I am saying "in a hermeneutic fashion" since—in contrast to the authors (like Rorty and Rouse) who rejected any kind of a "Diltheyan difference" by stressing that the human sciences' double hermeneutics does not entail methodological, logical, or epistemological distinctiveness—Eger argues that all significant characteristics of doubly interpretive inquiry are also to be found in the objectifying sciences. He states that the natural sciences are thoroughly interpretative since (a) language is part of their objects of inquiry; (b) interpreting (formal, technical, symbolic) language is an ingredient of natural scientific inquiry; (c) there is an interpretative "indwelling" (M. Polanyi) and familiarization with unknown symbols whereby novices become integrated in a "scientific fore-structure of meaning"; (d) there is an interpretive fore-seeing (anticipation) of inquiry's outcomes; (e) there are several events of translations in inquiry (like the translation of the inscriptions on instruments into conventional meanings circulating in the research work); and (f) the interpretative pedagogy of science teaching permeates the being of science throughout.

Eger describes his initiative as a conflation of the "theoretical circle" (the circular relation between natural phenomena and representations of these phenomena) and the "hermeneutic circle" that "includes more than representations; it includes practices and life-forms" (Eger 1999, 277). His version of the double hermeneutics (of natural scientific inquiry) is of prime importance to all kinds of interpretive science studies. Nonetheless, this version is not in complete agreement with the tenets of hermeneutic realism. (In particular, it is at odds with some of these tenets not because it unifies types of scientific inquiry by means of hermeneutic arguments, but for the opposite reason. In conflating to a certain extent the hermeneutics of inquiry and the "cultural hermeneutics" of science, Eger's conception tends to neglect essential differences between the interpretive-historical and the objectifying inquiry.) This is why the way of answering the question of how double hermeneutics enables one to capture scientific research's facticity cannot omit a critical analysis of Eger's conception.

What Eger counters is precisely the demarcation of two types of sciences by opposing double hermeneutics to robust realism. He counters it in many ways. But unlike Habermas, he does not criticize this demarcation for its allegedly dangerous commitment to a kind of "hermeneutic idealism".[66] Eger stresses, in particular, that whenever a natural scientist comes on the scene, she finds a pre-interpreted world and a language—not necessarily her own—already in being that is not to be detached

[66] Habermas (1984, 110) casts doubt on the possibility that an ontologically extended version of double hermeneutics might provide a reliable methodological position. For him, such a version would lead to "hermeneutic idealism". Of course, this argument does not make him an opponent of doubly interpretive methodology. Habermas pleads, in particular, for implementing double hermeneutics when the inquirer interprets—with a critical intent—the actors' repressed needs which are not transformed into motivations.

from the constitution of objects of inquiry. He even claims that a wholescale addressing of natural scientific inquiry's interpretative aspects demands the differentiation of three hermeneutic levels: the experimental articulation of data which takes place in a pre-interpreted world; the construction of theories that interpret data while becoming interpreted by data models; and the inevitable interpretation of established scientific results as a prerequisite for having effective scientific communication in which the rules for interpreting scientific results become part of the professional academic ethos. In developing this "triple hermeneutics", however, Eger heavily draws on the subject-object dichotomy. His discussion implies that the three levels of interpretation are, as it were, embraced by an overwhelming epistemic relationship. Strangely enough, the primacy of this relationship is vindicated by Eger's attempt at radicalizing hermeneutics. In opposing the champions (Giddens and Habermas in the first place) of implementing double hermeneutics as a demarcation criterion, he argues that both the human and the natural scientists are not "enveloped" in a "scientific fore-structure of meaning" (his expression). This makes them different from the everyday (pre-scientific) agents who are always already inside the original life-world (Eger 1999, 268). Scientists are in a situation that compels them to enter scientific fore-structure of meaning by struggling with their own received prejudices and indoctrinations.

At first glance, this seems to be a justified conclusion. Nobody is born within a "scientific fore-structure of meaning". Yet the idea of entering implies that this fore-structure is a separate body, ready to be attended by neophytes. (In assuming an originary presence of the fore-structure—presumably composed of discrete elements—such an entering is not on a par with the fusion of horizons which does not break the continuity of the meaningful articulation.) Moreover, Eger assumes that the "event of entering" is the initial hermeneutic event of scientific inquiry which triggers the chain of events that should be covered by the "triple hermeneutics" in question. The "scientific fore-structure of meaning" exists per se as something located in between the entering subject and the entities which through "the event of entering" will be interpretatively transformed into meaningful objects of inquiry. The supposition that the "scientific fore-structure of meaning" is a separate body that might be entered from outside commits Eger's scenario to a kind of essentialism. In this scenario, the fore-structure of meaning inescapably turns out to be a reified structure of determination deprived of interpretative-existential genesis. The empirical "event of entering" might be psychologically motivated, institutionally provoked, professionally demanded, socially promoted, or culturally conditioned and patterned. But once objectified as an empirical event, it is no longer ontologically situated and horizonally transcended. By implication, this event—as it is addressed by Eger—is deprived of the character of situated transcendence. Attributing such a character to it is sine qua non for treating it in terms of hermeneutic phenomenology. (The hermeneutic aspects, if any, of Eger's entering the scientific fore-structure of meaning could entirely be addressed in terms of Polanyi-like cognitivist hermeneutics and/or in Markus-like cultural hermeneutics.)

In hermeneutic realism, every individual scientist—following the rites of initiation—enters the professional milieu of an institutionalized scientific discipline.

But nobody is able to "enter" the trans-subjective hermeneutic fore-structuring—the interplay of practices and possibilities—of scientific inquiry. It is this "fore-structure of meaning" that—as inseparable from the interplay of practices and possibilities—discloses a discipline's domain as facticity and factuality of inquiry. In being ontologically opened and socially institutionalized, a domain becomes ready to be entered by particular individuals, educated and trained in a proper manner, and committed to a professional ethos. Like György Markus (1987), Eger tends to confuse science as institutional, culturally patterned, and educationally reproducible system of communication with science as the only mode of being-in-the-world which discloses reality-to-be-objectified. (It is another question that Eger draws completely different conclusions as compared with Markus.) To sum up, the weak point of Eger's hermeneutic program, in my view, consists in confusing the empirical event of entering—as amenable to being studied from an anthropological, a sociological, a psychological, or a cultural-historical viewpoint—with the ontological event of disclosing the reality of a domain of inquiry. In hermeneutic realism, this disclosing is to be regarded as the primordial hermeneutic event of scientific inquiry. Assuming that scientific inquiry is inaugurated by "the event of entering" would transform the phenomenology of inquiry's facticity into a "cultural hermeneutics" of science.

I will conclude the present section and the whole chapter with a summary of the conception of double hermeneutics developed so far. In this summary, some claims about the concept of pre-narrativity will begin to emerge. Like the interpretive inquiry in the human studies, the objectifying research process of the natural sciences is distinguished by a kind of double hermeneutics. Yet this does not imply a "hermeneutic unification" of all types of scientific inquiry. Unlike the interpretive human studies, the articulation and objectification of natural scientific domains is not employing radical reflexivity even when basic presuppositions (like those of causal determinism) are threatened to be disproved. Objectifying inquiry resists radical reflexivity because of its interpretive internalism, which prohibits reflexive deconstruction of theoretical presuppositions and ontic premises beyond the interplay of scientific practices and research possibilities, i.e., beyond the interplay which is intrinsic to the process of inquiry. But does the hermeneutic philosophy of objectifying inquiry also resist radical reflexivity? I am inclined to answer that question as follows: The hermeneutic philosophy of science should practice a kind of radical reflexivity, but without committing it to an external criticism of scientific inquiry. In hermeneutic realism, the criticism of any actual process of inquiry is—or ought to be—accorded with the tenets of interpretive internalism. Even when this criticism might be so radical as to aim at a change of the characteristic hermeneutic situation, it does not become a criticism from without. Needless to say, the articulation of scientific domains and the procedural objectification in science might also be studied from positions following a combination of radical reflexivity and external criticism of scientific inquiry. (Feminist interpretive-critical studies of processes of inquiry are a case in point in this regard.) This conclusion invites a further specification of the

profile of radical reflexivity in the cultural-historical human sciences, on the one hand, and the hermeneutic philosophy of science, on the other.

The use of double hermeneutics in the interpretive human sciences is a radically reflexive research strategy that, by "unsettling" interpreters' presuppositions, tries to comprehend the endogenous reflexivity of what is studied. Thus considered, double hermeneutics is the strategy of an investigatory dialogue: Creating an insecurity regarding the presuppositions poses new questions about the way in which the endogenous reflexivity of what is studied works. The new questions demand new contexts of addressing and answering them. The need of a re-contextualization stems, as it were, from challenges that the endogenous reflexivity of the "objects of inquiry" poses to the interpreter, thereby provoking her radical reflexivity. Unsettling the interpreter's presuppositions goes hand in hand with placing what is studied in ever new contexts. It is this mutual dependence of unsettling and re-contextualization that makes the interpretive process of inquiry a kind of investigatory dialogue. Questioning what is studied in a certain context alludes to facets that cannot be made intelligible in this context. A re-contextualization is needed in order to continue the investigatory dialogue. In each context what is studied not only shows a particular facet, but also provokes the interpreter in a characteristic manner, thereby putting her under pressure to problematize the relevance of her presuppositions, and to change the context of dialogizing. A re-contextualization can only be accomplished by means of radical reflexivity. From the viewpoint of the investigatory dialogue, the meaning of what is studied seems to be scattered over possible contexts that are open to be actualized via unsettling the presuppositions of contextualizing. Actualizing such contexts has much to do with the hermeneutic imagination of the inquirer.

We now ask in what sense radical reflexivity should be practiced by those who in an interpretive manner try to conceptualize the interpretive nature of the objectifying processes of inquiry (including the meaningful articulation and objectification of scientific domains). Radical reflexivity is indispensable when what is at stake is the conceptualization of a characteristic hermeneutic situation as a feat of the facticity of inquiry. It is this reflexivity that calls into question the relevance of the inquirer's presuppositions necessary for grasping practitioners' interpretative judgements involved in the appropriation and actualization of possibilities. Here the same kind of investigatory dialogue I briefly described should take place. Practitioners' judgments are supposedly part and parcel of inquirers' endogenous reflexivity. In the medium of these judgments, one chooses how to articulate and objectify the domain. However, one should not forget that practitioners' interpretive judgments—as a subject of the hermeneutic study of the facticity of domain's articulation—are already proposed within a characteristic hermeneutic situation. To reiterate, this situation is made explicit by practitioners' (non-radical) endogenous reflexivity, but it is primarily defined by the "logic or practices" or by practices' endogenous reflexivity.

I started my considerations on double hermeneutics with the claim that it is not merely an "interpretation of interpretation", but an approach to the two levels on which the constitution of meaning proceeds. Generally, the two levels correspond to

the two forms of endogenous reflexivity. Double hermeneutics operates by means of radical reflexivity that starts with an interpretive dialogue aimed at grasping the practitioners' interpretive judgments. This dialogical strategy has to unveil the tendency of appropriating possibilities for doing research, i.e., the characteristic hermeneutic situation of a domain's articulation and objectification. Once this situation becomes understood—with respect to the prevailing triad of fore-having, foreseeing, and fore-grasping of what becomes articulated and objectified—the study of the form of practices' endogenous reflexivity comes into play. Main themes on this level of interpretation are the plasticity of scientific practices to form various configurations, the entanglement of contextures-of-equipment with contexts of inquiry, the contextualization of the epistemic relation and the constitution of objectifying inquiry's contextual objectivity, and the way in which the characteristic hermeneutic situation operates as constraining (and heuristic) pre-normativity of articulation and objectification. My point is that all these themes are to be handled with regard to the pre-narrativity of the production of objectified factuality within the facticity of inquiry.

The empirical on the level of practices' endogenous reflexivity is the empirical of the production of factuality within the facticity of inquiry. It is a continuous stream of factuality *in statu nascendi* as fore-structured by the interplay of practices and possibilities. The empirical of factuality-within-facticity is imbued with contextualized meaning. Double hermeneutics unveils this empirical in its *pre-narrativity* (as opposed to the empirical as a static presence of discrete units). Pre-narrativity is factuality in its constant interpretive fore-structuring. Each choice and actualization of a possibility for doing research reveals new and conceals existing possibilities; i.e., opens a futural leeway for articulating the domain. Yet the choice is not to be detached from a series of past choices. This series as a trajectory of past events does not exist explicitly before the choice which opens the futural leeway takes place. The choice brings the trajectory to the fore. (This is why the explicit trajectories of past events become possible within the horizon of futural possibilities.) The actualized possibility being chosen makes factuality contextually present as a conventionally accepted endpoint of a trajectory of past events. Each choice of a possibility for doing research might be regarded as an endpoint, i.e., as a point of interception of a series of choices. Thus considered, the endpoint finalizes a story about a line of articulating and objectifying a scientific domain. Yet again this is only a conventional endpoint that enables the singling out of a particular narrative (a story that can be narrated). A re-contextualization of the research process—as provoked by the chosen possibility—would not only continue the conventionally finalized narrative, but would (possibly dramatically) change the story about the line of the domain's articulation and objectification. Pre-narrativity—qua a characteristic of the interpretive fore-structuring—operates before and independently of the kinds of narration by means of which one organizes the actual experience of being in a domain of scientific inquiry. Conceptualizing the pre-narrative articulation of scientific domains is the goal of double hermeneutics as employed in the hermeneutic philosophy of science.

Intermediate Reflections: Reflexivity in Scientific Inquiry and Empirical Ontologies of Hybrid Objects

At issue in this *Zwischenbetrachtung* is the approach to "empirical ontology" in science and technology studies (STS). As compared with approaches that focus on local arrangements of practices by means of a careful examination of the emerging order from the perspectives of all participants, "empirical ontology" displays several advantages. Nonetheless, in what follow it is accused of totally ignoring the (reflexive) facticity of the orders-in-a-state-of-creation. It is an illusion and a delusion of the champions of this approach that the multilayer portrayal of the factuality of local orders suffices to determine the plural being of entities that circulate in scientific, technological, and life-world practices. (I am referring to entities with a contextually changeable nature [hybrid entities]. Several case studies guided by the approach in question are devoted to the task of providing the empirical-ontological description of these entities.) In returning to Melvin Pollner's conception of reflexivity, these "intermediate reflections" offer a criticism of "empirical ontology" from the viewpoint of hermeneutic realism. There is an interesting analogy between this approach and Quine's naturalism. In a celebrated dictum of the latter, the philosophy of science is philosophy enough. The adherents to the approach I am going to critically analyze admit that the empirical ontology of practical orders' factuality is ontology enough. To both Quine's naturalism and "empirical ontology", the hermeneutic realist raises the objection that the abstinence from hermeneutics prevents one from crossing the threshold of factuality, and from seeing the empirical in its facticity.

1 Non-empirical Assumptions in the Radical Empiricization of Ontology

A tendency toward ontology has recently grown in popularity in science and technology studies. It is a tendency that tries to extend the ethnographic description of social entities and states of affairs (like the disease of atherosclerosis and the reality

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of fish farming) as they are placed and enacted in complex milieus of artifacts, technological devices, and equipment settings. After it is enacted, the entity/state appears to have a multiplied being, without becoming fragmented into many pieces. The ontic diversity concerns the manifold of the entity/state's modes of existence. The enactment occupies the central position in this extension, since it creates the dynamic unity of the entities and the milieus in which they circulate. It is precisely the ecstatic nature of enactment that escapes a purely ethnographic description and requires an empirical ontology of the whole complexity of social-entities-enacted-in-milieus-of-artifacts. This very complexity has its being in social practices. It is also a reality projected upon possibilities that are generated by the enactment of entities in those practices. By undoing any strong demarcation between humans and nonhumans in the complexity of enacted entities within particular settings of practices, the studies of empirical ontology present a new development of the actor-network theory.

While welcoming the tendency toward empirical ontology in STS as part and parcel of the post-metaphysical turn in social theory, in the next section I will oppose the impetus to reduce the phenomenon of "situated transcendence" and the ontology of facticity to empirical ontologies of factual orders. The claim will begin to emerge that a kind of hermeneutic (non-empirical) ontological reflection has to complement the studies of empirical ontology. My first task is to unfold the thesis that the unavoidability of "ontological difference" – or the difference between the description of multiple entities in the factuality of actions and activities, on the one hand, and the hermeneutic analysis of reality's meaningful articulation, on the other – provides a crucial argument against the full-fledged empiricization of ontology. Stated in this general form, the thesis will be advocated by taking up and further elaborating on Pollner's concept of radical reflexivity in a manner that will turn one's attention to a slightly modified version of the methodology of double hermeneutics. Yet I will continue to spell out this methodology – with regard to the reflection upon multiple entities and local interactive orders – by taking into consideration the ontological difference as it has been discussed in the preceding chapters. In line with the previous criticism of the mainstream of ethnomethodology, I will make the case that the conjugation of endogenous reflexivity (generated by a network of humans and nonhumans) and researcher's radical reflexivity requires more than ontic/factual description. This conjugation, recast in terms of double hermeneutics, allows one to make sense of the local interactive orders in their potentiality-for-being.

On a central claim of the philosophy which grounds the studies of empirical ontology, not only particular entities and state of affairs, but entire domains of reality are enacted in practices (Law and Lien 2013). The multiplying reality of farmed Atlantic salmon as a reality "without a single order" within fish farming practices is the topic in John Law and Marianne Lien's case study. Each practice is defined as web of relations ("choreography") among human and nonhumans. What becomes enacted acquires the status of being "almost but not quite created". The task consists in unfolding an ontology relevant to the domain of fish farming practices. This should be an empirical ontology of "contingent orders" that involve ordering processes, disorders, and "unknowable fluidities". Thus, the case study of these authors

shows what farmed Atlantic salmon becomes in multiple, fluid, and indeterminate configurations of practices. At stake is the multiplicity of a biological-species-in-different-human-practices, a multiplicity in a situation that is precarious and uncertain. The texture of practices manages to draw a demarcation between salmon and humans, but this demarcation is not to be recast in naturalist-objectivist terms. In their inextricable linkage with humans the farmed Atlantic salmon are ontologically defined as "Other to the human". But this kind of salmon is also Other to its "wild cousins" in the Atlantic ocean. Human-salmon practices are practices of an ongoing "Othering". The empirical ontology of this multiple and "almost created" (but nonetheless) natural creature – which however strongly it is enacted in practices remains biologically typified by a dorsal adipose fin posterior to the main dorsal fin and by several other genetic, biochemical, ethological, physiological, anatomical, etc., traits – is also an ontology of a process of what environmentalists and environmental historians call "artificialization". It is an artificialization within practices that does not have a natural state (as a point of departure) and a state of something completely constructed (as a final point). This is a process that constantly runs between hybrid (natural-artificial) states. I will return to Law and Lien's ontology in another context of discussion.

Empirical ontology is an initiative that promotes a way out of relativist-epistemological perspectivalism. By putting all participants in a system of orchestrated practices at the same level, the methodology of perspectivalism dissects each particular entity enacted in practices, thereby representing it as a manifold of separate objects whose existences depend on the practitioners/participants' standpoints.[1] By contrast, empirical ontology offers a holistic approach to practices, without assuming a grounding order. The interrelatedness of practices has an ontic priority over the practitioners' positions which allegedly control and warrant the practical order. Whereas perspectivalism relativizes and pluralizes the domain of configured practices, empirical ontology tries to retain the unity of the network in which the enacted entities become multiple with regard to their modes of existence. (From the

[1] The temporal and spatial dimensions of the creation of local rational orders of social activities are a persistent theme in all programs that aim to make ideas of hermeneutic phenomenology useful for empirical social studies. For a long time the paradigm of perspectivalism has dominated the attempts to introduce phenomenological concepts of rationality in these studies. Alfred Schütz's approach to the intersubjective constitution of meaningful realities is a case in point. Yet perspectivalism has proven to have significant flaws, and it has been overthrown step by step during the last four decades. It became clear that the local rational orders – whether they are homogeneous orders like those in a scientific laboratory, a factory, a school, a small-scale industry, a religious community, an artistic group, different kinds of "invisible colleges", etc., or heterogeneous orders like those created by the shared everyday life of a small urban community or a relatively isolated emigrant community composed of members of different social origins – are not outcomes of an progressive exchange of agents' perspectives within the network of social interaction. The conviction has gradually gained currency that the societal topos of interactive intersubjectivity does not have a self-sufficient being. In general terms, the intersubjective rationality (as manifested in a particular ethos) "takes place" within the horizons in which the interactive agents are "always already" thrown. But how is this "place" to be approached and scrutinized? It is not a fixed site that can be physically localized.

viewpoint of hermeneutic realism, this is a kind of factual unity within facticity. Accordingly, empirical ontology is dealing with the empirical qua production of factuality within facticity.) An entity enacted in this network does not become dissected and scattered in perspective-dependent objects. Rather it becomes multiplied and stratified in its own being. Stated differently, the enacted item becomes a multiple entity without losing its ontic identity. The task of empirical ontology is to grasp the entity's contextually scattered existence within the network of practices. Accordingly, the focus on a particular practice is limited to the question of how the practice weaves its relations with other practices whereby the interrelatedness enacts entities. By implication, the enacted entities have their modes of existence in overlapping practices. To sum up, the studies of empirical ontology focus on interrelated practices in a flux that only allows the existence(s) of entities-enacted-in-practices. Prominent champions of the ontological turn in STS argue that their approach provides resources for investigating how technoscientific practices change the world(s) materially, socially, morally, and politically. Following this approach, one scrutinizes the ways in which science and technology intervene in the world(s) (Marres 2013, 422).

There is no doubt that empirical ontology goes hand in hand with an immense variety of versions of constructivism. But it is much more than a mere supplement to social constructivism. In his review of Annemarie Mol (2002), Malcolm Ashmore (2005) argues that exploring the ways of cognitive construction is still an epistemological enterprise whereas the practical intervention in the world is something that belongs to the investigatory purview of ontology.[2] Yet empirical-ontological studies do not amount to investigating interventions in worlds already made. At stake also are issues like the "degrees of alterity" of the worlds which science and technology bring into being (Woolgar and Lezaun 2013, 323). In this regard, the ontological approach to STS suggests ways of studying "multiple entities" that are constantly *in statu nascendi*. These entities engender in their turn "multiple realities" that are also emerging *political realities*. More specifically, the ways in which the different types of practices enact the entities differently create emergent micro-political regimes of interaction within the networks of concerted practices (Brives 2013). The shift from (representational and/or normative) epistemology to ontology parallels the transi-

[2] Ashmore stresses also that Mol's ontological approach to practices should not be read as endorsing the search for "ontics, designed and destined to replace the tired old routines of epistemics" (Ashmore 2005, 829). In my opinion, the champions of empirical ontology are not looking for a confrontation with epistemological programs. Yet, in contrast to older supporters of science-as-practice, they are guided by the view that there is no hypostatized body of knowledge separable from the epistemic practices. The latter, however, are inextricably implicated in the multiple realities that have to be studied ontologically. Thus, there is no knowledge that cannot be treated in terms of empirical ontology (in particular, the units of knowledge are no more than specific "multiple entities"), and, at the same time, there is no knowledge that can only be approached/analyzed from an epistemological point of view. The champions of empirical ontology manage to overcome the traditional opposition between theory and practice. When Ashmore appeals in his review for peace between epistemics (which is dealing with the hot side of science, with novelty and controversy) and ontics, he still commits to the traditional opposition, thereby adhering to a sort of Cartesian presuppositions.

tion from science-as-knowledge to science-as-practice. Yet the ontological turn is by no means restricted to a moment of the praxeological turn. The ontological approach to practices and enacted entities has a lot of distinctive features that make it unique within the family of science-as-practice approaches. Let me briefly sketch out the main features.

The students of empirical ontologies prefer to use the plural and not only for realities and worlds. They speak of "ontologies" because they hold that each relatively autonomous body of orchestrated and concerted practices that enacts entities *sui generis* deserves its own "ontological model". (The term "model" here is to be understood not as a theoretical representation but as the outcome of a thick description that includes intervention in what is described.) Thus, there is a growing diversification of ontologies in STS. To put it bluntly, technoscience's progressive conquest of life-worlds contributes to the proliferation of empirical ontologies. The rationale behind the impetus of this proliferation might also be formulated as follows: Different enactments of an entity – ever acquiring new cultural meanings – in different configurations of practices entail different "ontological models" of that entity. The very production of these models is more a response to a cultural need than a process of conceptualization. Thus considered, a particular empirical ontology seems essentially akin to a description of a contexture-of-equipment as this description is reflexively accomplished by practitioners though their "ethnomethods" and intrinsic forms of "theorizing".

Since orchestrated practices generate orders, the ontological approach in STS avoids assuming a grounding order lying behind the particular orchestrations of practices and enactments of entities. The avowal of the insurmountable diversity of orders expresses the commitment of STS (and part of the feminist critique of science) to post-metaphysical initiatives and agendas. Law and Lien (2013) demonstrate cogently the way in which the ontological approach undoes the very idea of grounding order. These authors insist on the clear distinction between the question of what exists through enactment (the question of empirical ontology) and the question of the general ordering of the cosmos. Focusing on practices rather than on stable social structures implies a full-fledged concentration on the former question. In a further claim, there are no "orders in themselves" but only orders generated by practices. Accordingly, ontological questions of ordering (creation of contingent orders) are detached from any kind of global ontology of the world-as-presence. This approach turns the idea of "cosmos" (if any) into a Whiteheadian totality of ordering processes.

Law and Lien provide a nice non-foundationalist picture of the levels of practices' interrelatedness. This picture is obtained by unfolding the aforementioned claim that there is no ordered ground separate from practices and their relations. All kinds of ordering in a domain of interrelated practices are provisional, expressing specific effects of the interrelatedness. Entities are meaningfully reshaped as a consequence of changing choreographies as contextures-of-equipment. No entity can do its own identity behind the interrelated practices. The creation of a "choreography" in which a synergy between humans and nonhumans takes place is the first level addressed by the empirical studies of ontology. A well-functioning

choreography is one in which the involvements of entities in practices maintain the domain's persistent unity. The enacted entities are pieces of equipment indispensable for the domain's functionality. Within a well-functioning choreography entities are characterized by their serviceability, conduciveness, usability, and manipulability.

A second move consists in exploring "precarious choreographies" in which the interrelatedness of practices becomes disturbed. A precarious choreography might, for instance, arise from the maladjustment of an entity (as a piece of equipment) to the operative configuration of practices. Entities become dysfunctional in such choreographies. But the most important move is the thick description of the "textures of ordering practices". A texture draws, as it were, a demarcation between artifacts (entities enacted in practices) and "natural objects". The ontological study of a texture should unveil the hinterland of invisible practices (and invisible relations) that make alleged natural objects artifacts by assigning to them a status of "actants" playing normative roles (Law and Lien 2013, 369–371). In the texture, there are always "practices of Othering" that bring the (already discussed) artificialization into being. What is more important, however, is that the ontological study stops being a purely empirical ontology of a domain in its actual presence. It describes practices and enacted entities with regard to the possibilities of transforming natural objects into artifacts. Accordingly, it is also an ontology of what has only an "absent presence", or only a potentiality-for-being.

In anticipating my further discussion in the next section, I would say that the difference between "choreographies" and "textures" indicates in a tentative manner the ontological difference. More specifically, I tend to think that the distinction between a domain-as-a-diversity-of-choreographies (the actual and empirically given "nexuses of equipment") and a domain-as-a-texture (the potentiality for artificialization) corresponds to Heidegger's distinction between the (ontic) "work-world" and the (ontological) "worldhood" (Heidegger 1962, 95–102). Choreographies are present states that can be studied empirically (in an ontic manner), while the study of a texture should involve an (ontological) reflection upon the possibilities of "Othering" that arise from the interrelatedness of practices. The "worldhood" is distinguished by continuity (continuous constitution of meaning and meaningful articulation of a domain), whereas the "work-world" is a discrete concatenation and multiplication of practices and entities.

Latour's recent concept of the "modes of existence" is intended, in my opinion, to suggest a unified description of the "work-world" and the "worldhood". Approaching that plurality of modes of being which Latour has in sight hinges on a concept of experience that takes into consideration the horizons of possibilities. What becomes experienced is "always already" projected upon such horizons. The realities of human-nonhuman practices (as work-worlds) result from the ongoing appropriation of possibilities. The complementary unity of horizon and constructed reality (as actualized possibilities) would only allow one a description of the modes of existence beyond the "prison of epistemological divisions" (Latour 2013, 184–85). For him, the student (the anthropologist) dealing with the plurality of modes of existence can no longer rely on the "system of coordinates" proposed by the

bifurcation of object and subject. The new system of coordinates has to be constructed – so Latour's argument goes – by paying attention to multiple persistences and multiple transformations taking place in local orders and contextures-of-equipment. At issue in the new system is the ongoing meaningful articulation of entities by obtaining continuity through the discontinuities informed by these persistences and transformations. Latour's concept and conception of plurality of modes of existence show how the long road starting from social constructivism and passing via the ethnography of the laboratory life and actor-network theory reaches the point of empirical ontologies in which the modes of existence are scrutinized by empiricizing Heidegger's notions of work-world and worldhood.

One is not able to develop empirical ontology without a method. The ethnographic method of thick description proves to be the preferable one for unfolding empirical ontologies. The adherents of the ontological turn are very much engaged with diagnosing the changes of meaning within practices constituting forms of life: a diagnosing that should steer between "reading more into things than reason permits and less into them than it demands" (Geertz 1983, 16). In the method of thick description, the way of developing empirical ontology consists in scrutinizing the practices involved in the making of a relatively autonomous domain. The best case in point is Annemarie Mol's ethnography of (the domain of) hospital Z, as this descriptive work is entangled with another one: the"ethnography of atherosclerosis". The ontological vision of the multiple reality is achieved by an ethnographic description of how the enacted entities (a disease in the first place) become a part of what is done within the interrelatedness of practices. (The conceptualization of the ongoing interplay of "disease" and "illness" also essentially contributes to the design of this ethnographic scenario.) The description in question should be carried out in a manner that would prevent one from admitting the existence of passive objects "in the middle" of the interrelated practices, "waiting to be seen from the point of view of seemingly endless series of perspectives" (Mol 2002, 5). The body, the patient, the doctor, the technician, and the technology among many other entities are constantly reshaped and meaningfully re-constituted. The changing configurations of practices (and not the particular standpoints of the participants) are only responsible for objects' emergence and disappearance. (This is also Mol's argument for the irreducibility and irreplaceability of the ontological approach to/by traditional SSK constructivist-relativist-epistemological approaches.)

Again, the entities do not become fragmented but multiplied, hanging together in various ways. By implication, the changing configurations of practices constitute ontic multiplications. The ethnographic thick description enables one to describe the multiplication of an entity during its manipulations within a system of practices. This description is not only a method but an act of integration in what gets described as well. In this regard, Mol spells out the specificity of the ethnographic description's normativity. At issue is the question of how the ethnographer should intervene in the texture of practices in order to disclose the being (of multiple realities) which becomes continuously constituted. Important here is what Mol categorizes as a "third step" in the ethnographic description: the step of transforming this description into an ontology of practical constitution of meaningful entities. In performing

this step, one realizes that making an ontology of a particular multiple reality is a part of the ontic-ethnographic description of practices one is engaged with. Phrased differently, distancing from disembodied contemplation requires that the researcher's descriptive practices become a particular focus point of the ontic description. Unfolding empirical ontology is first and foremost a reflexive participation in the described reality (Mol 2002, 153).[3] The ontic study of the multiple entity of atherosclerosis as it is placed in the practices taking place in hospital Z has much to do with the distinction between knowing in medicine (about disease) and knowing about medicine (dealing with the etiology of illness). This is not an epistemic but an ontic distinction (i.e., a distinction between two kinds of practices taking place in the whole orchestration of the hospital's practices). If I am correct in my reading of Mol's study, the researcher might manage to move successfully between "knowing in" and "knowing about" only by means of her reflexive participation in the multiple reality. This conclusion is closely related to issues of radical reflexivity, which I will discuss later.

The ethnographic thick description dominates the landscape of empirical ontology. Yet there is also another methodological tendency in the ontic studies typically advocated by Latour. This tendency is inspired by the relevance of ethnomethodological descriptions to interpretive-ontological studies. The nexus between ethnomethods and the life-world's orders implies an ontic dimension of the descriptive work. However, this dimension is by no means amenable to the same description which builds the core of the ethnomethodological work; rather it remains hidden in this work.[4] For Garfinkel's followers, nothing in a social world can be taken for granted as a de-contextualized presence-at-hand. All entities are described as contextually accomplished entities. In other words, the description prevents one from hypostatizing objects. *Prima facie* there is no room for ontology (in the traditional – more or less metaphysical – sense) when one is dealing entirely with lived, immediate, unmediated, and congregational practices. There is no "ontological residue" that escapes the immediacy of the ethnomethodological description. However, studying the ways in which actors produce orders and manage the settings of their everyday activities amounts to investigating the modes of being in everyday life.

[3] The moment of empathy in this reflexive participation is not to be underestimated. Against the background of Mol's way of distinguishing between disease and illness, one is to state that the more the researcher involves her own epistemic practices in the scenario of ontic-ethnographic description, the more effectively she is able to understand the ways of "living with disease", i.e., the particular illness as a psychosocial phenomenon (as opposed to disease as an object of biomedicine).

[4] In the tradition of ethnomethodology there are several interesting attempts at making the ontological dimension explicit. One is Eric Livingston's ontological approach to the mathematical work's life-world. However, such attempts have always been met with skepticism by those adherents of the tradition who admit that the engagement with ontology would transform the enthomethodological description into interpretative theorizing, thereby restoring a sort of theoretical essentialism (Ginev 2013a, 117–127).

This is why the description of actors' endogenous methods of creating life-worlds might lead to ontologies of everydayness.

Two modifications/extensions of this description are of crucial importance for the passage to empirical ontology (and as I will show later, to non-empirical ontology as well). First, one has to undertake a step beyond the level of "irremediable indexicality" on whose primacy the ethnomethodologists insist. Second, the capability of producing (normative) orders is to be ascribed not only to reflexive actors, but to all "actants" (humans and nonhumans). At this point, I will return to my discussion of Pollner's (1991) conception. His attempt at integrating "radical reflexivity" in ethnomethodology allows one to carry out both extensions. Following Garfinkel's tenet that social norms are not imposed factors that guide, determine, regulate, or cause the social conduct in predefined scenes of action, Pollner suggests a detailed analysis of the reflexive accountability of action. He makes the case that the study of this accountability (brought into being by actors' endogenous reflexivity) depends on the researcher's radical reflexivity. It is this radical reflexivity that engenders critical self-questioning and appreciating the inventory (presuppositions, attitudes, concepts, devices, techniques, theoretical resources, and methods) of inquiry. Referentially reflexive appreciation of the ethnomethodological work is "radicalized when the appreciator is included within the scope of reflexivity, i.e., when the formulation of reflexivity – as well as every other feature of analysis – is appreciated as an endogenous achievement" (Pollner 1991, 372).

As a corollary to Pollner's considerations, the more intensive the preoccupation with radical reflexivity, the more elaborate the ethnomethodological description. By problematizing her own inventory, the researcher will more and more cease to look at actors' normative orders and life-worlds as something empirically given, and will begin to scrutinize them as particular actualizations of possibilities that remain in horizons of still not appropriated possibilities. This is why she reads the empirically actualized orders as open to further changes that might come into being by the appropriation of new possibilities. Instead of being apprehended as empirically given actualities (or metaphysically present factualities), orders become regarded as "inscribed" on horizons of possibilities. Radical reflexivity turns empirical local orders as objectified (discrete) factuality into (phenomenologically conceptualizable) empirical reality as production of factuality-within-facticity. In radicalizing the call for recursive examination of the assumptions underlying the procedural objectification of factuality, this kind of reflexivity deconstructs the constant presence of objectified factuality. There is no factuality that can be taken for granted. Every piece of the objectified factuality becomes matter for subsequent critical analysis. Paraphrasing Garfinkel, objectified factuality is always a gloss for in situ work. Exercising radical reflexivity leaves room only for factuality-within-facticity, factuality as it is continuously fore-structured and temporalized within horizons of possibilities. By implication, radical reflexivity is the way to empirical studies of the constitution of factuality through endogenous reflexivity of the life forms studied. In this regard, it can be viewed as "reflexivity of reflexivity".

Following this strategy for empirical studies, radical reflexivity seems to be critical to ethnomethodology as well. It calls into question the immediate actuality given in an ethnomethodological description since it casts doubts on the validity of the "intuitions and criteria" about empirical immediacy. In exercising this kind of reflexivity, one nullifies any uncritically accepted entity or state as "actually given", and attention is given to the ongoing constitution of what allegedly exists as empirically given. According to Pollner, a kind of (hermeneutic) analysis of this constitution should complement the empirical description and unveil the "empirically given" as mediated by contextualized practices. As a consequence, one starts to approach the actors' endogenous reflexivity with regard to its potentiality to constitute a meaningful reality. The potentiality for constitution is not externally (explanatory) added to what is actually present, but revealed as inherently operating in the interrelatedness of practices which is at stake in the ontological study. Accordingly, the first step mentioned above is put into effect: The ethnomethodological description is extended in a manner that allows one to go beyond "irremediable indexicality" and look for the ontology of everydayness (constituted meaningfully through endogenous reflexivity). Intensifying the preoccupation with radical reflexivity is also a prerequisite for making the second step. The researcher begins to realize that the physicality of nonhumans involved in human action and interaction participates in the constitution of orders and life-words as well. The capability to effectuate (and transgress) norms is to be assigned not only to the actors but to all "actants" (in Latour's Greimasian, semiotic sense).

The question I discussed with regard to Pollner's referential (radical) reflexivity can also be formulated as follows: Are the contingent orders of multiple entities (and realities of enacting practices) characterized by an actual being in itself (a mere factuality), or are they rather revealing – in their a potentiality-for-being – facticity of configuring practices? One certainly might render evidence for the claim that the new studies of ontology dispense with the concept of "being's actual presence". Thus, the champions of empirical ontology are interested in unveiling worlds and realities in the making. The empirical studies of ontology are seeking how entities come to be in relational, fluid, and more or less indeterminate practical modes of being-in-the-world (or "modes of existence"). Despite this evidence, however, there are two crucial arguments (an epistemological and a hermeneutic one) stating that (purely) empirical ontology cannot avoid a hypostatization of the actual being of what it deals with. In the epistemological argument, the empirical immediacy is inevitably shaped by non-empirical assumptions (or "prejudices"), and thus, it is always mediated by such assumptions. According to the hermeneutic argument, any empirically immediate state of affairs is the upshot of actualizing possibilities projected by interrelated practices upon horizons of practical existence. The "actually given" as empirical immediacy is ineluctably "produced" within the potentiality of existence (facticity).

It is my contention that the studies of empirical ontology do not have the resources to deal properly with these two arguments. I am not going to elaborate on the critical consequences following from the arguments. Let me only tentatively underscore the

following point: Regardless of how strong the stress on processual ordering, the search for a radical "empiricization" of ontology rehabilitates the priority of actuality over potentiality as this priority is launched by "metaphysics of presence". It is impossible – so the epistemological argument goes – to have an empirical description without presupposing an epistemic-representational attitude, and accordingly, to restrict the research work to dealing with an actual presence. (Thus, though representational epistemology has been solemnly banished, the epistemic representation of what is actual comes through a backdoor in each program that struggles for an "empiricization without remainder". This is true even when epistemic representation is achieved by means of "practical intervention").[5] The above-mentioned attitude inevitably places emphasis upon what actually becomes represented regardless of whether the latter is a given (stable and static) state or processes of ordering. All kinds of empirical investigations are epistemologically doomed to be committed to thematizing actualities. This is why in a (purely) empirical-ontological study, there is no room for radical reflexivity that radically might call into question all empirical immediacy of what is described.

This criticism leads to the question: It is possible at all to address the task of empirical ontology without committing to a version of (non-empirical) constitutional analysis of meaning (in the sense of the phenomenological tradition)? There is no doubt that the empirical stance in developing descriptive ontology should be reflexively enlightened about its own non-empirical assumptions that "make possible" the empirical immediacy of each particular ontological study. In a reflexive manner again, these assumptions have to be taken into consideration in constructing the empirical ontology. Pollner's radical reflexivity is to be implemented to the non-empirical (epistemological) assumptions of empirical ontology as well. Yet in what follows, I will pay attention exclusively to the hermeneutic argument, leaving aside the meta-epistemological critique of the anti-epistemological position held by the students of empirical ontology.[6] In the perspective of this argument, radical reflexivity provides the access to scrutinizing those aspects of the constitution of meaning (as an ontological issue) which are not amenable to immediate empirical study. In enabling one to integrate an interpretative approach to the situated constitution of meaning in the empirical description of a multiple reality – so my argument goes – radical reflexivity paves the way for having recourse to ontological difference in the studies of empirical ontology.

[5] At this point I should like to reiterate a motif from my previous criticism of Hacking's epistemology. He puts much emphasis upon the contradistinction between representing and intervening. However, being still committed to the primacy of the subject-object cut, his epistemology only makes intervening a privileged method of epistemic representation.

[6] I am using the expression "meta-epistemological critique" in order to emphasize that this critique is not inspired by the search for an epistemological alternative to empirical ontology. The aim is rather to uncover (by implementing reflexive-epistemological tactics) the "bad epistemology" tacitly involved in those versions of empirical ontology which insist on "empiricization without remainder".

2 Ontological Difference and Empirical Ontologies

A tendency to an internal critique of radical empiricization is already present in the tradition of empirical ontology. Let me briefly turn to a prominent example that illustrates this tendency. In an illuminating study, Noortje Marres (2013) introduces the interesting distinction between empirical and experimental ontology. By her account, empirical ontology deals with transformations of entities taking place in a domain where practical, technological, and scientific kinds of experience merge whereby the transformations may produce political effects. The circulation of power accompanying these transformations is at issue in empirical ontology. Nonetheless, this kind of ontology is still committed to the classical (human-centered) concept of politics. By contrast, experimental ontology follows the tenets of actor-network theory, and ascribes moral and political capacities to nonhumans. This program goes beyond the empirical studies of ontology in equipping (in a more radical fashion) nonhumans and environments with normative features (Marres and Lezaun 2011). In experimental ontology, politics exists as the leeway for possible normative engagements. In another formulation, politics is projected upon a horizon of possible accomplishments that can come into being through the deployment of devices, objects, and settings. Marres's program has an experimental character because it explores the possible interventions in the world (and their political consequences) in terms of "experiments with the world". The outcome of these experiments consists in obtaining the political profiles of various (actual and potential) configurations of practices. In this regard, experimental ontology means the ontology of a domain in terms of the leeway for its possible states.

In (post-metaphysical) political philosophy one introduces the distinction between politics (*la politique*) and the political (*le politique*). The latter refers to the post-ideological (beyond the traditional Left and the traditional Right) constitution of political topics within the multiplicity of social practices, while the former is reserved for the practices of conventional politics (Marchart 2007, 156). The political implications of Marres's experimental ontology are much closer to the political than to politics. More generally, the empirical-ontological tradition in STS tends to treat (with good arguments) the institutionalized political power as a not ontologically primordial force. For several authors, this power is constituted within the trans-subjectivity of being-involved-in-practices. Accordingly, politics is about relations between statuses and power, whereas the political refers to "ontological politics" (Woolgar and Lezaun 2013) as it is put into play by human and nonhuman accomplishments within orchestrated practices.

Furthermore, the "ontologization of politics" in terms of experimental ontology characterizes politics itself in its potentiality, i.e., not in its empirical stability but in terms of the ongoing actualization of possibilities. There is always an empirically untranslatable (or a trans-empirical) moment inherent in this characterization. With regard to this moment, Marres insists on overcoming the distinction between constituted and constituting ontologies. The activation of possible accomplishments affects the ways in which nonhumans exert influence over existing orders and

regimes of power, thereby playing (new) political roles. Accordingly, experimental ontology offers a distinctive way of how to make sense of nonhumans enacted in practices in terms of "political entities". The political contributions of nonhumans are to be located on the constituting side. The politics of nonhumans depends entirely on how projected possibilities will be appropriated (not by humans but by the trans-human interrelatedness of practices) in the course of articulating a particular domain as an institutionalized network of human-nonhuman modes of existence.[7] In this regard, Woolgar and Lezaun spell out the view that the ontic studies of the constitution of multiple realities necessitate – and enable one to defend – a "new form of political normativity". The way in which they suggest to "rethink politics through ontology" leads to a concept of political normativity predicated on the potentiality-for-being of the political. More specifically, they stress the diversity of possible trajectories of "ontological politics" engendered by enactments of multiple entities. By implication, the possible ways of "political constitution of humans and non-humans is in the very constitution of these entities in those terms (human and non-human)" (Woolgar and Lezaun 2013, 334).

The program of experimental ontology as exposed by Marres, however, seems to be underdeveloped in one respect. It does not take into account the kind of endogenous reflexivity generated by orchestrated practices in which the nonhumans are enacted. In saying this, I take up the motifs of reflexivity as they were discussed in the preceding section. A possible reason for this deficiency of reflexivity lies in the assumption that by addressing endogenous reflexivity one would rehabilitate the human actors' privileged position. Yet this assumption ceases to be valid if one does not restrict endogenous reflexivity to the human actors' reflexivity. Given that it is engendered by a whole domain of interrelated practices, endogenous reflexivity does not hinge only on the humans' self-interpretation. It proves to be essentially caused by the nonhumans' involvements and enactments as well. In other words, endogenous reflexivity refers to two different but intertwined things (conditions): the actors' cognitive capability of reflexive accountability (in the sense in which ethnomethodologists oppose the view of social actors as "judgmental dopes") and the reflexive properties brought into play by the interrelatedness of practices whose "logic" is essentially informed by the ways in which nonhumans participate in them.

An illustration of how these two dimensions of endogenous reflexivity complement each other is the change of the normative design of practices' interrelatedness accomplished at once "behind practitioners' backs" and through practitioners'

[7] As I pointed out, Marres's position is by no means an exception. As a rule, empirical studies of ontology tacitly admit a difference between ontic description and ontological reflection. Mol is seeking the difference between the ethnographic description of the "multiple body" (and other multiple entities) and the constitution of multiplicity. She makes the case that if one begins to study the interferences between the enactments of multiple entities (such as atherosclerosis and sex difference), then the complexities start to grow exponentially (Mol 2002, 151). The growth of complexity is precisely the theme of the ontological reflection.

self-interpretative control. Only by having recourse to endogenous reflexivity – so the argument for supplementing Marres's experimental ontology goes – is one able to ascribe normative (moral and political) capacities to nonhumans. In attributing reflexivity to the whole being-involved-in-practices that constantly creates adjustable and regulable order, one makes an important step in introducing ontological difference into the interpretative study of entities' enactments in practices. (At this point, I am appealing again to Czyzewski's (1994) distinction between two forms of endogenous reflexivity: one related to practitioners' self-interpretation and another that has much to do with the kind of accountability engendered by the intrinsic logic of practices. Bourdieu's concept of habitus suggests an appropriate approach to the unitary operation of the two forms of reflexivity. Defined as "systems of durable, transposable dispositions, structured structures predisposed to function as structuring structures" (Bourdieu 1990, 53), habitus takes into account at once the "conditionings" associated with the "logic" of practices' formation of contextual configurations and the practitioners' reflexive structuration that is not described as obedience to rules, though it generates norms and rules. The concept of habitus seems to be of great importance to the studies in empirical/experimental ontology since it allows one to investigate the transformations and multiplications of entities involved in systems of practices on a level that is independent of the participants' perspectives. For Bourdieu, the practical world that is constituted in its relationship with the habitus is "structuring structures" whereby such perspectives crystallize. The participants' perspectives supervene on the dispositions durably inculcated by "the possibilities and impossibilities, freedoms and necessities, opportunities and prohibitions" inscribed in the structuring structures (Bourdieu 1990, 54). Habitus embraces forms of reflexivity working within the "system of dispositions" and within practitioners' motivation and decisions.)

To reiterate, the more one intensifies radical reflexivity, the more one reflects upon the domain of human-nonhuman practices in its potentiality-for-being. As a consequence, one is no longer inclined to admit that the present situatedness of the entities undergoing multiplication is the only empirically possible state of affairs. In the perspective of radical reflexivity, the particular practices and entities are not only situated in the actual (factually given) configurations of practices, but also in horizons of possibilities (or Bourdieu's structuring structures as resting on potential generative schemes). These horizons are not to be disentangled from the mode of being-involved-in-practices. Radical reflexivity shows that what becomes situated (enacted and multiplied) in practices is constantly transcended by a horizon of possibilities. Only by ignoring this transcendence brought into being by the interplay of practices and possibilities can one (uncritically) accept the empirical immediacy of what becomes enacted as a multiple entity/reality. The horizon remains finite in each particular configuration of practices – there is a finite number of possibilities that can be appropriated in/by such a configuration – but with regard to the infinity of possible configurations of practices, the horizon is inexhaustible. By implication, the multiple entities and realities addressed by the studies of empirical ontology are

constantly in a state of situated transcendence. Approaching this state requires a (non-empirical) ontological reflection.[8]

The foregoing considerations imply the need of an extension – with regard to the concept developed in the preceding chapter – of double hermeneutics. In the extended concept, double hermeneutics should be seen as the way in which one relates radical reflexivity to the search for unveiling endogenous reflexivity as embodied in the interrelatedness of practices one is exploring. In elaborating on this relation, one is guided by the intention to reveal the potentiality-for-being (and accordingly, the ongoing situated transcendence) of the multiple reality constituted by (and within) this interrelatedness. Thus considered, double hermeneutics is a methodological strategy for doing justice to the ontological difference in the ontic study of multiple entities enacted in practices. In this scenario, double hermeneutics proceeds by paralleling ontological reflection and ontic-interpretative description. The reflection upon situated transcendence which is entitled to reveal the constitution of multiple entities in their potentiality (i.e., as embedded in horizons of possibilities) is an ontological reflection that ineluctably makes use of transcendental arguments. By contrast, the ontic-interpretative (ethnographic or ethnomethodological) description of how these entities circulate in changing configurations of practices is an empirical inquiry.

From a methodological point of view, double hermeneutics refers to the ways in which ontological reflection (upon the situated constitution of meaning) grounds the delineation of the empirical interpretation's objects of inquiry by disclosing the tendency to actualizing possibilities within the interrelatedness of practices under study (Ginev 2013b, 2014b). As I tried to demonstrate in the preceding chapter, the methodology of double hermeneutics takes into account the dual status of interpretation that is at once a cognitive procedure and also an "existential phenomenon". The hermeneutic realist addresses interpretation as an existential phenomenon by scrutinizing the meaningful articulation of reality's domains within "practices and possibilities". At the same time, interpretation is ubiquitous in all cognitive activities – from elementary perception and image recognition to the most sophisticated form of thinking. In this regard, interpretation is an ontic-cognitive ingredient of a wide range of practices. The methodology of double hermeneutics is entitled to reveal in each particular case of reality's meaningful articulation the ontic-cognitive manifestations of interpretation as an existential phenomenon. Thus considered, this methodology is a strategy of weakening the difference between the ontic and the ontological. An important part of this strategy is the resumption of the existential-analytical concepts of work-world and worldhood.

[8] In the Heideggerian tradition of hermeneutic phenomenology, empirical ontology (i.e., studies of domains' ontic structures) is dichotomously opposed to "transcendental ontology" (existential hermeneutics of the meaning of being). It is the methodology of double hermeneutics that manages to overcome this dichotomous opposition. Regardless of how significant the difference is, there is no cleavage between both types of ontology. Both types work in concert. The unfoldment of an interpretative description (and narrative) of multiple entities enacted in a multiple reality of concerted practices requires a cooperation between empirical studies of ontic orders in the making and ontological reflections about the integrity of a specific mode of being-in-the-world.

The distinction between work-world and worldhood, as discussed earlier, is in fact a special case of the distinction between factuality and facticity. (Describing a work-world amounts to producing factuality about what is ready-to-hand in a contexture-of-equipment). Thus, factuality consists in the totality of thematically given entities and "choreographies" (in the sense discussed previously). Factuality embraces, as it were, the whole of entities and practices composing a domain's actual reality. Furthermore, factuality refers to both the domain's normative orders and networks of causal relations. The domain's empirical ontology should make sense of these orders and networks by procedurally describing the enactments of entities in practices. By contrast, facticity is the ongoing constitution of meaning through appropriating possibilities projected by the interrelatedness of practices. Given the situated transcendence of what becomes constituted meaningfully, the appropriation and actualization of possibilities takes place within the same interrelatedness. Coming to grips with facticity requires hermeneutic-ontological reflection upon the interpretative interplay of practices and possibilities. (On several occasions in the course of this study, I stated that the distinction between factuality and facticity is seemingly the most straightforward way of explicating the idea of the ontological difference, but as a matter of fact these differences do not coincide. Empirical ontology [as developed in STS] is an ontological approach to factuality [and not to facticity], but it can and should involve ontological difference in its research scenarios.)

Let me reiterate, situated transcendence (of multiple entities and realities) is what remains inaccessible in (purely) empirical ontology. The relation of factuality to facticity brings to the fore the relativity of situated transcendence: Factuality is always situated in facticity, whereas facticity constantly transcends entities' actual reality. Yet both the way of situatedness (as an actual state within some leeway for possible states) and the way of transcendence (as an inexhaustible horizon of projected possibilities) are continuously changing as a result of continuous actualizations of possibilities that constitute meaning. By placing emphasis upon the hermeneutic fore-structuring of empirical ontology and by reflecting upon entities' potentiality-for-being, double hermeneutics makes the relativity of situated transcendence its principal theme. Thus considered, the hermeneutic fore-structuring relativizes ontological difference within the diverse scenarios of studying multiple entities and realities.

Integrating ontological difference in the studies of empirical ontology changes the thematic focus of investigation. More appropriate to the hermeneutically extended version of empirical ontology are not the local realities like "hospital Z", but, for instance, a global recasting of a disease (say, from a metabolic in an endocrinological one) and the concomitant changes of the corresponding illness. A purely empirical (ethnographic) study maintains its character by describing clearly localizable (in space and time) practices. Yet if the interrelatedness in which entities are enacted and multiplied is dispersed in many (physically disconnected) places, and at each of these places the "choreographies" are distinguished by their own regimes of temporality (of production and reproduction of entities and states), then obviously the temporal-spatial unity of the interrelatedness is not immediately

(empirically) given. Nonetheless, the human-nonhuman network (in which for this example a global recasting of an illness/disease takes place) presupposes the constitution of a non-empirical temporal-spatial "fusion" of clinical, scientific, diagnostic, technological, administrative-bureaucratic, and other practices. It is again a fusion-creating-dynamic-unity that requires for its analysis a non-empirical ontological reflection. A particular task of this reflection would consist in scrutinizing how the new network of practices in which the illness/disease being recast becomes enacted creates a new "chronotope". The latter is a unity of practices' temporality and spatiality that is never immediately given, but exists in horizons of temporalizing and spatializing of the enacted entity. The chronotope of interrelated practices is something that belongs to facticity and not to factuality. The ontic, human-nonhuman multiplication of what becomes enacted in the network of practices takes place in a chronotope that is constantly in the making.

Following a tendency in STS tradition of empirical ontology, I tried to adumbrate a move from radical reflexivity to double hermeneutics that integrates ontological difference in the empirical studies of multiple entities and realities. This move is in line, in my view, with the observation that the turn to ontology should not be seen as a way of grounding the empirical study of practices in a theory of what is ready-made (Woolgar and Lezaun 2013, 336). Doubtless, there is "idiosyncratic critical sensibility" involved in the reluctance to take the world at face value. It is this sensibility that has to be assisted by a radical reflexivity and a methodology of double hermeneutics. Thus, while the turn to ontology should continue to be an essentially empirical enterprise, critical sensitivity should be extended to cover the non-empirical dimensions of ontological interpretation.

As indicated earlier, the studies of empirical ontology demonstrate a clear commitment to post-metaphysical initiatives and agendas. The further engagement of these studies with radical reflexivity, double hermeneutics, and ontological difference will enhance their dialogue with hermeneutic phenomenology and other traditions of interpretative theorizing in which this commitment is of prime importance.

3 Concluding Remarks

As pointed out, the status of the "hybrid entities" – or the "artificialized natural entities" – occupies a central place in the studies of empirical ontology. Generally, these entities are the objects of inquiry of technoscience as studied in STS, provided that technoscience not only explores them but also operates in milieus populated with hybrid entities. (By implication, the hybrid entities are not only distinguished by a dualist status, but they – while being at once objects of inquiry and tools of technoscience – are also technologically scientificated entities and re-naturalized scientific-technological artifacts. This second-order duality was already touched upon when what was at stake was the problematic of life-worlds' scientification.) From the viewpoint of hermeneutic realism, the hybrid entities are artifacts (not necessarily

technological ones) that subsequently become re-integrated in natural systems. The hermeneutic realist opposes, however, the attempts at developing an "ontology of artificialization". Accordingly, she rejects the possibility of drawing a constitutive demarcation line between the natural and the artificial. Yet she admits that, like the status of the hybrid entities, together with their constitution as special objects of inquiry, the processes of artificialization are "written down" in a certain type of "texts" that contain objectifying conceptualizations of the formation of hybrid entities. (I have in mind the concept of "text" as it was discussed in the Introductory Chapter.) In another formulation, though the artificialization of natural systems is not studied specifically in the objectifying sciences, its totality as projected upon possibilities is "documented" in "texts" incorporating objectified factuality about hybrid entities.[9]

For the hermeneutic realist, therefore, tracking the formation of artificialized natural entities (and naturalized artificial entities) is in the first place an issue of scrutinizing the processes of textualizing certain domains of reality as they are disclosed for scientific inquiry: the domains in which the ways of "enacting" and multiplying these two kinds of entities are conceptualized. Let us recall that each "text" involves theoretically structured knowledge – as it refers to objectified factuality – constituted within (and by) a contextual configuration of scientific practices, granted that this knowledge is not detached from the facticity of inquiry. Thus considered, the "text" is not enclosed in a theoretical structure, but remains (a) open to interpretive fore-structuring within a horizon of possibilities and (b) dependent on its relevant context, which is always already inter-contextualized (i.e., related to all actually and potentially existing contexts in which the domain's meaningful articulation takes or may take place). Each "text" (1) contains knowledge about conceptualized factuality, and (2) "documents" conceptualizable reality through the way this knowledge is interpretatively fore-structured within a horizon of possibilities. To say that a "text" contains theoretically structured knowledge as it is contextually constituted and interpretively fore-structured amounts to stating that this "text" records/documents at the same time the (actualized and non-actualized) possibilities of the contextual production of objectified factuality within the facticity of inquiry. With regard to the enactment of hybrid entities, there are "texts" that do not conceptualize but record processes of artificialization as the totality of such a process is projected upon possibilities. Some of these possibilities may become reflected in the theoretical knowledge and the objectified factuality in the "text" as a relatively autonomous cognitive structure, but the totality remains not conceptualized by the theoretical knowledge. My claim is that "texts" incorporating theoretical knowledge about hybrid entities are constituted in the facticity of inquiry which opens possibilities for studying the processes of artificialization. In addition to this, I state that only this facticity opens such possibilities that become recorded in the

[9] Cultural studies will often address the genesis and the circulation in practices of hybrid entities. Yet, like empirical ontologies, cultural studies does this in a purely factual manner without taking into account the ways in which the ontological difference between factuality and facticity operates in the constitution of hybrid objects.

respective "texts". The totality of a process of artificialization can be "read off" by scrutinizing the textualizing through which the "text" is constituted. (As I will try to show, studying the totality of a process of artificialization in this way is not to be confused with re-contextualization of "texts" aiming to extend the objectified factuality about natural entities to cover the properties of artificialized entities.)

The important difference which I allude to when stating that something is written down, recorded, or documented in a "text" – independently of what is incorporated as a theoretically structured knowledge – can be elucidated as follows. The theoretically structured knowledge involved in a "text" is the outcome of a procedural objectification. This knowledge refers to objectified factuality. The "text" contains explicit knowledge about what is procedurally objectified within its relevant context. But in addition it documents something that is of a quite different nature. The production of theoretically structured knowledge is fore-structured by the interplay of practices and possibilities in the facticity of inquiry. Accordingly, the "text" documents/records this facticity as a horizon of possibilities that fore-structures the production of factuality. What is thus documented is not included in the explicit knowledge. Hence, in the "text" something is "written down" that is not a subject of procedural objectification in the process of inquiry. For instance, producing objectified factuality regarding climatic changes is one thing, but scrutinizing the horizon of possibilities within which the conceptualization of these changes takes place is quite another. In the latter case, the artificialization of climate systems – as it is projected upon possibilities – becomes documented in the "texts" in which the conceptualization of climatic changes (including the enactment of hybrid entities) turns into theoretically structured knowledge. It is this claim that will be unfolded in the rest of the concluding remarks.

Against the background of the foregoing considerations, the concept of "text" might tentatively be defined in two ways: one in quasi-epistemological terms and another closer to hermeneutic ontology. In the former way, each "text" consists of theoretically structured knowledge as it is situated in and transcended by the interplay of practices and possibilities. In the second way, each "text" records the choices and actualizations of possibilities whereby the contextual production of objectified factuality comes into being. (The "text" documents factuality projected upon possibilities revealed within the facticity of inquiry, or it records possibilities that always already transcend the actually objectified factuality.) Reflecting on the process of textualizing enables one to unify both ways of treating "texts". It is my contention that the best way of studying the meaningful multiplication and scattering of hybrid entities in networks of practices is not through direct ethnographic descriptions that result in empirical ontologies, but through "inspecting the destiny" of such entities via studying kinds of textualizing in which indirectly at issue are processes of artificializing the natural and naturalizing the artificial in various domains of reality disclosed to scientific objectification. (It is this "destiny" that is projected upon possibilities opened by that facticity in which the domain's textualizing takes place.) The shift of focus – from empirical ontologies to scrutiny of "texts" in which the formation and subsequent enactments of hybrid objects are

constituted as objectified factuality – does justice at the same time to the problematic of reflexivity as discussed earlier.

Following this line of reasoning, the issues that should be addressed first concern the type of "texts" in which the constitution of hybrid entities – and the multiple ways of their "enacting" in supposedly "natural systems" – as objects of inquiry becomes recorded (again, as a constitution projected upon possibilities). My claim is that the hybrid entities are conceptualized via re-contextualization of objects already "textualized" as purely natural objects and represented by objectified factuality.[10] This re-contextualization conceptualizes the hybrid entities – by producing objectified factuality for them – but it does not deal at all with the artificialization of the systems in which they are enacted. The outcome of re-contextualization is the constitution of "texts" that, on the one hand, incorporate structured knowledge about the ways of saving phenomena through data models and theoretical scenarios, and on the other, record the "destiny" of transformed natural systems – say, climate systems in which "artificialized natural objects" (like "clouds reacting to global warming" and "clouds taking part in tropical deforestation") are enacted. By implication, documented in such "texts" are possible ways of artificializing climate systems in conjunction with the multiple enactments of hybrid entities due to the forcings caused by human activity. Thus, to continue the example, greenhouse gases (like carbon dioxide and methane) are natural entities per se. They interact with another kind of natural entities – the clouds – and the result of this interaction is artificialized climate changes.[11]

Thus considered, the changes affected by greenhouse gases are rooted in the interaction of two kinds of natural entities (aerosols and clouds), and this interaction brings into play the formation of hybrid entities, on the one hand, and their multiple

[10] The phenomena observed and measured in this artificialized reality are saved (by meteorological theoretical scenarios) as quasi-natural events that are registered by long-term weather statistics. Thus, a climate forcing induced by human activities is "discovered" through taking measurements of variables like soil moisture, temperature, flora distribution, or salinity.

[11] Arguably, climatological objects of inquiry – more specifically, those creating (and created by) climatic changes – are nowadays among the most discussed hybrid entities distinguished by a "natural-artificial origin". It would be worthwhile to carry out a special study of the constitution of climatological "texts" in which – by means of re-contextualizing traditional objects of inquiry – one tries to objectify factors of climate change related to human activities as mingled with natural causes (such as solar radiation and volcanic eruptions) of these changes. In describing and measuring climatic changes through data models, one is not obliged to look for a clear separation between natural variability and human-technological interference (e.g., emissions of greenhouse gases and aerosols). It is the theoretical scenario that by saving phenomena captured by these data models one should establish the role of the interference mentioned. As a rule, the scenario "decides" what is to be treated as an anthropogenic factor of changes. Yet the theoretical scenario remains indifferent to the central subject of climate's artificialization: how the ways of "enacting" artificialized natural entities – that subsequently are multiplied due to various sorts of feedback – are artificializing climate systems (including the global climate system consisting of the atmosphere, oceans, land, and continental glaciers). Needless to say, the objectified factuality re-naturalizes the multiple enactment of artificialized natural entities.

enactments in climate systems, on the other. Strictly speaking, clouds as purely natural objects are also conceptualized as aerosols that can be studied, in particular, by means of colloid chemistry. Within the domain of nephology the "natural clouds" are approached as physical objects described by measurable properties like base temperature, liquid water content, saturation vapor pressure, concentration of cloud condensation nuclei, and amount of cloud droplets, etc. These are properties that can be conceptualized in terms of (say) thermodynamics, fluid motions, chemical reactions, and radiative transfer. Typical theoretical scenarios worked out in the domain of nephology are those entitled to save cloud-related meteorological phenomena by appealing to alterations of clouds' microstructures due to hygroscopic particles called cloud condensation nuclei. The alterations consist in changes of the concentration of cloud droplets and the size spectrum of clouds of these droplets (Cotton and Pielke 2007, 75). The description and saving of such phenomena is contextualized by practices of the microphysics of precipitation processes, practices of measuring cloud dynamics, practices of experimentation with the factors of precipitation, experimental identification of prolific sources of small condensation nuclei, practices of using satellites for estimating cloud droplet sizes, practices of measuring variations in the energy as longwave radiation emitted by the atmosphere, practices of measuring the absorption of terrestrial radiation by different types of clouds, and practices of studying clouds by computer model simulations.

At the same time, "texts" in nephology and other climatological domains record or document, for instance, the fore-structuring of contextually constructed theoretical models about how pockets of high moisture concentrations occur, thereby capturing a much wider range possibilities than the range of actualized possibilities in the domain's articulation. Through such models one saves phenomena related to (say) the formation of cumulus clouds as this formation is dependent on the landscape structure already transformed by human activity. Textualizing the domain of nephology is a process of articulating a natural domain of reality. But at the same time, re-contextualizing "texts" of nephology – by taking into consideration that the interaction of clouds with aerosols produced by human activity can contribute to the creation of artificial states (like reducing low-level cloud cover, making clouds darker, and lowering the albedo of snow) – conceptualizes the behavior of hybrid objects without, however, conceptualizing the very process of artificialization. This kind of extended textualizing reveals "artificial (non-natural) markers" in the disclosed domain of reality. Re-contextualizing "texts" constituted in nephology – by following the origins of these markers – leads to the creation of new "texts" that incorporate knowledge about the formation of unwittingly artificialized clouds. This knowledge involves data models that measure "climate sensitivity", provided that cloudiness is a parameter of this sensitivity.

Textualizing the formation of hybrid entities like the unwittingly artificialized clouds, through re-contextualizing "texts" constituted in nephology, proceeds by constructing theoretical scenarios for quasi-natural events. This kind of textualizing seems to be the only way of diagnosing the disorders of global natural system with-

out injecting ideological and value-oriented assumptions into the process of inquiry. The constituted "texts" incorporate theoretical knowledge and objectified factuality about (say) a change in energy flux at the tropopause (the boundary between the troposphere and the stratosphere) that indicates the effects of an enactment of hybrid entities. The structure of this knowledge does not differ from the structure of knowledge incorporated in the usual "texts" constituted in climatology as a natural science. Yet what becomes incorporated in these "texts" is objectified factuality about forms of climate radiative forcing, which supposedly does not belong to natural science. Identifying further the profile and the causes of the perturbation – as well as of possible feedback – requires a further re-contextualization of the "texts" that would be able to capture the production of precursors of aerosols, rendering possible the ways of "enacting" unwittingly artificialized clouds. The new "texts" would also contain knowledge about how the rising concentration of anthropogenic aerosols in clouds changes the amount of energy reflected by the clouds thus artificialized. The relevant context of this "text" can be made sensitive to studying (say) relations between industrial production of aerosols and the behavior of artificialized clouds that slam the atmospheric window. It is this kind of conceptualizing of the forms of "enacting" – as related to forms of climate forcing conceived of as an induced energy imbalance – that adduces evidence of the slow dying process of global natural systems.[12] The models or theoretical scenarios incorporated in the constituted "texts" might be sufficient for diagnosing the state of deceasing. But they do not have the resources for investigating the role of the systems' artificialization in this state. The artificialization cannot be represented by the objectified factuality produced through these models and scenarios.

In incorporating the conceptualization of climatic changes caused by unwittingly artificialized clouds (like greenhouse substances), the "texts" are naturalizing the multiple enactments of the hybrid entities in climate systems in a manner that prevents one from seeing them as part and parcel of the artificialization of these systems. The multiple enactments are represented, for instance, as objectified factuality about changes in the relative amounts of high versus low clouds that contribute to reducing or enhancing the amplitude of the warming. An enactment is contextually objectified (naturalized) by exploring the sensitivity of the climate system to a forcing. Unwittingly artificialized clouds – obtained in the first place by the aerosol

[12] The observation that pollution enhances the concentration of hygroscopic particles is not an observation about the artificialization of a climate system. It is only an observation of how the respective natural system reacts to external interventions by enhancing the amount of intrinsic feedback. (More than half of the predicted warming will not be caused directly by greenhouse gases but by feedback like the reduction in the fraction of incoming solar radiation reflected back to space as snow and ice cover recede.) The naturalist extension of textualizing the domain of nephology cannot capture the "enactment" and multiplication of hybrid entities like the unwittingly artificialized clouds. It only objectifies artificially induced climatic changes. Capturing the artificialization of climate systems should go much further than ending with the registration of these changes.

climate forcing – generate the most important global climate feedbacks as mechanism of artificializing climate systems. In my knowledge, there is nowadays a lack of good models for the effects of this feedbacks. But even if there were such models, they would not be capable of conceptualizing the artificialization of climate systems. "Enacting" unwittingly artificialized clouds becomes naturalized when the transformed climate systems are, for instance, described by models based on aerosol-cloud physics. Nonetheless, such models tell us, in particular, that "enacting" unwittingly artificialized clouds makes global warming spatially heterogeneous.[13] They quantitatively describe how, depending on their areal dynamics, these clouds amplify or reduce the effect of warming as associated in particular with sea level rises.

What becomes objectified in these models is, inter alia, the increased tendency toward drought and the increased rainfall rates as they are related to changes of plant and animal habitat. Through the models in question, one gains theoretically structured knowledge about the "multiple reality" – due to forcings – of the climate systems in which unwittingly artificialized clouds are "enacted". My claim is that precisely these "texts" incorporating such theoretically structured knowledge document the way of climate systems' existence as projected upon possibilities. These are at once possibilities in the systems' "destiny", and possible ways of studying the artificialization of climate systems. More specifically, the possibilities of artificializing natural systems are only to be explored by appropriating possibilities for doing research revealed by the facticity of inquiry that constitutes "texts" in which the multiple enactments of hybrid entities are objectified.

[13] The unwitting formation of artificial clouds chiefly consists in the increased number of nuclei and the tendency toward inhibiting the rainfall caused by smaller droplets, thereby increasing the lifetime of the average cloud cover on Earth. Studies of climatic changes that conceptualize the "unwittingly artificialized clouds" constitute the special kind of "texts". These studies show that the artificialized clouds are unwillingly "enacted" in climate systems as new absorbers and emitters of terrestrial radiation. Anthropogenic sources of cloud condensation nuclei (like automobile emissions, the burning of vegetative matter, and industrial combustion products) do not create but "enact" unwittingly artificialized clouds. In another formulation, these are sources of turning natural clouds into anthropogenic aerosols within natural climate systems. To reiterate, several processes and phenomena taking place in this situation can be contextualized by integrating new research practices and forming new contexts in the domain of nephology. The "enactment" of anthropogenic aerosols in climate systems is an artificial process that can be – on the level of theorizing – "naturalized" by means of proper textualizing within the newly formed contexts. A case in point are the studies modeling aerosol influences on precipitation by following "pollution tracks" as viewed by satellite imagery. Such tracks are exhibited not only by warm clouds, but also by clouds in areas where ice precipitation processes are prevalent.

Meaningful Articulation and Objectification of Reality in Scientific Inquiry

1 Prelude

My starting goal in this chapter is to spell out in more detail the distinction between contextures-of-equipment and contexts of inquiry as it was preliminarily depicted in the Introductory Chapter. I will cite again the established/received view: A scientific practice consists of actions and activities following a rule(s) in pursuing a goal. This view implies a purely "humanistic" approach to studying science as practices. All (non-normative and normative) elements of a scientific practice are determined by cognitive, volitional, and emotive faculties and dispositions of humans. However, I argued that the interrelatedness of (scientific) practices has ontological primacy over each and every particular practice of inquiry. The "humanistic" approach is no longer to be applied to this interrelatedness. The latter has a being in the interplay of practices and possibilities understood as the facticity of inquiry. In another formulation, the potentiality-for-being of the interrelatedness of scientific practices (disclosing a domain of reality) is always involved in a hermeneutic circularity. Thus considered, the interrelatedness is not only a dimension of the trans-subjective facticity of inquiry, but also of characteristics that post-humanist trends in science and technology studies (STS) describe. The interrelatedness of scientific practices is not determined by human faculties, and for this reason, it can be characterized as a "trans-human" facticity (i.e., transcending the human factors organizing the single practices). It is precisely this characterization that seems to be in line with those trends in science studies which advance strategies of deconstructing the imposed borderlines between humans and nonhumans involved in technoscience.[1]

[1] Like the "meaning of being" in hermeneutic phenomenology, the meaning informed by practices' potentiality for being is not to be "anthropologically deduced". In hermeneutic realism, all "human factors" are particular meaningful entities, events, and processes that are enacted qua "factors" due to particular contextualization. Humans are in a state of situated transcendence with respect to contextualizing facticity.

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Yet the hermeneutic-realist approach to undoing any metaphysically postulated division between human and nonhuman agents in favor of the "logic of practices" within the facticity of inquiry differs in several respects from the strategy of accentuating the role of the nonhumans (like animal organisms and technological artifacts) as this strategy is supported by post-humanist trends. Supporters of actor-network theory, of agential realism, and of empirical ontologies as well as other posthumanists predominantly attach importance to the issue of agency and the concomitant criticism of the reduction of agency to intentional human action.[2] The constant rearrangement of orders in technoscience involves the agency of humans and nonhumans. Thus considered, coming to grips with the "agential interference" does not require the ontological difference between factuality and facticity. Since humans and nonhumans alike are actors working in a strongly causal manner, all that they do and perform is to be registered as the objective factuality of causal effects. The kind of reverse naturalism once launched by the Strong Program is now extended in accordance with the new concept of agency.

Interestingly enough, this extension corresponds to the revised principle of symmetry as suggested by actor-network theory (ANT). This theory does not break with the tradition of absolutizing sociological factuality. Latour argues that ANT is not an initiative of compromising between micro and macro, or actor and system. Instead, ANT proceeds (a) from actors' accountability, (b) via rendering the "social fluid" of local interactions collectable, (c) to a "topography of the social". Following this trajectory, one should realize that "macro no longer describes a wider or larger site in which the micro would be embedded … but another equally local, equally micro place, which is connected to many others through some medium transporting specific types of traces" (Latour 2005, 176). This deconstruction of micro-macro opposition that allows one to consider at once the actor and the network in which it is integrated promises to take into account the spatializing and temporalizing facticity of the social. Yet the promise remains unkept. The topography of visible and empirically traceable sites uses the same sociological factuality which, say, the programs of structural functionalism appealing to micro-macro opposition use. For Latour (2005, 179), an actor-network is traced whenever – in the process of conceptualizing it – the decision is made to replace actors by local and connected sites. This replacement is at the same time a necessary condition of undoing any allegedly basic difference between humans and nonhumans: In these local and connected sites the merger of human activities and nonhuman entities takes place. However, the sites are again to be described as manifolds of factual discrete elements.

In hermeneutic realism, by contrast, the amalgam of actors integrated in a local network is always factually contingent, but it is prepared by a contextualization whose examination requires reflection upon facticity and the hermeneutic situation of contextualizing. Accordingly, the studies of the "trans-human reality" of technoscience cannot circumvent the difference between factuality and facticity. Following this line of reasoning, it should be noted that the hermeneutic realist is not so

[2] See, for instance, Schtazki (2002, 189–208). Schatzki champions a position that tries to balance between post-humanistic approaches and the "humanistic" theory of action.

interested in "heterogeneous networks" and "socio-technical-scientific assemblages". Her primary concern is rather with the immanent "hermeneutic logic" of scientific practices' interrelatedness, i.e., the "logic" of those ("trans-human") features and phenomena which are entirely informed by the being-in-interpretation of scientific inquiry. Among these features and phenomena are scientific practices' endogenous reflexivity, a kind of quasi-quantum entanglement of the contextures-of-equipment with the contexts of configured practices, and the complementarity of meaningful articulation and procedural objectification. It is this "logic" that will be examined in the present chapter.

The concept of environment as it stems from Heidegger's elaborations on the phenomenology of existential spatiality will provide the point of departure of my considerations in the present section. The totality of environments (each of them created by a particular practice) brings into being the worldness of the world in which every human is always already "thrown". The facticity of inquiry is built upon the worldness of the world, but (in contrast to the facticity of the "average everydayness") it manages – through the interplay of scientific practices and possibilities for doing research – to contextualize reality in a unique way. As already argued, due to this unique contextualization scientific inquiry articulates and objectifies the domains of reality. The interweavement of environments (of contextures-of-equipment) as characterizing the worldness of the world does not suffice to disclose these domains. Accordingly, the totality of environmental contextures-of-equipment does not reveal reality. (Here I have in mind not only the contextures of pre-scientific everydayness, but also the multitude of local contextures-of-equipment organized by the operativeness of particular scientific instruments, granted that they are treated as disentangled from the interplay of scientific practices and possibilities.) But the environments of the particular scientific practices are part of the facticity of inquiry in which domains of reality are disclosed to be objectified. The interplay of interrelated practices and possibilities in which this disclosure takes place constitutes contexts that are irreducible to environmental contextures-of-equipment. The concept of environment should be addressed with regard to the entanglement of contextures with the contextualization of facticity.

An environment is a temporal-spatial regime of a reproduction of actions and activities involved in the respective practice. It is a reproduction that in certain cases tolerates, prompts, and promotes deviations from (and innovations in) the temporal-spatial regime. But basically, the environment is arranged and designed with the objective of conserving the routine order of actions and activities. Putting the issues of temporalizing aside for the moment (and concentrating on that of spatializing), I will argue that in the reproduction of actions and activities, any scientific practice produces a physical-social environment.[3] Thus considered, the production of

[3] In line with Willem Hackmann's (1989) study, one might state that the different types of scientific instruments in the early modern time organize different interactive spatialities. In this regard, the experimental construction of novel phenomena through "active instruments" (Hackmann) was also a spatial event of interaction between experimenter and instrument. Of course, this interaction has been embedded in an immense social space (also involving the marketplace of instruments-as-

environment through the reproduction of actions and activities involved in a particular practice is to be seen as a minimalist version of what Henri Lefebvre conceives of as the "production of space". According to him, this production has to be analyzed in a manner that reveals social space "in its particularity to the extent that it ceases to be indistinguishable from mental space (as defined by the philosophers and mathematicians) on the one hand, and physical space on the other" (Lefebvre 1992, 27). Thus, the production of such a social-mental-physical space is discretely structured by relations of production understood in a sense close to that of the Marxist mode of production.

By contrast, Heidegger's approach to existential spatiality dispenses with the idea of discrete structuration. (Like the continuity of the "temporalizing of temporality", the existential analytic offers several ideas for making sense of the figure of the continuous "spatializing of spatiality".) Any particular environment belongs to a particular contexture-of-equipment. But there is no contexture-of-equipment that can be isolated from the continuum of the worldness of the world of routine circumspective concern (Heidegger 1962, 97). Consequently, there is no environment that can be represented as a discrete structure of relations. Hermeneutic realism follows the Heideggerian approach to the continuous production of environments. Yet the hermeneutic realist recasts this approach in terms of entanglement of the contextures-of-equipment with the contexts of inquiry. Heidegger's existential conception of science prohibits such entanglement, restricting the continuum of moving and interlacing contextures to the worldness of the world (and the practical-prescientific mode of being) only.[4] The contextures-of-equipment in scientific inquiry work ambivalently: They manage at once (a) to maximally enclose their environments and (b) to create "mechanisms of exchange" (Peter Galison) that more or less open these environments. To a great extent, this ambivalent functioning is due to the nature of scientific instruments.

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commodity) shared by all communities committed to the production and use of scientific instruments.

[4] As I argued, the relations between the worldness of the world and the work-world are a matter of particular interest for the hermeneutic realist. These relations have much to do with the investigation of how the practices of any particular mode of being in the world arrange the worldness of the world. The everyday-practical experience (of the average-inauthentic mode of being) maintains through its circumspective concern the interlacement of environmental contextures-of-equipment as a totality of a certain work-world. Depending on how the circumspective concern contextualizes what is ready-to-hand, a particular "working arrangement" of the worldness of the world comes into being. The relations between the worldness of the world and the work-world are touched upon in Section 15 and Section 26 of *Being and Time*. But Heidegger does not study them in a systematic manner. He assumes that a particular work-world – the work-world of the craftsman, for instance – is an actual state of affairs within the worldness of the world. It becomes clear from his elaborations that there is a manifold of work-worlds, each of them arranging the worldness of the world in a specific way. Heidegger further concedes that the work with which one concerns oneself contextualizes readiness-to-hand in both the "public world" and the "environing nature". Thus, the respective work-world always arranges the worldness of the world as an amalgam of contextualized public-natural utensils ready-to-hand. Arranging the worldness of the world as a work-world is an essential aspect of facticity.

Though maintaining the rigid orders within their contextures, scientific instruments (as "knowledge-producing machines") follow "patterns of exchange, use, and coordination" with other machines that sometimes are far from processes of inquiry (Galison 1997, 51). These instruments acquire meaning not only through arranging their laboratory environments, but also via their material links to other laboratory spaces. Galison speaks of a movement of scientific instruments within different "subcultures of laboratory practices" across various contextures-of-equipment. It is this movement that puts into effect new practices of arranging the "material culture of the laboratory". Nonetheless, in contrast to the contexts of inquiry, the contextures-of-equipment in scientific research are to a great extent isolated from each other. This allows one to treat their environments as relatively enclosed spatial structures. However, the price one has to pay for this treatment is the factual objectification of the research process, which prevents one from addressing the issue of entanglement of contextures-of-equipment with contexts of inquiry.

A splendid illustration of the "environmentalization" of individual scientific practices is provided by Steven Shapin's investigation of the social-physical spatiality of the seventeenth-century practices of experimentation, when the laboratory as the site of doing experiments became socially institutionalized. Yet the laboratory was at that time by no means the exclusive site (spatially arranged environment) of experimenting and generating experimental discourse. Shapin (1988, 378) points out that – along with private places like Robert Hooke's place of residence – the sites of experimental work "ranged from the apothecary's and instrument maker's shop, to the coffeehouse, the royal palace, the rooms of college fellows, and associated collegiate and university structures." All of these sites provided primitive contextures-of-equipment for experimentation. The incremental institutionalization of laboratory-experimental praxis upon the emergence of the Royal Society – as an institution that for the first time determined the formal conditions of entry to the spaces of experimentation – created the social-physical threshold for having publicly recognized environments of the practices of experimentation. The threshold was a mechanism that guaranteed models of space in which solitude – as a symbolic condition for the experimentalist to claim authenticity for his work – was legitimate. The spatiality of experimentation as enabling this solitude "defined the circumstances in which the new 'priest of nature' might produce knowledge as certain and as morally valuable as that of religious isolate" (Shapin 1988, 387). The first important caesura in this spatiality took place when Robert Hooke proposed to some honorable fellows to see some experiments with an air pump at his lodging. In analyzing this case, Shapin (1988, 404) concludes that "the normal pattern of movement in seventeenth-century experimental science was reversed: those who wanted to witness experimental knowledge in the making came to where instruments permanently lived, rather than obliging the instruments to come where witnesses lived." It is perhaps this caesura that marks the birth of a genuine environment of scientific activities and of a contexture-of-equipment for inquiry.

Michael Lynch's ethnographic studies of laboratory practices show how the aforementioned concept of the social-physical threshold of entering the spaces of experimentation became radically changed in the second half of the last century. A

special focus in these studies is the constitution of environments of particular practices. In his conclusion, these physical-instrumental environments are arranged not only to offer an optimal spatial functionality to the actions and activities accomplished within them, but also to become the "places of knowledge". The spatiality of the experimental practices is constituted to enable the transit to the epistemic spaces of scientific inquiry. Otherwise, this spatiality would destroy the facticity of inquiry. The physical space of the elaborated experimental systems is endowed with an "ecology of locally organized topical contextures" that proves to be the manifold of material-instrumental places of generating scientific knowledge (Lynch 1991, 74–75). (Shapin's)studies confirm this thesis as they demonstrate that the spatiality of early-modern experimental practices are at the same time the "sites of experimental discourse".)

Lynch accentuates the nexus between scientific practices' environments and the "places of knowledge" because his aim is to show that these places are first and foremost material settings, and not *topoi* within the idealizing cognition. The ethnomethodological studies of processes of inquiry are guided by the dictum that scientific knowledge is engendered where scientific activity is spatially generated. The contextures-of-equipment of scientific practices inhabit a material ground. (However, this claim might be generalized by stating that conceptual, mathematical, or purely theory-constructing practices of scientific inquiry have their own contextures-of-inquiry that predominantly inhabit a cognitive ground. In universalizing the concept of the contexture-of-equipment to be valid for all practices of inquiry, the hermeneutic realist does not restrict it to contextures equipped with physical instruments.)[5] For Lynch, if one wants to understand the space where scientific knowledge is produced, one is to confront an "ecology of local spaces" (involving walls, room dimensions, partitions, enclosures, and restrictions on entry) integrated with disciplinary practices. By his account, scientific knowledge is what counts in particular material and instrumentally equipped settings as convincing arguments (intrinsically tied to the practical devices) through which phenomena become accountable. The production of scientific knowledge does not rest on immanent cognitive processes that are nontransparent to approaches studying practices of inquiry as spatially organized in their instrumentally equipped environments.

However attractive this ethnomethodological picture might look, there is something missing in it that is crucial for the production of scientific knowledge. The environments of the particular contextures-of-equipment are constituted by (and are constituting) elementary research activities. They are places suitable for dealing with contingent facts or for collecting data, but they are too simple for organizing (spatially non-localizable) networks of various kinds of activities which may produce effective and convincing arguments for making phenomena accountable, i.e., for producing knowledge capable of saving phenomena. In fact, a contexture-of-equipment as providing the environment of the activities of a single practice of inquiry is not appropriate at all for registering and describing a phenomenon that is

[5] Ethnomethodologists also pay close attention to the specificity of purely conceptual practices of inquiry. In this regard see Lynch and Jordan (1995).

in need of being theoretically saved. It is an impossible mission to do justice to the production of scientific knowledge – designed and structured to save phenomena – by being exclusively preoccupied with the local orders of engendering knowledge. (In studying the incremental expansion of the institutionalized working place for doing [experimental] research, Galison introduces the notion of "outer laboratory" to cover the relevant professional macro-environment. He argues that the formation of the latter does not preclude the micro-environment constituted by idiosyncratic initiatives. There is no relation of determination between the two types of environments. By the same token, the transitions from the "inner" to the "outer" laboratory are not to be described in terms of causal chains. But they also cannot be made intelligible by meticulous descriptions of extending social orders. The micro- and macro-environments are rather mutually presupposing each other. Galison discusses the cases when the distinction between "inner" and "outer" spatiality for doing research loses its meaning as the major laboratories delocalize their outcomes through networks of computer analysis and control.)

The difficulties which the ethnomethodologists are facing when trying to come to grips with the complexity of the practical constitution of scientific knowledge that has the potential to disclose a domain of reality as being amenable to becoming objectified are by no means reducible to technical problems of moving from micro- to macro-levels of analysis. (As already discussed, Latour's approach to deconstructing the micro-macro opposition might be quite helpful in this regard.) The kernel of these difficulties is the inability of ethnomethodology to cope with the facticity of scientific inquiry. Ethnomethodology replaces this facticity with the factuality of the local orders of knowledge production, granted that this factuality is a subject of a kind of phenomenological description and not of empirical-analytical study. However, in skipping (or in being unable to deal with) the facticity of scientific inquiry, one fails to address the specificity of scientific knowledge. It is an illusion that science's capability to reveal reality might be accounted by meticulous descriptions of local scientific accomplishments. The "ecology of local spaces" and local orders of activities lack the resources to deal with contexts of scientific inquiry that have complex spatial organization, but do not have environmental localization. The champions of this ecology are confronted with a dilemma upon whose horns the destiny of the anti-essentialist approach to scientific practices is tossed: Either phenomenological description of environments or deductive explanation that nolens volens hypostatizes of non-local structures and orders. The hermeneutic realist denounces this dilemma. It does not exist, since the non-locality of the interrelated scientific practices can be accounted without hypostatizing hidden (explanatory) essences.

There is certainly no hidden foundation behind or beneath the diversity of material-instrumental settings and local orders of scientific knowledge production that is presumably responsible for the generalization of contingently produced pieces of knowledge. Ethnomethodologists are absolutely right in their scrupulous concern of avoiding any hypostatization of global orders of scientific knowledge production, as such orders are envisioned not only by all kinds of normative epistemology, but also by most of the programs of cognitive sociology of science. For

them, Foucault's discontinuities between spaces of discursive production are the starting point in dealing with the contextual generation of scientific knowledge. Yet to state that these discontinuities and all environmental contextures of knowledge-constituting scientific activities take place within the continuity of interplaying practices and possibilities for doing research does not amount to asserting that hidden foundations are unifying the local orders of knowledge production. Roughly, the interplay of practices and possibilities opens a horizon that brings into being the integrity of the dispersed contextures-of-equipment of scientific activities in a given domain of research. How this interplay operates in integrating the local "places of knowledge" is an issue that cannot be addressed by means of ethnomethodological description. The treatment of this issue requires (a) the introduction of a proper ontological difference in addressing the production of scientific knowledge and (b) the elaboration on a methodology of double hermeneutics as a way of coming to grips with the facticity of scientific inquiry.

Now, the statement that the exclusive preoccupation with the local orders of scientific knowledge production precludes one from the possibility to address the issue of how science discloses and meaningfully articulates reality does not entail that the production of conceptually elaborated scientific knowledge is not also contextualized. The statement only implies that the contextualization of the scientific knowledge through which the reality of saved phenomena becomes revealed does not take place in the contextures which are the central topic of Shapin, Lynch, and many other cognitive sociologists and ethnomethodologists. This knowledge is obviously produced in much broader contexts that do not have fixed environmental localizations and do not provide a homogeneous spatial organization of actions and activities.[6] After inducing experimentally constructed and measurable phenomena, the whole research process leaves the contextures of experimental instrumentation, thereby becoming contextualized by other communities and audiences participating in the production of scientific knowledge. Yet the contexts I have in mind are by no means disentangled from scientific inquiry's local environments and contextures-of-equipment. Leaving the contextures of experimental instrumentation is not to be understood in a literary sense – like I am now leaving this room – but as a broadening of the site of knowledge production.

How to cope with this picture of intertwining non-localizable orders of scientific revealing, articulating, and objectifying domains of reality with the inescapable locality of the actions and activities of scientific inquiry is a principal preoccupation

[6] The increasing spatial heterogeneity of the production of scientific knowledge is intrinsic in the evolvement of practices of experimentation. It is the growth in the range of instrumentation that has contributed to the growing complexity of the spatiality of knowledge production. The experts on scientific experimentation are unanimous in arguing that phenomena are released in and by instrumental manipulation. But what is the destiny of the released phenomena? The theoretical plots endowed with power of explanation and argumentation do not meet the released phenomena within the experimental contextures-of-equipment (the workplace of experimenters). This is already a sufficient argument for disavowing the view that by scrutinizing the local orders of research activities, one is in a position to address the entirety of the production of scientific knowledge.

of the hermeneutic realist. Tentatively, I would like to point out that the quest for a "methodical order" leading step by step from the particular environments and contextures of instrumental manipulation to contexts of producing theories with fundamental symmetries and unifying equations is a productive enterprise when at stake is the issue of transportation of instrumental and discursive practices from the prescientific life-world into the sites of scientific knowledge production. Yet it is a futile enterprise when one should address the transitions from contextures of equipment to the constitution of (what I call) "texts". The local spatial-instrumental settings of scientific activities and the contexts of inquiry enabling the saving of phenomena are not subordinated in an ascending order, but are entangled with one another. It is the kind of entanglement that is at stake in hermeneutic realism.[7]

I will conclude the section with a brief comment on an approach that is seemingly pertinent to the problematics discussed so far. Peter Galison (1997, 46–63) implements his model of "trading zones" to explain the "context of context" of the cooperation of scientific subcultures committed to diverging forms of theorizing and experimentation. He aims at discovering forms of cooperation among divergent forms of inquiry under the conditions of an increasing heterogeneity of scientific subcultures. The trading zones of exchange do not need global agreement. They are intermediate zones in which practices could be coordinated locally even where the articulated meanings clash. The local coordination of practices within trading zones accounts for how local knowledge becomes widely accepted. Working the local exchanges out – so Galison's argument goes – would allow one to figure out the possibility of locally convergent meanings between globally diverging subcultures. The boundary work is conceived of as a production of local languages which grow in the interstices between subcultures. The global divergences can be set aside, while the local exchanges should be worked out. In so doing, one becomes entirely preoccupied with the question of how science manages to create a homogeneous order within its diverging subcultures. In my view, Galison's approach provides an excellent account of dynamic interlinks and interfaces within the unsurmountable and growing heterogeneity of scientific subcultures. However, this approach seems to be irrelevant to the issue of the relatedness between contingent contextures of equipment in which scientific work is situated and the contexts whereby this work discloses, articulates, and objectifies domains of reality.

[7] To reiterate my argument, the methodical orders as envisioned by the Erlangen School's constructivists are always already within the hermeneutic circularity of the interplay of practices and possibilities. Surely, the "justificatory recourse" to the life-world makes no fundamentalist claims, but invokes a normative directedness that is hardly to be found in scientific inquiry. The Erlangen constructivists do not offer scenarios of the articulation of (methodical) norms, and this is due to the hermeneutic deficiency of their program.

2 Contextures-of-Equipment and Contexts of Inquiry

2.1 A Scientific Practice from Within and Without

My point of departure in this section is a tentative illustration of the received view of scientific practice as an array of spatially-temporally organized, normatively ruled, and goal-oriented actions and activities. Suppose that the goal is to obtain an experimental verification of a theoretical prediction (derived from the Standard Model of the unified electroweak theory) about how a collection of elementary particles of a certain type behaves. (Suppose that the test for this prediction requires the production of particles called intermediate vector bosons in a certain range that is suitable for theoretical calculations through models of quantum chromodynamics.) The relevant practice of experimentation in this case is rather complex and operates using highly sophisticated technical equipment. Together with the entities which the actions enact (make ready-to-hand) and environmentally arrange, the practice forms a contexture-of-equipment. Suppose further that this is a certain practice of experimentation in collider physics, say the production of antiprotons at an accelerator by bombardment of a target with a high-energy proton beam.

For clarity, imagine in addition that this practice came into being in the second half of the 1970s, and the collider is the CERN proton-antiproton collider as characterized by a specific detection geometry, the use of calorimetry for particles and electromagnetic showers, and characteristic magnetic field volume. Admittedly, this equipment is well matched to the task of analyzing the complexity of hadronic phenomena. It is capable of generating hadronic collisions at an energy large enough to provide observable rates. The use of calorimetry allows one to identify components of neutrino emission in a vector boson decay. The primary aim of the CERN proton-antiproton collider was to produce and detect charged and neutral intermediate vector bosons (or weak IVBs). This type of collider was the outcome of the conversion of the CERN Super Proton Synchrotron. The approval of this equipment was to a great extent provoked by the proof of renormalizability of the electroweak theory. The experimental observation – accomplished by European teams – of this theory's predictions (like predictions of weak boson mass values) was the main impetus for creating the proton-antiproton collider. By means of this collider the decay of the W boson was first observed at the end of 1982 (Altarelli and Di Lella 1989).[8]

The practice of experimentation I am referring to is composed of procedural actions and rule-following activities of installing an experimental setup and performing a series of experiments. Thus, the experimenters (1) look for matching the proton circumference to the circumference of the antiproton accumulation within

[8] An important factor was the discussion of what is a precise test of the electroweak theory. According to participants in experiments at CERN aimed at establishing the W boson mass versus the Z boson mass, the proton-antiproton collider ensured W and Z production in a range that was very suitable for calculations in a theoretical framework. The experiments provided the opportunity for a precise comparison of the theoretical predictions about the weak bosons versus the experimental data.

the synchrotron; (2) observe and control the variables of the produced antiproton and the production angle; (3) single out pertinent quantities (like the number of particles produced per interacting proton) that have to be measured experimentally; (4) establish a maximum production of antiprotons around a given antiproton momentum; (5) prepare diagrams for measured antiproton production for various target materials; (6) try to obtain information about the extent to which the Coulomb scattering (provoked by the electric charge of the nuclei) has a negligible effect on the antiproton production; (7) choose a suitable lens (in the form of a magnetic horn) for the antiproton accumulation by employing computer modeling; (8) cool the target (e.g., tungsten) and try to avoid its oxidation and disintegration; (9) register different types of oscillations for various beams in the synchrotron; (10) interpret the obtained results both in real space and in six-dimensional phase space (position coordinates and the momentum associated with each coordinate) characterizing the density of the antiproton accumulation, and so on.

This practice of experimentation with the production of antiprotons as composed of the aforementioned actions and activities does form a unit of ongoing inquiry, but it is not capable by itself to bring the reality of a scientific domain into being. As a single practice, it does not ensure necessary conditions for having the facticity of meaningful articulation which discloses a domain. To reiterate, a practice isolated from the contextually arranged (and contextualizing) practices projecting their interrelatedness upon a horizon of possibilities is no longer a part of the domain's articulation and objectification. This is why the "minimal fragment" from the facticity of inquiry which can bring a domain into being is the contexts of configured practices. Furthermore, only a practice that is instrumental in the interplay of practices and possibilities may participate in facticity that reveals reality. The experimental practice of antiproton production has contributed to disclosing a domain of reality by being enmeshed and contextualized in a wide range of other practices (including engineering practices of improving the accelerator's work like adding a superconducting low beta section), each of them distinguished by its own contexture-of-equipment. Thus, for instance, once contextualized by practices of quantum chromodynamics, the experimental practice of producing antiprotons in order to study hadronic events participates in revealing the reality of strong interactions between quarks and gluons characterized by "color charge".

The reason for building the CERN proton-antiproton collider and carrying out the practice in question was provoked by a configuration of scientific practices aiming at studying W and Z weak bosons. The practice prepared experiments designed for the study of vector bosons in the early 1980s. In this regard, the original practice was improved through correction procedures of the detector that enhanced the acceptance for charged tracks. The experimental production of antiprotons also became contextualized by practices of studying jets in hadron-hadron collisions. The historical initiation of this practice is not to be disentangled from the belief that in exploring such collisions, one could learn about the properties and interactions of (what Richard Feynman called) partons: point-like constituents of hadrons that are identical with quarks and gluons. Looking for jets in hadron-hadron collisions was also motivated by new practices of perturbative quantum chro-

modynamics which enabled new tests of Feynman's parton model (Ellis and Scott 1989, 132). It was this gauge theory of strong interactions that most clearly predicted jets in such collisions. For a long period in the 1970s, the experimental production of antiprotons was not a very successful practice for demonstrating the existence of jets in hadron-hadron collisions. It is nowadays widely accepted that the later discovery of the plot of "two-jet dominance at high transverse energy" is among the most important discoveries achieved using the proton-antiproton collider.

The experimentation with the production of antiprotons can be replicated arbitrarily many times by changing different components in the range of (1–10). The interlinked activities composing the practice – each of them following its rules and algorithms – and the material resources they utilize form a contexture-of-equipment that involves a basic apparatus by means of which entities that are ready-to-hand (accelerated protons and produced antiprotons for various target materials) become manipulated. In this contexture/setting several experiments are carried out and various experimental systems are formed, all of them preserving the same readiness-to-hand, provided that the practice remains unchanged. (In this account, ready-to-hand is what has the character of being manipulable and readable. Thus, the incoming particle beam is manipulable by means of dipole magnets like "injection kicker magnets". Furthermore, the beam might be bunched by a radio frequency system and decelerated.) The practice would not lose its identity if the variations in its composing actions and activities preserve the interrelations which it has with other experimental, instrumental, computational, and theoretical practices of inquiry (Janich 1998, 101–110). (Not to mention that this identity is always preserved when the experimental practices are carried out in the environments of other contextures-of-equipment, given that the type of apparatus and the experimental design are the same.)

Yet if one changes the configuration of practice's interrelations with other practices of inquiry, then the replication would be a new practice of repeating an experiment. In this case, what is at stake is not merely the assurance that the results can be replicated, but a new contextual articulation of meaning. (It is an open and complicated question as to whether the reproduction of an experiment by using different apparatuses [characterized by different systematic errors] without changing the context of inquiry should be counted as inaugurating a new experimental practice. Galison (1997, 10) observes that "even where the cloud chamber and the bubble chamber overlap, they do so more because they share practices associated with their design, operation, and characteristic demonstration strategies than because they are both used to resolve the same particular puzzle within physics." However, more often than not the aim of this repeating by using alternative instrument is to eliminate – or at least to reduce – the possibility that the experimental result is an artifact. In keeping in mind that the different apparatuses also have different backgrounds of technological practices and procedures of calibration, one might assume that such a replication may evoke a re-contextualization and a formation of new experimental practice. [Think, for instance, on the re-contextualization implied by the introduction of the electron microscope in molecular biology.] The work of Allan Franklin

convincingly shows that a basic experiment is associated with several epistemological strategies. Repeating an experiment for technical reasons does not necessarily preserve the respective strategy.)[9]

To reiterate a previous argument in a more conventional philosophy of science idiom, varying an experiment (by placing it in a different context of inquiry) is a new research practice since in the new configuration the experiment might serve, for instance, as an alternative test for a hypothesis that within the preceding configuration has been successfully tested. Or alternatively, the replication may take into account new variables, thereby provoking the quest for new explanatory resources of the experimental results. In fact, placing a practice of experimentation in a new configuration whereby one figures out an alternative test for a hypothesis doubly changes the initial practice: Besides the purposive change of performing the practice, i.e., the change related to relevant data acquisition, it might change the theoretical background on which the experimental apparatus depends (Franklin 1989, 123–129). In addition, re-contextualizing a practice of experimentation might change the type of experiment, say, from one that measures quantities into another that aims at creating a phenomenon.

One may accept Harry Collins's well-known argument that there is a lack of a definitive criterion regarding reliability of an experimental apparatus. Under the condition of "experimenter's regress", it is not clear what should count as a successful outcome. Yet there is a conclusion that Collins fails – as Eger's criticism being mentioned shows – to draw from his analysis. Not negotiations that aim at breaking the regress in the indecisiveness regarding the proper work of an apparatus, but the need of a re-contextualization of the experiment follows from the lack of the criterion mentioned. Changing the configuration of practices is a way out of the regress. Re-contextualizing an experimental practice is a potentially infinite process within the articulation of a scientific domain, but this is by no means an infinite regress. (It is another question that from a sociological point of view this re-contextualization is surrounded by negotiations. However, the change of the context is due more to the "logic of scientific practices" than the scientific community's decision making. In particular, the elimination of dissonances among practices of inquiry is to be chiefly attributed to their resilience to revise existing and enter in new configurations. This conclusion is in line with the claim that scientific practices' reflexivity – in carving out and maintaining the characteristic hermeneutic situation – grounds inquirers' intentional reflexivity as this claim was discussed in connection with double hermeneutics.)

The experts on the nature of experimentation are unanimous in their insistence that not all experiments are theory-laden and exclusively entitled to measure quanti-

[9] Galison (1997, 20–22) pays heed to another important factor – the activation of different experimental traditions – for a re-contextualization in repeating experiments. He differentiates between the "image tradition" (distinguished by the production of homomorphic representations) and the "logic tradition" (producing homologous representations). Instruments and apparatuses exist in such traditions as part and parcel of the "material culture of the laboratory shifts". What he explores is the "life of instruments" with regard to the "fusion of traditions of experimentation". Such a fusion does not necessarily break the continuity in the reproduction of an experimental practice.

ties determined by a theory. In addressing experimentation as activities projected upon possibilities, David Gooding asks the question of what an experiment is like before there are clearly articulated hypotheses to test. He introduces in this regard the concept of "construals" to refer to the means of interpreting experiments for the sake of taking into account the plasticity of scientific experience. More specifically, construals are means for making sense of experimental data in a manner that would allow the incorporation of these data in contextual interpretations. Thus, Gooding (1990, 87–88) distinguishes between construals and interpretations. The former cannot be grasped independently of the experimental activities that produce them. Construals enable an ascent from the immediate and concrete experience of experimentation. By contrast, the concept of interpretation is reserved for the experimental manipulations of entities based on firm rules. Construing creates communicable representations of experimental experience and at the same time integrates them into established regimes of interpretation. To put it in terms of the distinction which is the main issue of this chapter, construals are active in the contextures-of-equipment, whereas interpretations are to be attributed to the contexts of inquiry. Thus considered, construals play a leading role when a practice of experimentation becomes re-contextualized. They constantly engender possibilities for such a re-contextualization, which Gooding describes as plasticity of experience. In particular, a construal proves its effectiveness as it becomes vindicated in the repetition of an experiment occurring in a new configuration of practices. In the perspective of hermeneutic realism, Gooding's construals are experiential mediators between inquiry's facticity and the factuality of the inquired.[10]

The contexture of the cited practice of experimentation in collider physics is devised to be congruent with contextures organized by other scientific practices, but nevertheless it is sufficiently well isolated from other settings of inquiry. There are entities ready-to-hand within this contexture that basically are tied to the practice's environment and can only occasionally be transferred to other contextures. To

[10] Though I completely agree with the role Gooding assigns to construals, I am not inclined to accept without reservation his way of differentiating between interpretations and construals. By Gooding's account, construals refer to actions as they are on a par with talk and thought. They precede the Cartesian split of subject and object, and emphasize the articulation of meaning on a pre-linguistic and pre-predicative level. Interpretations within linguistic media communicate the meaning thus articulated. This way of differentiating between construals and interpretations, which follows the tenets of social constructivism, is to be criticized from the viewpoint of hermeneutic phenomenology. Gooding's differentiation replaces the Cartesian dualism with a dichotomy between extra-linguistic construals and linguistically designed interpretations. I agree that actions are on a par with talk and thought. Yet, a genuinely non-Cartesian position supplying Gooding's distinction with proper arguments would rest on the following two assumptions: (1) Talk and thought constitute meaning only in contexts of actions; (2) since language-thinking is entangled with actions and activities, all actions and activities – including the non-verbal ones – always already take place in linguistic media whereby the latter make them meaningful. These two assumptions render impossible the way of differentiating based on opposing extra-linguistic to linguistic actions and activities. Despite this disagreement with the way in which Gooding's distinction is grounded, his concept of construals is of prime importance to any hermeneutic approach to experimentation.

reiterate, each scientific practice keeps the environment of its contexture-of-equipment maximally enclosed. The practitioners manage to do this by making not only the particular manipulable entities but also the whole environment of the practice functionally ready-to-hand, which is a well-known subject in the ethnographic studies of science's laboratory life. The transfer of laboratory samples from one contexture to another in disciplines like analytical chemistry and microbiology is a usual event that brings into play some regular links between contextures. Yet this transfer is still insufficient to dislocate the upshots of the particular contextures, thereby uniting them in an integral process of inquiry. In some cases, the inquirers intentionally resist such a dislocation that might threaten the identity of the particular practice they are engaged with.

Enclosing the contexture allows them to present the outcome of practice's multifarious performance – the experimental results – in a unitary and homogeneous space of representation. In contrast to the contexture, however, this space does not remain enclosed. In a claim that was preliminarily outlined in the Introductory Chapter and will be addressed in more detail later, the space of representing the outcome of applying a readable technology is always already situated in a circulation of semiotic representations that does not leave room for a "transcendental signified" beyond the mutually translatable systems of signs. (Thus, the results of experiments carried out at the proton-antiproton collider might immediately be represented as formulas about dilepton events related to characteristic hadron reactions and their decays. These formulas refer to unobservable factors like missing energy, which invites a further reading and semiotic representation. Once the experimental results are integrated in a circulation of semiotic representations, the circulation retroactively increases the complexity of the events in high-energy proton-antiproton collisions.)

All manipulable entities involved in scientific inquiry have a being, but only in contextures-of-equipment. These entities range from the cell culture dish and the optical microscope to the oncomouse and artifacts of nanotechnology instrumental in laboratory work.[11] If they would become detached from the contextures-of-equipment, they would lose their status of entities belonging to the mode of being of scientific inquiry (i.e., to the facticity of inquiry). A particular contexture inaugurated by a certain practice of inquiry is accordingly characterized by (a) a readable technology (of making what is manipulable in the contexture into a set of meaningful items like data, graphs, diagrams, models, etc.), and (b) a space of representation (in which what is read becomes transformed into various kinds of signs and symbols open to be re-read in the contextures of other practices). There is a kind of semiosis in scientific research: The semiotic representations of what is read and manipulated

[11] Many of the entities I am speaking about have been "socialized" in non-scientific contexts as well. Such a "socialization" and the concomitant exchange of scientific and non-scientific entities is of prime importance to the studies of technoscience. In investigating the conjugated processes of "scientification" of non-scientific social areas and growing "socialization" of technoscience, some authors address the "changing geometries" of the social existence of the technoscience's contexture-of-equipment (Mol and Law 1994; Marres 2012). I partially dealt with this subject in the Intermediate Reflections.

in a certain contexture are at the very moment of their production dislocated and placed in the circulation of systems of signs. Accordingly, *the transitions from contextures-of-equipment to contexts of configured practices are mediated by a kind of semiosis.* Yet it is not, as I will try to show, a semiosis that can be localized in particular nexuses of contextures and contexts. The generation of semiotic systems in the research process is rather stretched out over the whole facticity of inquiry.

Let me stress once more that the hermeneutic realist works with a broad concept of manipulating-within-contextures-of-equipment. This concept also includes the localized manipulations of idealized entities existing only through their symbolic representations. Thus, for instance, the physicists working in quantum electrodynamics make use of form factors that presumably describe the structure of particles. They are symbolically represented by matrix elements of operators. These elements are amenable to formal manipulations that may reduce them. The so-called Gordon decomposition is a case in point. With the help of this formal manipulation, the physicists are, in particular, able to represent the coupling of the electron to the electromagnetic field by reducing matrix elements, which eventually allows them to describe electrons as "point-like" particles. In the case of mathematical representation of the electromagnetic currents for hadrons, the formal manipulations that reduce matrix elements are of prime importance since hadrons are not point-like particles, and accordingly, a formalism that describes a point particle with unit charge and a Dirac magnetic moment is not applicable. To sum up, when what matters is a manipulation of entities that are ready-to-hand as mathematical symbols, then obviously the boundary between contexture and context becomes completely effaced. Yet this effacement does not contradict the thesis of the entanglement of contextures-of-equipment with contexts of inquiry.

A conclusion reached so far is that the multiplicity of loosely interconnected contextures-of-equipment in a research process that meaningfully articulates a scientific domain is still not capable (1) of warranting a *sui generis* facticity of inquiry, i.e., the self-sufficiency and autonomy of inquiry as a mode of being, and (2) of disclosing the reality of a domain. The self-sufficiency mentioned is due not to the contextures (each of them composed of the activities of a single practice) but to the contexts of the domain's meaningful articulation. Each context as constituted by a configuration of scientific practices is characterized by a synergy of readable technologies and interpenetrating spaces of representation. By this account, to the domain's interrelatedness of practices corresponds the domain's totality of co-referential contexts (or the domain's intercontextuality). The term "intercontextuality" also stands for the dissemination/dispersal of meaning over the domain's actual and potential contexts of inquiry due to the interrelatedness of practices. (This dissemination is facilitated and partially accomplished by the aforementioned semiosis and the mutual translatability of semiotic systems operating in the research process.) Vis-à-vis the distinction between contextures-of-equipment and contexts of doing research, hermeneutic realism is to be defined as a realism about the meaningful articulation of reality within co-referential contexts of scientific practices, providing that what becomes articulated is predicated on the way in which what is ready-to-hand within the contextures-of-equipment is entangled with the

interrelatedness of practices and their contextual configurations. Let me juxtapose this claim with an established view in the philosophy of science.

In extending Duhem's thesis, Hacking argues that the concentration only on the play between theory and observation leads to a "miserly quarter-truth". The play has much larger scope that involves "data, theory, experiment, phenomenology, equipment, data processing" (Hacking 1992, 55). All these components are constantly in a state of co-adjustment, but this does not imply stability. Duhem's underdetermination operates in all relations of co-adjustment. Relative stability under the conditions of underdetermination and indeterminacy is the distinctive feature of the laboratory sciences. Hacking's philosophical task consists in explaining the "sheer determinateness" of the mature processes of inquiry in these sciences. In his explanatory scenario, the stability-based-on-indeterminacy of laboratory science is not due – as the standard realists assume – to "underlying reality". This stability (far from ideal co-adjustment) arises "when theories and laboratory equipment evolve in such a way that match each other and are mutually self-vindicating" (Hacking 1992, 56).

Anomalies emerging within this order are tackled by devising new instruments supposedly generating new data interpretable by new theoretical models. What Hacking adds to this Kuhnian picture is that the old network of data, instruments, and models remains in place. (Against this background, he defines anew the idea of interventionist-instrumentalist realism: Modifying the working regimes of instruments keeps humans' intellectual and material world together.) But since the measurements taking place in the networks are performed by two categories of instruments that are not matchable, there is a growing disunity of science characterized by maturity of its laboratory practices. Maybe I am wrong, but I do not see more than conventional wisdom in Hacking's proposal to cope with the task of explaining the maturity/stability of the laboratory sciences. Yet he suggests an interesting supplement: The order of co-adjusting components of scientific research presupposes the coherent coexistence of thought, action, materials, and marks, but not a coherence theory of truth. Hacking even speaks of a theory of this coherent coexistence. But it is hard to find in his work indications of how such a theory is to be achieved. The hermeneutic realist admits that a "coherence theory of thought, action, materials, and marks" is no more and no less than the hermeneutics of facticity. Applying this theory to scientific inquiry requires focusing on the way in which the contextures-of-equipment are entangled with contexts of inquiry.

Since reality is disclosed through interpretive circularity, hermeneutic realism makes this circularity a central theme. To undertake a first step in shedding light on the way in which contextures and contexts are mutually dependent, I will prolong the heuristic analogy with the microphysical idea of entanglement as it was discussed in the Introductory Chapter. The operations/manipulations taking place within the contextures-of-equipment appropriately correlate with phenomena saved in the contexts of inquiry. This correlation is not based on causal relations. Moreover, it reflexively controls itself, which is manifested by the changes of configurations of practices leading to re-contextualization of what is studied. Reflexivity generated and embedded in this correlation is another facet of (what I called) the endogenous

reflexivity of scientific practices. It is the mutual dependence of contextures and contexts of inquiry that appears, in particular, in the form of correlations between manipulative operations and phenomena constructed by means of instruments. (Phenomena that are in need of being theoretically saved become contextually revealed through working out data models assigned to register patterns in the data collected. Yet data acquisition is obtained by means of operations within particular contextures. Such operations are ingredients of practices like calibrating measurement equipment and introducing a proper statistical technique for data processing. The operations performed within the contextures are always already entangled with the contexts of saving phenomena.) These considerations invoke the analogy mentioned above.

To resume the discussion from the Introductory Chapter, it is the operations-phenomena correlation that provides a ground for drawing this analogy. In quantum mechanics (since Schrödinger), two subsystems of a system are regarded as entangled if the state of the system is not expressible as a tensor product from the state vectors of the subsystems. The states of the system are described by specifying the relative states of one subsystem with respect to the states of the other. It is quantum entanglement that prohibits the treatment of the subsystems in terms of individual entities existing per se. This prohibition analytically follows from the fact that the physical properties that could be measured only on the system are not derivable from measurements on the subsystems. The system is not describable up to the interactive relations between the subsystems. The subsystems are not characterized by quantum states of their own. Conversely, only the system of the two interacting subsystems has an existence of its own.

Entanglement has much to do with quantum contextuality.[12] The latter is defined by the so-called no-go theorems which rule out (at least certain types of) hidden variables. In these theorems, quantum mechanics cannot be made compatible with classical models that are non-contextual for the measurements of observables. Furthermore, there is no preexistence of physical quantities independent of experimental setting. Non-contextuality means that the value of an observable does not depend on which other compatible observable is measured jointly with it (Szangolies 2015, 41–44). Some physicists still hope that an adequate hidden variable theory might be constructed, which would afford the control over hidden variables underlying the quantum states of systems under study. For these physicists, the further development of the concept of non-contextuality continues to be a versatile enterprise. However, the hermeneutic realist is much more akin to the disbelievers in hidden variables. According to her, irrespective of how complete and detailed is the description of the correlation between the operations (of manipulating and reading) within contextures-of-equipment and the ways of saving phenomena within contexts of inquiry, the effects of entanglement are not to be eliminated by questing for a reducibility of this correlation to a purely causal relation of determination.

[12] Roughly, quantum contextuality is a corollary to Heisenberg's uncertainty theorem: One and the same observable might be co-measurable with different sets of observables. This is why the observable (as identified by measurements) is unavoidably contextualized.

The mutual dependence or the correlations between contextures-of-equipment and contexts of inquiry bear a resemblance to quantum correlations. This resemblance can be illuminated in the following manner: Information about scientific activities within contextures-of-equipment is instantaneously dislocated and transmitted to contexts of inquiry that are not in direct physical contact with these contextures. (Phrased differently, the results obtained in any contexture-of-equipment are immediately scattered over indefinite number of contexts of inquiry.) The information mentioned is generated by the entanglement of the particular contextures and the contextual configurations of practices (and accordingly, with the whole intercontextuality of a domain's meaningful articulation). The semiosis which is stretched out over the facticity of inquiry is the milieu in which the "quantum correlations" that make possible "entangled states" take place.

The heuristic analogy with entanglement allows one to come to terms with two irreconcilable – but intuitively equally justified – observations. On the one hand, the totality of co-referential contexts in a scientific domain (or the domain's intercontextuality) is based upon what is ready-to-hand within the contextures. The contexts of inquiry receive semiotically embodied results of what is manipulated and read through particular readable technologies. Therefore, all contexts of inquiry arise out of contextures-of-equipment. On the other hand, the constitution of each particular contexture of scientific practice in the research process presupposes the potentiality-for-meaning (i.e., the inexhaustible horizon of possibilities for doing research in a scientific domain) as it is projected by the contexts of inquiry. (Without such a "presupposition" the instrumental manipulations taking place in any single contexture would be deprived of the horizon of their meaningfulness.) Hence, there is no constitution of contextures without contexts of inquiry. The way in which the particular scientific practices are entangled with the interrelatedness corresponds to a hermeneutic circularity of the constitution of single contextures-of-equipment and the whole of contexts articulating a domain of inquiry. To enter into this circularity in a proper manner is the main task of the hermeneutic philosophy of science as the philosophical conception of science relevant to hermeneutic realism.

2.2 Semiosis Through Reading-and-Representation

In the main thesis of this section, the meaningful articulation of a scientific domain consists in the generation of meaning within the circulation of co-translatable semiotic systems and overlapping spaces of representation. The domain's objectification that runs parallel to its meaningful articulation is due to a transformation of representation that takes place within the same circulation. As already noted, the manipulation of entities within a particular contexture-of-equipment and its environment produces signs that from the very moment of their initiation are – in contrast to the manipulable entities – beyond the contexture. (In the case of the previously discussed practice of collider physics, these are signs resulting from a statistical proceeding of experimental data. The semiotic system of the constructed data models

becomes translatable into, say, the semiotic system of a quark model stemming from the analysis of symmetry patterns. The symmetry of the currents is of prime importance to the electroweak theory. The patterns of symmetry are represented by the so-called current algebra, which is a semiotic system about quarks' quantum numbers. This semiotic system is on its part translatable into a system representing the currents in terms of quark fields that satisfy certain equal-time canonical anti-commutation relations (Paschos 2007, 21–28). I mention this to provide a tentative illustration of how results obtained in a contexture-of-equipment begin to circulate in semiotic systems and spaces of representation.)

In taking up the claim of the ubiquity of semiosis, I will argue that the production of signs in scientific inquiry is always already within the circulation of semiotic systems. Stating that the manipulable entities are tied to the particular contextures-of-equipment whereas the signs produced by the manipulation of these entities are constantly beyond the environmental arrangement of any particular practice of inquiry is a statement that ought to be construed in connection with the following claim: Because of the hermeneutic circularity between single contextures-of-equipment and (the intercontextuality) of the contexts of configured practices, each contexture is always already within the interplay of practices and possibilities of inquiry. The production of signs by reading manipulable entities proceeds within this interplay. Thus, reading entities in a particular contexture does not produce signs *de novo*, but rather adopts and elaborates on a system of externally (with regard to the contexture's environment) transmitted signs.

In reading manipulable entities and elaborating on externally transmitted signs, one makes the semiotic outcome of this reading compatible with signs obtained in other contextures. The production of new signs is impossible without the translation of signs already produced. This is why I argued that the semiosis in scientific inquiry is stretched out over the whole facticity of inquiry. The readable technology and the space of representation which distinguish a particular contexture transmit signs from one to another practice of inquiry, thereby enabling the circulation of signs within the interplay of practices and possibilities. Now, the observation that the manipulability of entities within contextures assumes the continuous production of signs within the process of inquiry is to be generalized to cover the contexts of configured practices as assuming the same ubiquity of semiosis in the articulation and objectification of a domain. In a certain context – due to the synergy of readable technologies and the deferring spaces of representation – a relatively self-sufficient system of signs comes into being. Yet this system always already takes place within the intercontextuality of a scientific domain. The intercontextuality owes its existence to the circulation of systems of signs across the contexts of inquiry.

The circulation has its own hermeneutic device of preserving itself that consists in the ongoing mutual translatability of the semiotic systems involved in the meaningful articulation and objectification of a scientific domain. Since this translatability is not secondary to the aforementioned semiosis but rather affords it, the circulation generates signs and symbols by translating semiotic systems across spaces of representation. In the sociology of scientific knowledge there is a tradition of specifying a class of scientific practices as representational practices (Lynch and

Woolgar 1988). Though this tradition has produced several interesting views, the hermeneutic realist is not inclined to approve the separation of a special class of representational practices of inquiry. She rather tries to show that each and every scientific practice is distinguished by a characteristic space of representation. This generalization of the representational dimension of scientific research might be vindicated by tackling again the issue of how symbolically embodied representations-as mediate between the facticity of inquiry and the objectified factuality. It is the ongoing semiosis in scientific inquiry that tears the research process away from the particular environment and contextures-of-equipment. This thesis might be interpreted in terms of empirical sociology as well as in ontological terms.[13]

The interpretation in ontological terms concerns the transformation of representations-as into contextualized representations-of distinguished by stable referents. This is an ontological transformation that enables epistemic representations-of. (Roughly, it corresponds to the way in which one accounts for the passage from utensils that are ready-to-hand to entities that are present-at-hand in in terms of hermeneutic phenomenology.) The circulation of representations-as and the co-translatability of semiotic systems are part and parcel of that mode of being which articulates a domain. The transformation mentioned takes place within this mode, and is necessary for objectifying the domain. Each context of inquiry has resources to accomplish this transformation and to single out the referents of semiotic systems and spaces of representations. These referents become subsequently procedurally stabilized. (The more intensive and effective the transformation, the closer the the inquiry to the pole of de-contextualization. However, one has to keep in mind that the de-contextualization is always contextualized by a configuration of practices.)

When physicists doing research in quantum electrodynamics work with the gauge theory, they represent mathematically all gauge bosons and fermions as massless particles. But they are aware that these representations-as are not transformable into representations-of since the photon is the only massless vector particle that has an identifiable referent for representations-of. In order to carry out the intended transformation, they elaborate on procedures (like the Higgs mechanism) that give masses to gauge bosons and fermions. These procedures basically draw on

[13] From a sociological viewpoint, the systems of signs transcending the local sites and settings of knowledge production become means of communication that induce the special inter-subjectivity of scientific communities. In this regard, the non-localizable semiosis that puts into operation the circulation of semiotic representations-as is a "transcendental condition" for having scientific communities. The institutionalized networks of communicating scientific results are entitled to integrate these systems in the technical languages of scientific disciplines whereby the intrinsic translatability of one system into another I discussed earlier becomes to a great extent effaced in the texts of scientific papers (viewed as second-order representations of the spaces of representations circulating in the process of inquiry). This effacement takes place for the sake of making scientific communication more effective. Of course, the different types of scientific papers – publicizing experimental results, techniques of measurements, construction of data models measuring parameters, descriptions of phenomena to be theoretically conceptualized, useful mathematical formalisms, theoretical models, etc. – accentuate and scrutinize diverse translations of one semiotic system into another. Nonetheless, scientific communication tends to skip details of the intrinsic translatability within the circulation of semiotic representations.

the connection between particle masses and symmetries. In several cases, it is the breaking of the symmetry that generates a mass term. Spelling out this connection allows the physicists to gain representations-of particles initially introduced by means of the gauge theory. The differentiation between the two types of representation belongs to the semiosis of a scientific domain, and will be tackled below. The transformation of representations-as into contextual representations-of and the stabilization of referents hinges on the characteristic hermeneutic situation, and is a part of the domain's objectification.

Before proceeding further, let us recall that each configuration of scientific practices that puts into operation a relatively autonomous context of inquiry is at once meaningfully articulating and objectifying a domain. Such a configuration creates meaning by representing the outcome of a certain practice (say, the selection of experimental data exhibiting patterns) in terms of the outcome of another practice (say, data models measuring parameters related to a phenomenon). There is a trend in the philosophy of science that – following the lead of Hacking – posits that scientific representation is intrinsically tied to scientific intervention in the physical world. Scientific instruments are at once knowledge-producing tools and intervening technologies. Thus, computer technology used in the process of inquiry is a paradigmatic example of technology that in dealing with computational complexity interweaves representation and intervention (Lenhard 2015, 115). My reticence regarding this interweavement is elicited by the uncritical receiving of the concept of representation from Cartesian epistemology. Enriching this concept by assigning to it an interventionist dimension does not change the situation. Representation – conceived of as a procedure of displaying structures by means of technological devices – assumes that there are structures out there waiting to be represented through intervening in the world which is otherwise a mere presence. Authors adhering to this trend cogently make the case that the avant-garde technologies in scientific research manage to deconstruct the very boundary between representing and intervening. Yet again this is done within the tacitly presupposed framework of (what Nelson Goodman calls) "the copy theory of representation". Furthermore, the way in which the "interventionists" try to deconstruct the boundary mentioned makes scientific inquiry a kind of engineering activity governed by instrumental rationality. In this regard, their efforts bring to mind the intimate relation between this kind of rationality and representational epistemology. It is my contention that the intervening realist can hardly escape from the pitfall of becoming apologetic about this relation.

The way in which the hermeneutic realist makes use of the expression of representation-as – in contrasting it to the expression of representation-of – is rooted in two traditions stemming respectively from Goodman's nominalist (anti-essentialist) philosophy and hermeneutic phenomenology. In his conception of symbolic representation Goodman differentiates between dyadic denotative representation-of and representation-as (in a sense close to that used here). He argues that the latter is already at work in the mode in which the human eye functions interpretatively: What the eye sees "is regulated by need and prejudices. It selects, rejects, organizes, discriminates, associates, classifies, analyzes, constructs. It does not so much mirror

as take and make" (Goodman 1968, 7–8). Representation-as is a tool of what he calls "representational practice", which accompanies all symbolically organized human activities. Representation-as is not a pictorial reproduction of an object. Representation-as is rather a contextual envisioning of what is in a state of ongoing meaningful constitution in practices.

For Goodman, the emphasis on "as" indicates that this mode of representing has the character of construal, and the choice and handling of the instrument of representing participate in the construal. It is precisely the interpretative-reflexive aspect of Goodman's conception that the hermeneutic realist makes into a central theme: The circulation in overlapping spaces of representation of what is meaningfully constituted through readable technologies is not only a constant transference/translatability of signs from one space to another that generates meaning, but also a machinery that undermines any effort to assign a state of "mere presence" to any meaningful entity in the research process. The ongoing representation of "something as something-differently-envisioned" draws attention to the adequacy and efficacy of the instruments of reading/representing. Focusing on these instruments (and investigating their contextual adequacy and efficacy) opens the avenue to practitioners' interpretative reflexivity as that dimension of the characteristic hermeneutic situation of their inquiry which makes the very situation explicit. I will claim that this reflexivity is most clearly displayed in the theoretical objects' reading-and-representing, each of them understood as a manifold of contextually constructed and theoretically saved phenomena.

The Introductory Chapter made the case that representing something-as-something epitomizes the way in which the pre-objectifying hermeneutic-as operates. With regard to the unity of meaningful articulation and procedural objectification, the view of representing-as appeals to a much more general image of the hermeneutic-as as compared with that developed in hermeneutic phenomenology. In the account exposed in *Being and Time*, the interpretive articulation of something-as-something works on a pre-predicative level and within environmental contextures. By contrast, the generalized account I put forward portrays a kind of the hermeneutic-as that operates in (and through) representations of something-as-something. Thus considered, the hermeneutic-as enables the transitions not only between contextures-of-equipment but also between contexts of inquiry, provided that these transitions do not destroy the horizon of interpretation of something-as-something. Accordingly, the articulation of meaning is due to the way in which practices are configured. At the same time, the configuration in which the interpretive-representational something-as-something circulates allows one to objectify factuality that remains fore-structured by the horizon of possible representations-as by transforming a portion of the latter into representations-of.

It is the generalized view of the hermeneutic-as that overcomes the dichotomy between pre-predicative articulation of meaning and objectification based on predication. Instead of this dichotomy, the hermeneutic realist emphasizes the inseparability of contextualized meaning and objectified data models which (inseparability) only scientific inquiry may achieve. Furthermore, the generalized view states that the hermeneutic-as operates in conjunction with intercontextual transference of

semiotic means and co-translatability of semiotic systems. Translating a system of signs and symbols from one space of representation into another constitutes meaning within the horizon of interpretation shared by both spaces. It is this translation that requires the elaboration of a kind "ontological rhetoric" of science, i.e., a program that goes beyond the scope of the rhetorical studies of scientific discourse and communication (Ginev 1999b). Roughly, this ought to be a rhetorical program focusing on the translatability of semiotic representations in scientific inquiry, given that this translatability is the terrain on which the hermeneutic-as operates in the meaningful articulation of a domain. It is a kind of rhetoric that studies reading-and-representing qua constitution of meaning. The representation of something-as-something within the translatability unavoidably involves a moment of metaphorization, or metonymization, or semantic change based on another trope (Kay 1997; Sarasin 2007). In the basic tenet of the "ontological rhetoric" of science, the articulation of meaning in scientific inquiry proceeds by figurative/tropical shifts supplying the co-translatability of semiotic representations. These shifts belong to the interpretive fore-structuring in the production of objectified factuality, or to the way in which representation-as fore-structures representation-of. With this conclusion in mind, let me turn again to the previous example of scientific practice.

Suppose that the practice of experimentation with the production of antiprotons is related to scientific practices that aim at detecting the theoretical objects called "intermediate vector bosons" (presumably serving as the exchange quanta which mediate the weak force). The relatedness is rather intercontextual since historically the search for these particles is due to a re-contextualization of experimental practice's original context of inquiry. Within the new context of inquiry one experimentally observes that at certain energies relative to the masses of the vector bosons there is an interference term between the electromagnetic and weak interactions. In an experiment carried out in the same contexture-of-equipment (located in CERN) but within the new configuration of practices, one studied carefully how at higher energies that approach the mass of one of these bosons (the Z boson) the weak term dominates. This is (if not a crucial) an essential experimental result confirming predictions of electroweak theory.

Being intercontextually related with the new context, the former practice of experimentation becomes specified as experimenting with hadronic collisions at an energy high enough to provide observable rates. For the sake of illustration, let me mention some of the practices with which the experimental practice thus specified has been contextually working in concert at a certain stage in the development of high-energy physics: the practice of creating data models for interpreting the Standard Model of the electroweak theory whereby properties of the "intermediate vector bosons" are to be compared with the predictions of the Standard Model; the practice of devising techniques of renormalization; the practice of conceptualizing various phenomena of weak interaction; the practice of investigating the role of electroweak bosons in the generation of scalar bosons; the practice of using broken symmetries to predict elementary particles' properties; and practices of coping with arbitrary features of the Standard Model as it has become constituted by the

symmetries of the electroweak theory and quantum electrodynamics.[14] Each of these practices represents the intermediate vector bosons in a characteristic manner. Cases in point are Feynman diagrams, the gauge-boson mass matrix, measurements and data models of eigenvalues as associated with eigenvectors, quanta of vector fields, combinations of quark flavors, etc.[15]

Here is a brief intermediate summary. Any relatively autonomous context of inquiry instituted by a configuration of scientific practices enacts a circulation of representations – what is represented in the space of a particular practice is already deferred in the spaces of representation of other practices. In other words, the context does not provide a fixed and static representation of what is contextualized. The context enacts a circulation of representations-as, granted that each practice of the contextualizing configuration has its own space of representation. Through the circulation of representations-as the researchers identify – by implementing their epistemic resources – the existence of contextualized objects and/or structures. The representation of something-as-something is always embodied in signs. Basically, the circulation of representations is mediated and carried out by circulating signs (indexes, iconic signs, and symbols). The specific signs (charts, photographs, tables, graphs, diagrams, equations, and so on) of a certain space of representation are interpreted through signs produced in another space. The interpretative representation-as is constantly deferred to an upcoming space of representation.

In the preceding chapter I commented on Fleck's concept of "signal of resistance". This concept can *mutatis mutandis* be applied to the transformation of representations-as into representations-of. Thus, the objectification of the weak interactions was accomplished to a great extent by means of such a resistance to the circulation of representations-as that generated representations-of with procedurally stable referents. The early articulation of the domain of quantum electrodynamics was characterized by translatable semiotic representations-as concerning the

[14] At a certain stage the experimental practice of antiproton production has been related to practices that the domain's articulation has subsequently disclaimed. Cases in point are the construction of models with hypothetical quarks, the elaboration on toy mathematical models, or the search for further measurable parameters that can be presented by data models as a result of a rejection of the existence of neutral currents.

[15] For more on the ways in which experimental practices in weak interaction physics have been contextualized at the time when the debate on the existence of neutral currents has been topical, see Pickering (1984). Pickering's case study is guided by the dictum that historians should not put the phenomena studied by physicists first. Instead, they have to prioritize the practices of inquiry. His case study – based on the assumption that the interpretive practices and the natural phenomena stand or fall together – pioneers the efforts to demonstrate how the facticity of scientific practices reveals phenomena and presents them in their objectified factuality. Unfortunately, Pickering – in line with the constructivist paradigm of accentuating the negotiations – puts too much emphasis on theorists' and experimenters' pragmatic motivations (including the symbiosis of such motivations), and largely neglects the role of the interpretative constitution of meaning. In hermeneutic realism, the trans-subjective constitution of meaning is always prior to any motivation for experimental or theoretical construction (and production of phenomena) in scientific inquiry. Had Pickering taken into consideration the interpretive constitution, he probably would have had better arguments for coupling practices and phenomena, and (like Barad) would have regarded them in their inseparability within the facticity of inquiry.

ways in which the interactions of gravity, the strong force, and electromagnetism respect the three discrete symmetries (parity, charge conjugation, and time reversal) in elementary particle physics. It was the resistance in the translatability of such representations-as that forbade one to include the weak interactions in the list of interactions respecting the discrete symmetries. As a result, the representations-of the weak interactions came into being which took the form of theoretical models of phenomena related to the violation of parity and charge conjugation. These representations-of the weak interactions led to the formulation of a central theorem in the articulation and objectification of quantum electrodynamics: Any local field theory based on special relativity and quantum mechanics is invariant under the combined action of parity, charge conjugation, and time reversal. Briefly, the formulation of this theorem resulted from the resistance that arose in the circulation of semiotic representations-as causing the models of (representations-of) the weak interactions.[16]

Let me express the idea of circulating representations-as in an alternative manner. Within a particular context the spaces of representation – as related to the specifically configured scientific practices – are interpenetrating each other: The representation of measurements is already deferred in the space of designing new experiments, the outcome of experimentation is deferred in the space of interpreting theoretical models, the data models by means of which one interprets a theoretical model penetrate the space in which new measurements are initiated, and so on. The meaning of what is read by a certain technology in its space of representation is to be seen in the next space corresponding to another readable technology. Stated otherwise, the signs embodying the representation of what is obtained in a contexture-of-equipment are always already read and bestowed upon meaning within the next space of representation whereby a semiotic transformation takes place, and the older system of signs boils down to a new one. This description is convenient for addressing a process that reverses the transformation discussed so far: the re-contextualization of representations-of which places them again in the circulation of representations-as.

What I have in mind is a semiotic transformation that re-contextualizes representations-of. As a result, the representations-of (as presupposing a stable relation of denotation) become more or less "swallowed up" by circulating representations-as within the deferral of spaces of representation. This transformation occurs always when there is a re-contextualization of the process of inquiry. Thus, to change the example exploited so far, the equilibrium model of Michaelis and Menten formalizes enzyme kinetics in a manner that enables one to introduce stable representations-of the specificity of enzymatic reactions (as compared with the kinetics of the non-metabolic chemical reactions). These are representations-of measurable phenomena (constructed through patterned data concerning the change of the reaction rate and the concentration of a substrate over time) described by a system of

[16] The resistance itself can be identified as a historical event by analyzing Lee and Yang's suggestion that parity is possibly violated by the weak interactions and Wu's subsequent experimental proof that these interactions are to be represented as violating this symmetry.

nonlinear differential equations. (This formalism is a mathematical plot that predicts reaction velocity as a function of substrate concentration.) The semiotic systems of these representations-of include diagrams like saturation curves, graphs of parameter values, and symbols of the mathematical formalism being implemented. Michaelis-Menten's approach presupposes that the formation of enzyme-substrate complex is fast relative to the breakdown rate; the concentration of substrate remains essentially constant during the time course of the reaction; and the conversion of product back to substrate is negligible (Marangoni 2003, 43). The formal model (representations-of) based on these presuppositions objectified the domain of enzymology in the second decade of the last century.

A re-contextualization of this objectification was initiated by Briggs and Haldane (in 1925) bringing into play some alternative presuppositions. More specifically, Briggs and Haldane suggested a formalization of enzyme kinetics that presupposes a quasi-steady state in which the concentration of enzyme-substrate complex remains essentially constant. In contrast to Michaelis-Menten's rate-determining step approach, Briggs and Haldane chose the steady state approximation. Though the formalisms of both approaches to enzyme kinetics are equivalent and produce the same computations, the alternative presuppositions of Briggs and Haldane formal model proved to facilitate the search for mathematical plots aiming at linearization of the Michaelis-Menten nonlinear equation. These plots recast the representations-of associated with the Michaelis-Menten model and reintegrated ("swallowed up") them in the circulation of representations-as. Having in mind, however, that the plots of linearization are inferior to the nonlinear model with regard to the interpretation of constructed data models, the new envisioning and representations-as did not destruct the previously procedurally stabilized referents. As a rule, the semiotic transformation of representations-of into representations-as does not eliminate the already accomplished articulation-objectification of a scientific domain.

Along with the two indicated transformations of semiotically embodied representations, there are reversible transformations related to signs' semantic interpretation. In the ongoing deferral (displacement) of what has been represented in a given space, a co-interpretative play of signifier and signified often takes place: What is represented as a signified outcome in a certain space becomes a tool of representation (signifier) in the next space (Rheinberger 1997, 102–113). The overlapping spaces of representation prompt the ways in which the configured readable technologies work in concert. What becomes meaningfully articulated in a certain context of scientific research is a unity of experimental data, measurements, data models, observable and unobservable phenomena, and theoretical model(s) entitled to save the phenomena. This is a unity constituted through the contextually configured readable technologies and the integral representation within the overlapping spaces. In mentioning a subject central to Hans-Jörg Rheinberger's work – the interchange of signifier and signified in scientific inquiry – I enter the territory of a special brand of semiotics that hermeneutic philosophy of science ought not to overlook: By reading data, phenomena, events, objects, structures, models, computer simulations, equations, calculations, etc., scientific practices – in line with the

aforementioned mutual translatability of semiotic systems – constantly produce meaning through reversible semantic interpretations that accompany the production of signs from signs.

In raising this claim, I am not trying to say that scientific inquiry is locked up in semiotic systems, and consequently, the domains of reality it discloses are no more than a play of interchanging and mutually interpreting signs. It is also not my aim to argue that the only "access" of science to reality is via such systems. My point is that the constant production of signs from signs – by means of readable technologies and overlapping spaces of representation – mediates and eventually unites facticity that constitutes meanings ready to be objectified and factuality that becomes constituted through objectification. The production of mutually interpreting signs within the circulation of spaces of representations is a part of the empirical as unity of production-of-factuality-within-facticity.[17] The proliferation of signs promotes representations-of and objectification through a new kind of "signals of resistance" arising out of the co-interpretive interchange of signifier and signified. Thus considered, the production of signs from signs by means of reversible semantic interpretations is a dimension of the inquiry's interplay of practices and possibilities. It is the dimension which concerns the way in which the interplay of practices and possibilities constitutes reality-as-objectified-factuality within reality's ongoing meaningful articulation.

Summing up, scientific inquiry that discloses a domain is a process of reading that meaningfully articulates what is disclosed by creating translatable semiotic systems and a circulation of representation-as that generates meanings. Some of the signs produced in this process are – following *mutatis mutandis* Peirce's classification – indexical signs (like the data which are idiosyncratic to a particular contexture-of-equipment), others are signs whose meaning does not change over several contextual interpretations (like the measurements of parameters through established data models), and still others are either iconic signs (like spark-chamber photographs or computer-generated simulations as illustrated by the Monte Carlo program) or symbols (ranging from dependent and independent variables of differential equations to complex formal symbols like Lagrangians and Hamiltonians). All signs created in the reading process stem from the facticity of inquiry and denote factuality that is either still ready-to-hand in contextures or objectified as a presence-at-hand within configured practices. Thus, the kind of semiosis that takes place in the process of reading bridges horizon-bound facticity with objectified factuality. Scientific inquiry as a reading process does not amount to taking/collecting information about what is studied that is subsequently presented as varieties of signs. It is rather a process that constantly creates semiotic systems by means of their co-translatability: The circulation of representations-as within a configuration of practices proves to be a continuous translation that engenders new systems of signs from older systems. The kind of representation-as within interpenetrating and deferring spaces amounts to this translatability that puts into effect what I called "textualizing"

[17] In connection with developing a program for a new reconstruction of de Saussure's project for semiology, I defend this point in Ginev (2013f).

within the facticity of scientific inquiry – a subject to which the Concluding Chapter is devoted.

3 Hermeneutic Circles of Articulation and Objectification in Scientific Research

Admittedly, scientific research is by no means starting from the constitution of meaningful objects and/or structures. There is a much lower level of disclosing and meaningfully articulating a domain of reality in the research process. The elementary units of reality's meaningful articulation within the interplay of scientific practices and projected possibilities for doing research are the data. Beginning with a celebrated paper of James Bogen and James Woodward (1988), there is an established tradition of making a distinction between data and phenomena in the philosophy of science. In elaborating on this distinction, James Brown (1994, 125) observes that the reality is "full of data, but there are relatively few phenomena." The authors working in this tradition claim that theories predict and explain phenomena (that are usually unobservable), but not data. Phenomena are procedurally stabilized and can resist changes over different experimental situations as parts of different contexts of inquiry. Their characteristics are repeatable in a more or less wide range of contexts. In other words, these characteristics are detectable by different configurations of scientific practices (or readable by different technologies). By contrast, data are strongly contextualized; i.e., they are idiosyncratic to the contextures-of-equipment in which they have been obtained (Bogen and Woodward 1988, 319).

More often than not data enjoy stability not in a whole context of configured practices, but only in the experimental contexture/setting/situation in which they have been obtained. The initial collection of data – like functional magnetic resonance images, to cite a favored example of Bogen – obtained through a particular experimental practice is in many cases an unstable composite that only begins to make sense when a set of the collected data shows patterns, provided that phenomena correspond to characteristically patterned data. (Put differently, the stabilization of a collection of data as a data set that allows the detection of a phenomenon proceeds by identifying the pattern which can present the phenomenon. Accordingly, it is not the contexture-of-equipment but the context of configured practices that decides what actually is observed through the produced data. Or to state it again in Bogen's vocabulary, the context decides on what questions data produced by instrumental and statistical manipulations can be used to answer.)

In criticizing the representationalist-epistemological view that phenomena are patterns that scientists can picture, James McAllister (1997) asks the important question of how to differ the patterns that correspond to phenomena from the other patterns that data sets exhibit. McAllister places the treatment of this question within the facticity of inquiry. It is the logic of scientific practices that enables one to specify the relevant respect in which the patterns that correspond to phenomena

differ from other patterns. I would add that this specification proceeds in a characteristic hermeneutic situation. Accordingly, the investigators stipulate within the facticity of inquiry the patterns they should try to explain as corresponding to phenomena. Explaining patterns in this way is not in the sense that investigators must discover which patterns ought to be explained. It is the facticity of inquiry (and not the world-out-there) that decides which patterns one should explain.

The articulation of data should not be restricted to experimentation and measurement. Indeed, data refer to individual events recorded by particular detectors. Yet the acquisition of data and their interpretation as meaningful units take place in the hermeneutic circularity of contextual reading where a much larger class of scientific practices are at work and act in concert. However contingent and indexical the detected data may be, their recognition as (relevant) data depends on instrumental technologies and statistical techniques that tacitly participate in the aforementioned circularity. Allan Franklin (1990, 104) argues that the acceptance of data is based upon various strategies that "distinguish between a valid observation or measurement and an artifact created by the experimental apparatus." What is important in these strategies is that they appeal to scientists' reflexive attitude toward the whole interpretative context of constituting data. Accordingly, scientists become committed to practices of instrumentation that are closely related to several kinds of analytical practices, always opening more possibilities for data detection than the actually recorded data in a given context.

The instrumental observations of measurable data are within the horizon of possibilities for a further calibration of instruments, new manipulations of experimental entities, a change of the statistical technique for data analysis, a new dealing with artifacts that are known in advance to be present in the experimental situation, a redesigning that improves the sensitivity of apparatus, alternative implementations of the experimental apparatus due to changes in background knowledge, and so on.[18] These are as yet (within the current context) non-actualized possibilities for recording data whose appropriation would exceed the bulk of recorded data. The practices of calibration – called by Franklin (1997, 31–33) an "experimental strategy" for legitimating the reliability of the achieved results – are perhaps the most important device for reducing the diversity of data. In Franklin's approach, calibration is to be viewed as the use of a surrogate signal to standardize an instrument. What the experiment aims to investigate is unknown phenomena. A substitute for these phenomena is a signal of supposedly already-known properties. Calibration acquires a status of experimental strategy when we assume that if "an apparatus reproduces known phenomena (i.e., the known characteristics of the surrogate signal), then we legitimately strengthen our belief that the apparatus is working properly and that the experimental

[18] The Ninov affair (in 1999) shows how strongly the data collection and selection in experiments in nuclear chemistry is dependent on the complex types of software. The affair concerns not the accuracy of the experiments, but the correctness of the translation of the computer results into reports on events taking place in the decay chain of unstable transuranium elements. The affair was provoked by discovering a fabrication of results that is entirely rooted in the aforementioned translation. Famously, the re-examination of the data from the experiments confirmed the discoveries of the two radioactive synthetic elements 111 and 112.

results produced with that apparatus are reliable" (Franklin 1997, 31). (Franklin develops this conception in the aftermath of his debate with Harry Collins about the capability of calibration to stop the "experimenters' regress". Calibration is experimental strategy – so Franklin's argument goes – because it provides an epistemological justification [for eschewing the regress] that is independent of social factors.)

It goes without saying that the statement about the practices of calibration as strategies for reducing the diversity of data is true under the condition that there is no plurality of incompatible numerical scales for the measurements. The practices of calibration prepare and ensure the stability of data which is necessary for constructing data models. Thus, these practices play a role in representing phenomena by measurable data. They manage to do this by means of their own interpretative resources – in particular, the interpretations they advance of how to convert performed operations with instruments into a definite value of what is measured (Soler et al. 2013, 282–285).

In adhering to the view that the detection and selection of data is within an open horizon of interpretation, the hermeneutic realist challenges the validity of the post-empiricist thesis of theory-ladenness. True, scientific theories interfere on very low levels of objectification and cognitive structuration of factuality, including the level of selecting relevant data and constructing an appropriate empirical basis for theorizing. Nevertheless, the thesis is dubious in two respects. First, it can only be formulated by assuming the scheme-content distinction – an assumption that, as already indicated, the hermeneutic realist denies. Second, and more importantly, the thesis presupposes an intra-theoretical enclosure of the production of data (cum a kind of theoretical holism). The observation that something (represented by data) exists in accordance with a model does not imply that the detected and selected data are determined by the intrinsic logic of theorizing. Anticipating my further considerations, acquisition and proceeding of data, on the one hand, and construction of theoretical models, on the other, are involved in an integral hermeneutic circle, but they are independently fore-structured, and remain open (not determined) within this circle. Like theorizing itself, the production of data patterned by a model measuring a phenomenon is situated in the horizon of interplaying scientific practices and possibilities for doing research. Moreover, the hermeneutic realist holds – without disputing the significance of the logical and semantic reconstructions of theoretical structures – that the concept of scientific theory has to be reconsidered by putting the "practices of theorizing" first. There is nothing in the structure of scientific theories that is not constituted by practices like elaborating on equations to serve as theoretical models, harmonizing semantic interpretations of concepts with basic equations, adjusting general theoretical formulations to be invariant under certain transformations, extending a formalism to cover new phenomena by avoiding ad hoc hypotheses, or devising scenarios for testing experimentally theoretical predictions.

The objections against the thesis of theory-ladenness raised from the viewpoint of hermeneutic realism are not to be confused with the criticism of this thesis suggested by Bogen and Woodward. According to these authors, the thesis is invalid

because there is no direct epistemological link between theories and observations (data). Phenomena are produced from data but without the help of theories. I do not agree with this line of reasoning, since it epistemologically cuts the research process into separate sectors that can only post factum be assembled and presented as a unitary epistemic system. Though renouncing the theory-ladenness thesis, the hermeneutic realist insists on the constant cooperation of experimental and theoretical practices in the research process. Analyzing this cooperation in a proper manner requires a comprehensive hermeneutic theory of experimentation. In this regard, I would like to touch upon the impressive work done (chiefly in the 1990s) by hermeneutic philosophers of science who developed various aspects of such a theory. One has to first mention Robert Crease's conception of "experimentation as performance" in which the stage of this performance – the laboratory – is taken to be "the horizon for readable technologies" (in Heelan's sense) (Crease 1993, 103).[19]

Let me now return to the thesis that the way in which a theory operates in each particular case of its implementation might be illuminated in terms of practices of theorizing. This thesis seems to be a common denominator for the conceptions of "practice turn". In some of them the thesis is unduly exaggerated. In contrast to these conceptions, I do not mean to suggest that the accounts which appeal only to such practices, thereby avoiding images of syntactically coherent and semantically complete "cognitive bodies", are capable of rendering all essential analytical results obtained by the logical (axiomatic-syntactic and semantic) approaches to scientific theories. The universal applicability of the interpretive-practical view of scientific theories, which I insist on, suffices in bringing to naught the traditional prejudice of looking upon theories as extra-practical, purely mental constructions. Yet this applicability does not imply a total replaceability of the logical approaches by the interpretive-practical view: The hermeneutic realist does not aim at replacing the epistemological (and/or the semantic) concept of scientific theory with a concept of theory as a manifold of practices of theorizing. Such a replacement is untenable and would lead to absurd consequences. (In countering Rouse's attempt at radical replacement of the logical approaches, Robert Crease (1993, 193) persuasively argues that "astrology, witchcraft, and various pseudo-discoveries also had their own practices, their own interpretations, their own power relations, their own standardizations, their own world disclosed in the practices." What they do not have is the capability to objectify by saving phenomena theoretically. It is the role of theory and theoretical models in objectification that most effectively demarcates science from pseudoscience.)

In repudiating the aforementioned replacement, the hermeneutic realist tries to find the formula for a division of labor between the logical/semantic and the

[19] Crease makes the case that the emergence of a phenomenon in an experimental situation is unavoidably involved in a back and forth motion between experimentalists and equipment. The motion calls into play the fore-having, the fore-seeing, and the fore-conception of the emerging phenomenon. This triad is informed by both the instrumental equipment and the theoretical practices surrounding the experimental situation. (On the hermeneutic approaches to experimentation, see also Heelan (1992), Crease (1992), and Crease (1995).)

interpretative-practical approaches to theory. Roughly, when at issue is the intra-theoretical conceptual organization of objectified factuality, one cannot avoid an epistemological and/or a semantic view of scientific theory. In this case, even if one dismisses the primacy of the theories' fundamental law equations, and puts more emphasis on the "phenomenological laws" as expressing science's cognitive content – as Nancy Cartwright (1983, 99–107) suggests – one has to keep in mind that the objectified factuality retains its status through both empirical and model-semantic interpretations of theoretical models in which the phenomenological laws are working. By contrast, when one focuses on the facticity of scientific inquiry (and the interpretive fore-structuring of all conceptual frameworks in this facticity), there is no alternative to viewing theories as contextualized practices of theorizing. As I will try to demonstrate, it is the concept of textualizing in scientific inquiry that affords the coexistence and complementarity of the two concepts. (Speaking of "science's cognitive content" does not corrupt the quest for radical anti-essentialism and radical avoidance of hypostatizing cognitive structures in science, if one assumes the primacy of textualizing. It is my contention that this cognitive content is not independent in an absolute sense. It can only be found in the "texts" constituted in scientific inquiry. Yet these "texts", as I will show, reveal not only cognitive content, but also the ways in which it is interpretatively fore-structured and meaningfully produced within the interplay of practices and possibilities of inquiry.)

Treating theories in terms of the practices which constitute them is intimately related to addressing the observational, experimental, instrumental, measuring, controlling, etc. practices as closely related to – but nevertheless independent of – the practices of theorizing. If one is no longer inclined to look at scientific instrumentation as a continuation of theory construction by other means, then one has good reasons to subscribe to a view – with far-reaching consequences – suggested by Patrick Heelan: The articulation of data is not a theory-laden, but a praxis-laden process (Heelan 1998, 284–285). Heelan suggests a hermeneutic construal of Hacking's dictum that experiment has a life of its own. This construal specifies the dictum significantly: Practices of experimentation have a life of their own by being involved in the whole hermeneutic circularity of inquiry which transforms the praxis-laden entities of scientific manipulation into theoretically savable patterns of data. When practices of experimentation present an object-as-measurable, they serve a "praxis-laden function". When the procedures of measurement take data from the measurable object, they perform a "theory-laden data-taking function". In Heelan's basic claim, there is no observation and measurement without the prior preparation and presentation of objects-as-measurable. The fulfillment of the data-taking function is always within the horizon of praxis as possible instrumentation.

The "binary valence of the empirical" Heelan refers to expresses the dual status of data in scientific inquiry: (a) as articulated within the facticity of interplaying practices and possibilities, and thus becoming "praxis-laden"; and (b) as theoretically framed (and theory-laden) objectified factuality. Heelan's term for facticity of inquiry is the "scientific culture of the laboratory". In drawing a parallel between Heelan's binary valence of the empirical in scientific inquiry and the distinction between the facticity of the research process and the factuality of what becomes

objectified in this process, I have to note that I am not quite satisfied with the effectiveness of Heelan's way of distinguishing between what is practically laden and what is theoretically laden. In my view, he reverses Hanson's thesis of theory-ladenness without noting that the interpretive praxis-ladenness is a phenomenon that is not amenable to a conceptualization in formal-semantic terms.

In Heelan's argument, scientific data are practically laden since they from the very outset enter socio-cultural fora. They first enter the public forum of scientific research, and then "other fora within which individual 'theoretical entities' and the data about them can become cultural entities" (Heelan 1998, 285). But is not the same argument usable for advocating the cultural-public character of the theoretically laden scientific instruments and experimental apparatuses? Furthermore, he argues that the hardware of experimentation is a theory-laden technology because it is unavoidably overseen by a theory. But if so, then again why not expand the same argument to the production of data, regardless of how strongly these data would be subsequently culturally reshaped? It is my contention that these ambiguities in Heelan's conception are due to the lack of distinction between meaningful articulation and objectification within inquiry. From the viewpoint of hermeneutic realism, this is the phenomenological distinction which grounds any – more or less conventional – way of differentiating between theory-ladenness and praxis-ladenness in the research process.

The hermeneutic circle in which data are collected, selected, and patterned characterizes the initial step in having a meaningful reality amenable to being procedurally objectified. However, this circle – albeit being a primary stage with regard to the "didactic order" of treating the research process in a scientific domain – takes place already within the horizon of presenting phenomena through possible data models. The didactic order of scientific inquiry suggests a transition from data acquisition to construction of data models.[20] The chronological unfolding of the research process corresponds to this order. Yet it would be a non sequitur, from a hermeneutic viewpoint, to say that the interpretative circularity of creating data models is a (subsequent) extension of the primary hermeneutic circle in scientific research. The detection and selection of data are "always already" within the horizon of possibilities for constructing data models (graphical representations in particular). A data model – being itself in a horizon of possibilities of conceptualizing and theorizing – does not determine the selection of data. However, such a model instructs the experimentalists in the choices of relevant data. Technically speaking, the possible ways of presenting phenomena by data models inform one about how to cut the random and systematic errors in data collection. The data models alert one to possibilities that uncontrolled variables may exercise systematic effects on the production of data. The construction of data models is entitled also, however, to serve more sophisticated hermeneutic functions in data collection. Thus, this

[20] The research process in several domains (especially in physical chemistry) is characterized by a sequence of different types of data models (e.g., a numerical representation of data is replaced by a graphical representation).

construction may alert one to wrong expectations stemming from biased preconceptions (Garland et al. 2009, 6).

Bas van Fraassen (2008, 172), following Patrick Suppes's suggestions, cogently argues that "through construction of data models the experimentalist is in general bringing the theoretician small rational structures, constructed carefully from selected data." It is the data model as such a small structure ("empirical algebra") that can be integrated into a theoretical model's larger structure. This is why in constructing data models, the experimentalist employs practices of idealization as well. (Thus, the numerical calculations of measured values may involve the practice of smoothing these values. The practices of noise reduction are perhaps the most complex practices of formal analysis involved in the construction of data models. Grinnell (2009, 43–45) attractively describes cases in which the experimental practice manages to transform noise into unexpected data.) The practices of noise reduction are hidden in the detection of data, but their interplay with the possibilities they engender affords both this detection and (to a greater extent) the subsequent selection of data. Furthermore, the idealizing practices in the construction of a small structure of data open possibilities for representing phenomena by repeatedly measured parameters. Data models can represent phenomena by means of reading items that are immediately ready-to-hand under laboratory conditions within contextures-of-equipment. Following a line of reasoning of the preceding section, data models are the most typical representational device mediating between contextures of single practices and contexts of configured practices. Creating data models by reading measurable parameters and quantitatively representing phenomena broadens the horizon of the interplay of practices and possibilities, thereby opening new contexts of inquiry.

The hermeneutic circularity of constructing data models transcends not only each of its particular outcomes, but also goes beyond itself as a whole by indicating a further articulation of meaning related to the theoretical interpretation of the phenomena which these models represent. Here again I would like to stress McAllister's view that since all the infinitely many patterns that are exhibited in a data collection have equal claim to correspond to phenomena, the inquirers are those who stipulate what to count as a relevant phenomenon to be saved by choosing which pattern is corresponding to the phenomenon. This is why the phenomena are those patterned data or data models that the inquirers "intend to study or hope to explain" (McAllister 1997, 224). Let me sum up the point of the preceding considerations: *Prima facie* the construction of data models seems to be a (chronological) next step of extending the hermeneutic circularity of reading/representing by taking into account practices and possibilities specifically involved in the processing of data. Then again, the "didactic order" of scientific inquiry is not in agreement with the "hermeneutic logic" of the reading process since the data collection and selection (by applying, in particular, filters for reducing noise stemming from various sources) takes place within the horizon of constructing possible data models that might quantitatively represent the investigated phenomenon.

A data model is constructed (at least in mathematical physics) from a statistical analysis of data – an analysis that allows one to summarize relative frequencies of

what is measured. The object measured is located in a logical space – understood as an ensemble of logical possibilities – characteristically associated with the unity of readings by interrelated readable technologies (including intercontextually related technologies).[21] The construction of data models is always already within the horizon of saving possible (observable and unobservable) phenomena by means of possible theoretical models. Phrased differently, the construction of data models describing measurable phenomena is within the horizon of possible theoretical models of saving these phenomena. As already pointed out, the interpretative circularity that characterizes this saving enables one to appropriate possibilities of embedding phenomena (as represented by data models) in theoretical models. Building on the semantic view of scientific theories, the minimal algebraic structure of a data model becomes a substructure of a larger mathematical structure.

In a central claim of hermeneutic realism, *always when a phenomenon becomes saved by fitting a data model in a theoretical model, a theoretical object becomes partially envisioned (read and represented) in the respective context of inquiry*.

In stating that the construction of data models unavoidably takes place within a horizon of theorizing, one invokes a further expansion of the interplay of practices and possibilities of inquiry. In some cases, the expanded interplay is concomitant with the emergence of special intermediary structures that mediate between the practices of data model construction and the practices of theorizing. Thus, in studying the nature of Carnot's theory of heat engines, Hasok Chang (2004, 186–192) notes the "semi-concrete models of the Carnot cycle" which Thomson worked out. By means of them, Thomson was able to embed data models (about certain parameters measured as functions of temperature measured by an air thermometer) in theoretical models whereby the theoretical object of absolute temperature became envisioned. At the same time, the semi-concrete models allowed Thomson to compute the heat-work relations from data models.

The envisioning of a theoretical object by saving phenomena evolves from the interpretative circle of reading data models as representing phenomena that will be saved via theoretical models. It is a circle between a phenomenon represented by a

[21] The identity of object measured is complicated when the measuring apparatus is interacting with the system to which the object belongs. The issue of entangled measurement is of prime importance in this regard. The paradigmatic illustration for tackling this issue is the so-called von Neumann measurement in quantum mechanics: In deviating from the Copenhagen interpretation, one describes the quantum measurement in quantum-mechanical terms as an interaction between the measured system and the measuring apparatus. Both ingredients are formally construed as basic vectors in a Hilbert space. Accordingly, one may arrange entanglement dynamically in a way in which the final superposition would involve both the system and the apparatus. In so doing, one would no longer be able to attribute an individual state vector to the system or to the apparatus. Since the traditional interpretation of measurement is no longer relevant to this case, one has to take a reflexive stance in order to determine the observables that are measured. The observables are not uniquely defined by the final state of von Neumann measurement. (For the formal difficulties in this connection – in particular, the difficulties in coping with simultaneous measurement of non-commuting observables – see Schlosshauer 2007, 53–58.) Textualizing that involves, in the meaningful articulation of a domain, constitutive interaction between what is measuring and what is measured leads to (a particular kind of) what I will address under the heading of "reflexive texts".

particular set of measurements and the whole of possible models that might save this phenomenon. The envisioning of a theoretical object may also take place in contexts of inquiry that cross two or more domains of inquiry. A case in point is the construction of data models representing a measurable phenomenon that by being saved through theoretical resources of a given domain indicates the existence of an unexpected phenomenon that is beyond the domain's phenomenal scope, but is quite relevant to another domain. Interestingly enough, the indicated phenomenon has been ruled out by data models of the other domain. It is the task of saving it that leads to envisioning a theoretical object within contexts and spaces of representation crossing different domains.

Here is an example of the case just mentioned. Within the domain of paleomagnetism – the studies of the historical changes of the Earth's magnetic field – the phenomenon of reverse polarity of this field has been known since as early as the mid-1950s. Data models for representing and measuring this phenomenon were constructed from collecting data of lava samples and self-reversing minerals in rocks pertinent to magnetic measurements. These data models showed that changes in polarity were not random in time, but "that groups of normal and reverse lavas followed each other in stratigraphic order and appeared to be time-dependent" (Opdyke 2003, 97). The phenomenon of reversing polarity of the geomagnetic field became – after a decade of intensive work on data collection carried out by six research teams, and in spite of the geophysical community's skepticism to the phenomenon's existence – represented by proper data models. Constructing data models of reverse polarity indicated the possibility of another – strongly rejected by several scientific communities in the preceding three decades – phenomenon, that of continental drift. This possibility was nurtured in the early 1960s by paleomagnetic data models of polar wandering. At that time, one began to relate data of paleomagnetism and other numerical data – like those collected in surveying the magnetic anomaly pattern through a marine magnetometer – to data of paleoclimate. Matching both types of data created data models for representing the phenomenon of continental drift. Yet this phenomenon could not become saved through the theoretical models of existing domains.

It was the formation of the domain of plate tectonics which began to provide the proper theoretical models. The theoretical object they introduced (with reference to isostasy) was that of the "convection currents in the Earth's mantle" as the cause of the horizontal movements of continents. The theoretical models advanced by plate tectonics were successful in saving phenomena like the sea floor magnetic stripes, the similarities of magnetic events in terrestrial and sea floor basalts, and the preservation of a symmetrical pattern of the periodic reversal of the geomagnetic field by rocks across the ocean floor's medial rift. The theoretically saved phenomena envisioned the ways in which the "convection currents in the Earth's mantle" operate in such a way as to provide a causal mechanism for continental drift. Plate tectonics succeeded in diversifying the general phenomenon of continental drift in a series of phenomena, each of them savable by the domain's particular theoretical model, and able to envision further the theoretical object in question.

Envisioning a theoretical object through saving phenomena is the most significant event in the meaningful articulation of a domain as it is disclosed in scientific inquiry. The interplay of practices and possibilities and the hermeneutic circularity of inquiry in which this event takes place make the envisioning (and sometimes visualization) of theoretical objects that part of the facticity of domain's articulation which brings into being the integrity of what I called a process of textualizing. Before unfolding this assertion, however, some summarizing considerations concerning the three stages of meaningful articulation and objectification of a research domain are in order. (Let me first tentatively return to the example of the chemiosmotic theory and the domain of vectorial metabolism in order to flesh out the differentiation of the stages of articulation/objectification. Acquisition of relevant data for the mechanism for oxidative phosphorylation as a possible mechanism based on proton motive force is the first stage of making meaningful a newly disclosed domain of reality. The second stage is characterized by specifying theoretical models of the original hypothesis and constructing proper data models [like measurements of the number of ATPs synthesized] that cannot be accounted through models of the chemical theory of oxidative phosphorylation. At this stage, specific phenomena are read, revealed, and measured by data models – for instance, phenomena about the activity of the enzyme ATPase and other respiratory and phosphorylating enzymes in submitochondrial particles, and phenomena related to the osmotic properties of mitochondria. These are phenomena that resist recasting and saving in terms and models of high-energy intermediates theory or phenomena that cannot be described and explained on the basis of discrete phosphorylation steps. Mitchell's chemiosmotic theory is not distinguished by dense conceptuality. But its models entitled to save phenomena of oxidative phosphorylation introduce a theoretical object that is successfully envisioned through experiments on bacterial membranes whose impermeability to protons creates a proton gradient across the membranes. Other experiments [with the so-called uncouplers] succeeded to collapse the proton gradient by breaking the link between respiration and the synthesis of ATP.[22] These experiments also envisioned the theoretical object in question. This is the theoretical object of ATP-synthesis-coupled-to-electrochemical-gradient.)

The picture thus depicted looks suspiciously close to the deductive-nomological scenario for theoretical account of phenomena constructed by experimental data along with the partial empirical interpretation of theoretical terms. Yet this scenario stands and falls by the condition of deductive closure and completeness of the three stages involved. Taking into account the motifs of interpretive fore-structuring and openness nullifies the scenario. It is the expanding horizon of fore-structuring that renders impossible a re-description of the three-stage picture in terms of a theory construction analyzed by the deductive-nomological approach. By implication, the

[22] The most serious objection – raised by Albert Lehninger – which the champions of the chemiosmotic theory had to meet was related to the membranes' impermeability: The occurrence of oxidative phosphorylation is not to be expected if the membranes are badly damaged. The repeating of the experiments presumably supporting the objection show that submitochondrial particles contained intact membranes.

process of textualizing is not analogous to the process of theory construction. The second process will make sense if and only if there is semantic completeness of what is constructed. Unless the "texts" are not isolated from inquiry's interplay of practices and possibilities, the process of textualizing prevents one from questing for such completeness for what is textualized. By the same token, the "texts" are not something like generalized images of theories that somehow involve background knowledge, metaphysical assumptions, and other "hidden structures" that supposedly are necessary for the process of theory construction. Textualizing refers to the expanding fore-structuring of theoretical production of objectified factuality within the changing contexts of inquiry. Accordingly, the "texts" record the stages of fore-structuring as they lead to envisioning theoretical objects that are ever open to be re-contextualized.

The first stage – the collection of data and the search for patterns in the collected data – takes place within the contextures-of-equipment of scientific inquiry. But detecting and selecting data is unavoidably fore-structured by configured practices and projected possibilities for a construction of data models. Articulating the reality of a scientific domain in patterned sets of data that represent phenomena as ensembles of measurable parameters – the second stage of reality's meaningful articulation and objectification – proceeds in its own horizon that is already projected before the acquisition of data. Accordingly, the proceeding of data is fore-structured within this horizon. In fore-structuring the collection of data within contextures-of-equipment, the construction of data models becomes on its part fore-structured by the interplaying practices and possibilities of saving phenomena through envisioning theoretical objects, i.e., by the interplay and the corresponding hermeneutic circularity which enables the third stage of the meaningful articulation and objectification of the domain's reality. In other words, the construction of data models that measure phenomena is within the already projected horizon of contextual envisioning theoretical objects.

In this account, each new stage (a) fore-structures the previous stage and (b) transcends itself, thereby expanding the horizon of interplaying practices and possibilities and the hermeneutic circularity of the domain's articulation and objectification. (It is this expanding horizon of fore-structuring that is in full contrast with the deductive-nomological scenario.) Though justified in several respects, the use of the image and imagery of stages of fore-structuring in the process of inquiry might suggest the wrong impression of hierarchically ordered levels in revealing reality through this process. The impression is, as it were, strengthened by the tacit corollary to the conjunction of (a) and (b) that the third stage of reality's articulation and objectification within scientific inquiry remains without being fore-structured in a proper form. Yet this corollary is wrong, for the third stage does not break with the hermeneutic circularity of meaning constitution. According to (b), this stage also transcends itself, which implies that the way of saving phenomena via models activating contextual envisioning of theoretical objects projects itself upon possibilities that are to be contextually appropriated. In being situated and transcended, the articulation and objectification of a domain's reality as a manifold of saved phenomena is hermeneutically fore-structured. The third stage of revealing reality within

scientific inquiry is fore-structured by the other two stages which – in line with the integral circularity of inquiry – the practices and possibilities of saving phenomena and envisioning theoretical objects are fore-structuring.

Here again I have to invoke the image of the integral hermeneutic circle of the process of inquiry in a scientific domain. The interpretative fore-structuring of the domain's reality disclosed in scientific inquiry consists in an integral hermeneutic circle of meaningful articulation that – by enabling the domain's objectification – involves cycles of detecting and selecting data, constructing data models, and saving phenomena through theoretical models that prompt the acquisition of further data within the contexts of inquiry. Thanks to this circle the stages of inquiry that are fore-structured serve the function of fore-structuring as well. The medium wherein the ongoing and continuous interpretive fore-structuring of a domain's structuration takes place is the circulation of representations-as embodied in semiotic systems. In accordance with the conclusions of the preceding section, this is also the medium of the non-localizable semiosis of various signs and symbols serving as mediators between contextures-of-equipment and contexts of inquiry, and operating via their co-translatability in the transitions from one space of representation into another. The medium of circulating representations, semiosis, and translatability of semiotic systems embraces all of the three stages of a domain's meaningful articulation and objectification. By implication, the integral hermeneutic circle of the process of inquiry in a scientific domain takes effect within this medium.

The medium I am discussing is what becomes textualized in the process of inquiry. Since the integral hermeneutic circle unites the facticity of inquiry (the interplaying practices and possibilities of the three stages) and the objectified factuality, the "texts" created in scientific inquiry-as-textualizing are the places of facticity-factuality unity. My efforts now will be directed to clarifying this unity by having recourse to reading and representing the theoretical objects. As already pointed out, the interplay of practices and possibilities through which theoretical objects become partially/contextually envisioned via saving phenomena provides the broadest horizon of articulation in scientific inquiry. It is this horizon in which the stage of a domain's articulation through saving phenomena becomes fore-structured by the practices and possibilities of the other two stages. Saving a phenomenon by means of a theoretical model remains situated in and transcended by the interplay of experimental, instrumental, and measuring practices and the possibilities for data selecting, patterning, and arranging in proper order. An articulated unit of a scientific domain in which a saved phenomenon shows how a theoretical object is read and represented-as is a textualized expression of the domain's reality.

The kind of contextual reading and representing of science's theoretical objects as entities (or structures) that might reveal their being through what is ready-to-hand within contextures-of-equipment is much more complicated than the other kinds of representation-as in the research process. Yet, to reiterate, it is the reading/representing of theoretical objects that constitutes relatively autonomous "text" that is amenable to a further re-contextualization in the articulation of a domain. My point is that reading and representing theoretical objects contextually is tantamount to the whole

meaningful articulation of reality of a domain disclosed in scientific inquiry. This claim analytically follows from the thesis that the integral hermeneutic circle of reality's meaningful articulation in scientific inquiry is the circle of saving phenomena by means of reading theoretical objects. Like the interplay of practices and possibilities for doing research, the reading-and-representing of theoretical objects is an infinite process. Science's theoretical objects are either related to mathematical idealizations (such as "absolute black body") or to hypothetical explanatory scenarios (such as "regulatory genes"). (No doubt, this division should not be absolutized. As a rule, theoretical objects involve in its being mathematical idealization and virtually existing hypothetical properties. It has to be stressed – again in opposition to both standard realism and instrumentalism – that in the perspective of hermeneutic realism theoretical objects related to mathematical idealizations are not epistemic constructions, but ontological entities articulated within modes of being-in-the-world.)[23]

Theoretical objects are always predicated on a dual existence: They are at once "inscribed" on horizons of possibilities – thereby constantly having potentiality-for-being – and empirically identified (envisioned) in contexts of inquiry. (Roughly, this duality corresponds to their meaningful articulation within facticity, and their factual identification.) The search for a unity in the dual existence is justified by the following observation: For each particular theoretical object, there is a possibly infinite number of contextual (partial) realizations of the objects' potentiality-for-being, given that a partial realization comes to the fore through an actualization of a class of possibilities upon which the objects' being is projected. Thus characterized, a theoretical object is constantly envisioned (in particular, visualized) in contexts of inquiry, but it can never be empirically identified in a definitive manner with respect to the totality of the factual manifestations of its constitutive properties. (Put differently, there is no final context in which the object can be read and represented as something existing per se or as something whose intrinsic properties and ontic identity are totally revealed. It follows from the inexhaustibility of the contextual interpretations of science's theoretical objects that the meaningful articulation of scientific domains is not finalizable – a conclusion already drawn when at stake were other aspects of the facticity of inquiry.)

A theoretical object can never become transformed in its dual existence into a completed actual presence. Of course, this view does not imply that the hermeneutic realist insists on the "eternity" – as resulting from the inexhaustibility of contextual interpretations – of each particular theoretical object. Instead, what follows from the claim that such an object can never become a completed actual presence is the need to address – in terms of hermeneutic realism – the issue of how and when science's

[23] There is a special class of theoretical objects which are neither introduced by means of hypothesis nor through mathematical idealization. Their existence is rather initially allowed by solutions of equations. A classic example is the positron as it has been allowed by the Dirac equation. The debut of such objects in scientific inquiry shows that the dual existence might follow an initial period of virtual unitary existence. The dual existence of the positron became reality when the negative-energy electron solution to the Dirac equation was rejected. At this time, possibilities for other negative-energy solutions to this equations emerged, and they fit the experimental results.

theoretical objects cease to exist. The answer must be sought again in the theoretical objects' special mode of being. As Lorraine Daston argues on various occasions, theoretical objects' ways of coming into being and passing away are ingredients of their biographies. A "biography" of a scientific object in the perspective of historical epistemology is more a story about a certain mode of being – a claim defended also by Latour – than a historiographic overview of the strategies of producing knowledge about this object. In developing further Daston and Galison's (and Latour's) approach to historical epistemology, Theodore Arabatzis manages to consider a certain class of scientific objects – in his words, the class of "non-historical natural kinds" – as "historical entities". (These are objects that after being once represented by conceptualized factuality are no longer distinguished by evolvement in historical time, e.g., electrons. Any of them emerges "when various phenomena coalesce as manifestations of a single hidden entity" (Arabatzis 2011, 385). Nevertheless, they have historicity when at stake are their cultural-historical biographies.) From the viewpoint of hermeneutic realism, Arabatzis addresses the historicity of scientific objects as existing in the facticity of inquiry. He deals with the way in which these objects come into being, and exist under culturally stipulated conditions. The hermeneutic realist handles the biographies of science's theoretical objects by following the view of interpretative internalism in the first place.

The preceding considerations touch upon an issue that concerns the argument against equating theoretical objects with theoretical concepts/terms (Ginev 2015a, 107–122). Starting with Carnap's intention to approach theoretical terms in a manner that would dissolve rather than solve the ontic dispute between realism and instrumentalism, the tendency to transforming the whole discussion about these terms into an entirely methodological discussion has become a winning trend in the analytical philosophy of science (Friedman 2011). The hermeneutic realist supports this Carnapian trend since the alternative trends which relate the discussion to ontic issues are reifying science's theoretical terms. Yet she is convinced that the methodological discussion of these terms has nothing to do with the "biographies" of science's theoretical objects. Theoretical terms are elements of theory's conceptual organization, and their intra-theoretical role is defined by this organization, whereas theoretical objects are meaningfully constituted within particular modes of being-in-the-world. It is the strong insistence on theoretical objects' non-identification with theoretical concepts that distinguishes hermeneutic realism's approach to these objects from the approaches to the non-observational entities designated by theoretical terms as these approaches are suggested in the realism debate. Within this debate the issue of how to identify science's non-observational entities is an epistemological and/or a semantic issue. For the hermeneutic realist, the existence of science's theoretical objects is an ontological subject. In handling this subject, she is not interested in – or at least does not privilege the theme of – how a scientific theory contributes to the interpretation of its primitive (theoretical) terms. Differentiating between theoretical terms and theoretical objects makes sense only in connection with the ontological difference between factuality and facticity.

Furthermore, the hermeneutic realist is not preoccupied with how to make sense of the distinction between observational and theoretical terms. (She is also not

engaged with the views which discard this distinction by means of epistemological/semantic arguments.) The basic difference between the ontological approach to theoretical objects advanced by hermeneutic realism and the approaches to the theoretical terms is most drastic with respect to the issue of contextualization. The determination of the meaning of a theoretical term invokes the so-called contextual theory of meaning. According to the latter, the extension (Frege's meaning) of a theoretical term is defined by the theory's axioms, but its intension (Frege's sense) depends on a theoretical model that contextualizes the semantic interpretation of these axioms. This view of contextualization was already rejected as ignoring the very contextualization of the theory's construction.

In assuming the primacy of the theory's conceptual organization (and supporting scientific realism), one is doomed to look for an observable referent for each theoretical term, granted that this referent somehow represents the unobservable entities and properties which the term expresses. From the viewpoint of hermeneutic realism, a theoretical object does not amount to a theoretical term with a possible observable referent. From this viewpoint, the birthplace of science's theoretical objects – whether they are introduced by a hypothesis, or determined through theory's axioms, or through mathematical idealizations, or by a convention (in Poincaré's sense)[24] – is the facticity of inquiry. By contrast, the theoretical terms exist only within conceptual frameworks whereby they get factual content. Consequently, these terms have a debut after the formation of an epistemic relationship within the facticity of inquiry. Scientific theories (as conceptual frameworks) fix the (semantic) meanings of the theoretical terms by assigning to each of them an observable referent and factual content.[25] This fixation results from a conceptualization (within theory) of certain contextual interpretations of a theoretical object.

By the same token, the factual content of a theoretical term becomes intra-theoretically fixed by disentangling a limited number of a theoretical object's contextual interpretations from the ongoing interplay of practices and possibilities. By contrast, the theoretical object is never "fixed" by a theory since its meaning (and mode of being) is projected upon possibilities that always already transcend each and every conceptualization of factuality. This is why I am holding that a theoretical object has first and foremost a being in the facticity of meaningful articulation, regardless of whether it is designated by a proper term. Once emerged from this facticity, the theoretical object becomes constantly exposed to a pertinent conceptualization and an intra-theoretical stylization that make it expressible via theoretical terms with fixed factual content. Yet again, framing theoretical objects in conceptual

[24] More precisely, the conventional stipulation refers to the mathematical structure with which the theoretical object is associated.

[25] Anjan Chakrvartty (2007, 14–15) points out that in the heyday of the post-empiricist philosophy of science (from the early 1960s to the early 1980s) the expression of "theoretical term" was standardly used to denote terms for unobservables, but nowadays it is used to refer to any scientific term. With regard to the expression's older meaning, Chakrvartty differentiates between theoretical terms denoting detectable unobservables and terms referring to undetectable unobservables (entities and processes that are neither observable nor detectable, but whose existence one posits for theoretical and explanatory reasons).

frameworks is only one among many possible ways of contextualizing these objects in the course of a domain's articulation and objectification. Bluntly, any configuration of scientific practices directly or indirectly aims at conceptualizing a theoretical object.

One might argue (in a Kuhn-like manner) that a theoretical object vanishes when the believers in its existence – like members of scientific communities – pass away. Yet this conclusion is at odds with hermeneutic realism. The existence of a theoretical object does not depend on the collective subjectivity of the believers' community since this existence is "inscribed" on a trans-subjective horizon of possibilities for the object's contextual interpretations and ways of its envisioning through saving phenomena. These possibilities keep being projected even when all believers have passed away. (Hypothetically, an "officially dead" theoretical object might become revived if a new trend of inquiry appropriates possibilities that will make the object contextually envisioned.) A theoretical object ceases to exist when the whole facticity of scientific inquiry – qua a particular mode of being-in-the-world – becomes superseded by completely different interplay of scientific practices and possibilities for doing research.

This case is clearly epitomized by the destiny of phlogiston. Analytical philosophers of science often use the construct of phlogiston as an example for a theoretical term defined within a theory that – despite its explanatory (and even predictive) power – is unable to specify the term's observable referent. Because of this special status, the story of phlogiston seems to provide a convenient historical episode for vindicating structural realism. In structuralist reconstructions, the phlogiston theory establishes – in terms either of the dephlogistification of the fuel or metal, or the phlogistification of the air – empirical regularities concerning various chemical processes. Standard realists fail to explain this success in their usual manner – through appealing to the theory's approximate truth. By contrast, structural realism explains this success by analyzing the unobservable structural process posited by phlogiston theory. In the suggested explanation, the posited structure/process succeeded in unifying various kinds of observable process, thereby enabling the chemists to make successful theoretical predictions.[26]

[26] See, in particular, Ladyman (2011). In this article the case study of the phlogiston theory is entitled to show not only the priority of scientific structuralism over standard realism but also the primacy of ontic structural realism over the epistemic version of this realist position. Structural realists have designed several ingenious case studies of the replacement of phlogiston theory by oxygen theory with the aim of forging proper arguments against standard scientific realism. Though phlogiston is without factual content, it seems to have been a useful fictional construct enabling unifying explanations of a wide range of processes from respiration to combustion. For ontic and epistemic structural realists, this conclusion is important, for it shows that the regularities unveiled by the superseded theory remain valid in oxygen theory; i.e., something like a structure – an unobservable network of relations underlying the observable processes – has been preserved after the theory replacement. Structural realists dismiss phlogiston, but do justice to the structure (as related to empirical regularities) which emerged through the explanatory application of phlogiston to processes as diverse as the calcination of metals, ordinary combustion, and respiration. I agree with Gerald Doppelt's argument against the structural realists' account of the successes of phlogiston theory. For Doppelt (2011, 296), this account "assumes the truth of current chemistry's

How does the death of phlogiston look from the viewpoint of hermeneutic realism? Seen from a historiographic perspective, it was not the oxygen theory that annihilated the horizon of making sense of phlogiston. In other words, even after the rise of this theory there was a wide range of possible phenomena that were amenable to being saved by evoking the envisioning of phlogiston. François Rouelle's revising reading of Stahl's theory led to a differentiation between phlogiston as principle (in the sense of the Aristotelian triad of principles, qualities, and virtues) and as the matter of fire, and opened a new horizon of possibilities for making sense of this theoretical object. Interestingly enough, for those who followed Rouelle's version of phlogiston theory, the treatment of phlogiston as principle and the non-quantitative experimental study of its role in chemical processes prevent them from becoming committed to the quest of reducing chemistry to physics. This position is documented by the article on chemistry in the *Encyclopedia* written by a pupil of Rouelle. Phlogiston as a theoretical object "died" after the horizon mentioned began drastically to diminish, thereby ceasing to be a horizon of anti-reductionist expectations for affirming chemistry as an autonomous science. It was the development of imageries and conceptual figures for chemical affinities as being based on causal laws of physics whereby Newtonian dynamics made an inroad into chemistry – and not the oxygen theory – that made phlogiston as principle meaningless.

Although no more than a fictional object, phlogiston has been existing not only in the imaginative minds of its creators but in all research contexts in which it has been envisioned (read and represented). Being envisioned in the facticity of a certain kind of scientific inquiry, phlogiston has had a meaningful existence within the mode of existence corresponding to that facticity. Phlogiston "died" when the facticity of its meaningful existence was "worn out". The shrinking horizon of possibilities for its envisioning was the forerunner of the coming death of this theoretical object. The theoretical term of phlogiston could have transmitted its structural-explanatory potential in post-Lavoisier chemistry. But this does not change the "biography" (in Daston's sense) of the theoretical object of phlogiston. The end of this biography occurs when there are no longer possibilities for doing research whose appropriation would make sense of phlogiston as a meaningful entity. A theoretical object cease to exist when there is no open horizon upon which the object's potentiality-for-being can be projected. (This conclusion is confirmed by Douglas Allchin's (1997) study of the destiny of the "high-energy intermediates of ox-phos" that was already discussed in another chapter. The identification of and the way of envisioning this theoretical object have been vigorously pursued by prominent biochemists in the period from the early 1950s to the mid-1970s. Allchin makes the case that objectified factuality about the existence of the high-energy intermediates has been actively constructed. This factuality consists not in artifacts but in "erroneous facts", given that the latter acquire this status when evidence leads the researchers to see them as facts belonging to another domain. [By his account,

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ontological claims concerning oxygenation and reduction. This assumption violates structuralists' key claim that the truth of such theoretical posits cannot be known or used to explain the success of scientific theories."

artifacts in experimental research work are those that lost their epistemic value as causal relationships became better known.] The believers in the high-energy intermediates "did view nature" (Allchin), and in following their belief, they produced important facts that "expressed nature". However, these facts gained their meanings not through envisioning the theoretical object in question, but by being tied (in each particular case) to another domain [such as the domain of NAD coupling]. Making facts meaningful in this way is an indication that there is no longer an open horizon of possibilities for envisioning certain theoretical object within the original domain of inquiry.)

An extant theoretical object is, as it were, scattered over its possible contextual readings and representations (and, by implication, over a greater diversity of contextures-of-equipment). The object's being is distinguished by a growing "dispersal" of its contextual identifications (Ginev 2008b). The ways in which one ascribes contextualized empirical identities to a theoretical object are dictated by the scenarios of how to save particular phenomena. *Theoretical objects are existing in both factuality and facticity – and accordingly, in the ontic-ontological difference and unity of reality (as being objectified and being projected upon a horizon of possibilities). Their being is (a) contextually scattered, (b) characterized by absent presence with regard to the attempts of their comprehensive factual identification, and (c) distinguished with a potential "inexhaustibility" with respect to their possible interpretations*. This claim opposes at once the view that theoretical objects are predicated on actual presence in the hypostatized factual reality, and the view that they are but convenient instruments for conceptualization and conceptual organization of data. As already mentioned in the Introductory Chapter, the claim confronts the empiricist doctrine of observability which presumes that there is actually present meaning – contained in the terms referring to theoretical objects – waiting to be made explicit by unfolding an observational (experiential) language. In this doctrine, the meaning of a theoretical term is fixed and can be "exhausted" without remainder by explicating the empirical basis that makes this meaning observable. Yet if theoretical objects are never totally envisioned and interpreted, then it seems plausible to assume that they are Platonic entities whose existence per se is not to be achieved (and in this sense, not to be exhausted). With this assumption, a theoretical object should be interpreted as an essence that remains invariant within potentially infinite variations. The hermeneutic realist strongly denies this essentialist interpretation of theoretical objects' mode of existence. More specifically, she holds that theoretical objects' being is not determined by a mathematical, mental, or physical essence that is beyond contextualization and meaningful articulation.

The thesis that all entities taking place in scientific inquiry are meaningfully constituted in the research process sounds very much like the neo-Kantian dictum that scientific entities are not prior to scientific theorizing. The spread of Kantian attitudes toward the mode of being of theoretical objects was recently promoted in the analytical philosophy of science by the reception of Ernst Cassirer's form of structuralism about the theories in physics.[27] According to Cassirer, objects like

[27] See in particular French and Ladyman (2003a), Massimi (2005, 28–31), and Massimi (2011).

atoms or electrons can only be defined implicitly by having recourse to the structures through which they have been introduced. Epistemic structural realists follow this tenet when denying the existence of autonomous objects beyond or behind structures. But their commitment to neo-Kantianism is by no means limited to that point only. They believe in the existence of a whole "architectonic of scientific knowledge" that – as a regulative and not a constitutive a priori – regulates scientific inquiry. More specifically, it regulates the quest for good epistemic conditions under which assertions about unobservable theoretical objects (as embedded in structures) would be justifiable. Since the architectonic of scientific knowledge fulfills its regulative function in inquiry via the process of theory construction, there are no scientific entities (including theoretical objects) prior to theorizing. Scientific theorizing is fixing (by means of mathematical structures) the aforementioned epistemic conditions which are envisioned in a regulative-aprioristic manner by the architectonic.[28] Against this view, hermeneutic realism states that there is no architectonic of scientific knowledge prior to the facticity of scientific inquiry.

4 The Absent Presence of Science's Theoretical Objects

From a slightly different perspective, the conclusion reached in the preceding section can be expressed as follows. Science's theoretical objects are neither entities in themselves nor entities postulated by theories to serve the function of useful fictions in saving phenomena. The total interpretation of a theoretical object is beyond the "reading potential" of any particular context of inquiry: There is no context in which one might accomplish an exhaustive interpretation of a theoretical object. Each theoretical object has a potentiality of being in intercontextuality. (By "exhaustive interpretation" I mean one that would eliminate the need of a further interpretative re-contextualization of the object.) More importantly, a theoretical object is not only interpretatively inexhaustible within the particular configurations of practices, but each new contextualization of such an object extends the possibilities of its further reading, provided that the horizon of the domain's meaningful articulation is not shrinking. I will briefly track the "destiny" or the "biography" of the theoretical object "enzymes" in order to put flesh on my discussion. In what follows, first a quasi-historiographic description of symptomatic conceptual and empirical

[28] Cassirer describes the architectonic as involving results of measurement, laws, and principles. The principles prescribe the form of laws. But neither the principles nor the laws operate outside the space of measurements. In the internalist perspective of this architectonic, one determines the criteria for identifying entities and the conditions under which scientific knowledge defines the references of the unobservable objects. The way in which scientific structuralists of different sorts receive Cassirer's views might be criticized from a broader perspective that specifies the place of this "architectonic view" in the whole of his philosophy. Cassirer is by no means a Kantian structuralist. The architectonic of scientific knowledge is part of his dynamic-processual theory of symbolism in which the anti-structuralist thesis of the priority of the constitution of symbols over the linguistic structures occupies a central place (Krois 2011, 11–14).

difficulties in enzymes' envisioning will be suggested. In a second step – continuing an analysis I started elsewhere (Ginev 2015a, 126–137) – a fourfold (formal, material, structural, and functional) contextual identification of this theoretical object will be discussed.

In 1878 Willy Kühne introduced – in connection with a criticism he leveled at the speculations on the existence of intracellular ferments – the term "enzyme" to refer to a hypothetical object that as a "living spark" catalyzes (due to its "animated force") every chemical action and reaction in all eukaryotic organisms. Kühne also stipulated the conditions under which this object could be empirically identified. He emphasized the essential difference between "organized ferments" (supposedly living microorganisms) and "unorganized ferments" (enzymes). The new theoretical object would have to be laboratory envisioned as a highly effective catalytic agent that can function outside the living cell. (However, Kühne did not rule out the possibility of intracellular enzymes.) It was the specification of the difference being mentioned as a distinction between ferments produced by the "living protoplasm" and enzymes (nonliving substances) that essentially prompted the transition from Liebig-style physiological chemistry to contemporary biochemistry in the early twentieth century.[29] Thus, a new scientific domain became disclosed in whose articulation a lot of contexts came into being for studying in vitro and in vivo the catalysis of metabolic reactions. Reading and representing various physiological, chemical, and cytological phenomena by means of data models within these contexts led to a multiple envisioning of the theoretical object "enzymes", and accordingly, to a progressive "textualizing" and a meaningful articulation of the domain of enzymology. (For a long period, the contextual representations-as and representations-of alluded to the role of "enzymes", but these representations did not gain a status of models capable to save the above-mentioned phenomena, thereby envisioning the theoretical object). Most of the possibilities generated by practices in the initial contexts were actualized in the first two decades of the last century.

Eduard Buchner's discovery that the cell juice extracted from macerated yeast can ferment sugar to alcohol and carbon dioxide was the first genuine empirical identification of the theoretical object. It was a discovery of the soluble enzyme "zymase" responsible for a process of cell-free fermentation. At the same time, another contextual envisioning of enzymes was regarded as controversial: The attempts at extracting "unorganized ferments" from organs of the animal body that in vitro can promote activities of organs failed. Nonetheless, the "professional ideology" of the newborn discipline of biochemistry was shaped by the conviction that one can explain chemically the vital processes of digestion, metabolism, respiration, and assimilation by ascribing to each chemical change occurring in the living cell a specific intracellular enzyme (Kohler 1973, 185). Franz Hofmeister expressed this conviction by raising the dictum that all vital reactions are mediated by intracellular enzymes. In the context of extracting enzymes from reactions' products,

[29] Theoretical biology's dominant paradigm of the late nineteenth century prohibited the existence of Kühne's enzymes. In this paradigm, the synthesis and transportation of materials in living organisms are accomplished by biochemical reactions within cells, but without any catalytic participation of extracellular ferments in these reactions.

a further envisioning of the object was achieved by identifying enzymes that hydrolyze a substrate to oxidizable forms. Yet the progress in extracting enzymes catalyzing other reactions than hydrolysis was for a long period not impressive. This failure created the belief that the enzymes are only able to catalyze relatively simple biochemical reactions.

In the year 1894, three years before Buchner's epochal discovery that sugar is fermented by yeast extracts, Emil Fischer speculatively figured out a context of conceptualizing enzymes that several decades later – after the introduction of representational devices of protein structure by means of X-ray diffraction analysis, and the development of models of the tertiary structure of macromolecules – would become a basic research trend in enzymes' structural envisioning. What Fischer began to constitute was the context of modeling the work of enzymes in terms of stereochemistry. Fischer's experimental investigation of the role of "albuminoid substances" in the living cells led him to the conclusion that the molecular asymmetry – and more generally, the "geometrical structure" of the molecules – is crucial in the enzymatic catalysis. This conclusion was the hour of birth of the "lock and key" model entitled to explain the enzymes' activity through complementary geometric shapes of the enzyme and the substrate.[30] The research work in this context of identifying enzymes would reach its apex in Daniel Koshland's model of the continuous reshaping during enzyme-substrate interactions suggested in 1958. Envisioning the theoretical object enzymes by predominantly paying attention to the geometrical structure of molecules hinted at possibilities for doing research whose appropriation gradually eliminated the difference between the chemical activity of living cells and the activity of chemical reagents (in particular, reagents distinguished by molecular asymmetry) (Fruton 2006, 70). This development opened an avenue to the initial version of the enzyme theory of metabolism in which the distinction between vital and enzyme action definitely vanished.

Immediately upon Buchner's discovery, a reaction against dethroning living protoplasm in favor of zymase began to take shape. It was not easy to annul the dominant view that all metabolic processes are carried out by the whole living protoplasm. The reaction against extracellular enzymes was inspired by motifs coming from physiological chemistry and the Liebig-Pasteur dispute. Richard Neumeister, who – though accepting cell-free fermentation – insisted that fermentation is too complex a process to be reduced to the catalytic role of zymase, called into question that enzymes even exist. He argued that enzymes could not play a role in glycolysis or in the cleavage of sugar to alcohol and carbon dioxide. For an externalist historian of science like Robert Kohler (1972), the acceptance of zymase was a social phenomenon. Yet the clash between the "emerging enzymologists" and the adepts

[30] Very soon, however, enzyme identification by means of stereochemistry was cast into doubt by the discovery of enzymatic reactions for which the lock and key model is invalid. Nonetheless, the theoretical model of how appropriately shaped substrate molecules fit into the lock (enzyme) was the first case of saving the phenomenon of extracellular fermentation by means of a theoretical model. Starting from this case, the search for envisioning (reading and representing) the enzymes would be carried out by broadening the practices of constructing models that might formalize the kinetics of enzyme catalyzed reactions.

of the protoplasm theory provoked a significant re-contextualization of the way of identifying and envisioning enzymes. The novel context was constituted by the search for active proteins inside the cell that form the same "sidechains" which physiological chemistry ascribed to living protoplasm. Due to this research the domain of enzymology was disclosed as irreducible to any other domain, or to a constellation of existing scientific domains. Later on, in the same research tradition the main issue became the existence of oxidative and reductive enzymes. Like these enzymes, those of the intermediate stages of lactic and alcoholic fermentations were identified with respect to their role in reactions. Yet no enzyme was obtained in a pure crystalline form. The purification of enzymes required a new re-contextualization of the research work.

Otto Warburg – a leading figure in enzymology during the period of its institutionalization – declared in 1928 that the "methods of preparative chemistry" are underdeveloped for enabling the ultimate identification of enzymes. At approximately the same time, authoritative voices in biochemistry tried to adduce evidence that proteins are not part of enzymes like invertase. However, the isolation of enzymes as crystalline proteins was imminent. In the second half of the 1920s experimental practices demonstrated that protein molecules possess unique catalytic activities. Some biologists started to speculate that enzymes are proteins whose structure contains inorganic cofactors. In the 1930s the isolation of enzyme molecules by means of purification through crystallization, and the description of their structure and function became usual practices, especially after the introduction of adequate tests of purity. Enzymes became envisioned at the molecular level.

The new context of structural-molecular research involved reading practices and spaces of representation like the crystallization of proteins identified as enzymes (including ribonuclease and deoxyribonuclease); determining the homogeneity of isolated enzymes; making X-ray photographs of crystalline pepsin; developing conceptual models about structural modifications of enzymatic molecules during reactions; experiments that identified the function of nicotinamide adenine dinucleotide in hydride transfer; experimentation with the methylene blue effect that drew attention to the role of coenzymes; and, last but not least, experimentation with the phosphate-transfer fermentation that led to the pathbreaking discovery of the synthesis of ATP from ADP as a fundamental model of bioenergetics. Drawing attention to coenzymes was a sufficient reason for a new re-contextualization. It was particularly the way in which coenzymes operate as metabolic intermediates that essentially changed enzymes' envisioning.

The intermediate formation of enzyme-substrate complexes is one of enzymology's oldest subjects that underwent several re-conceptualizations. It was initially introduced in connection with studying the equilibrium states in enzymatic processes. Studies in this regard were carried out in Fischer's context of enzymes' "geometrical" envisioning. Very soon, however, these studies elicited an essentially new context of enzymes' identification: the context of enzyme kinetics. The formal reading and representing of the theoretical object being discussed was achieved when in the year 1913 covariant mathematical equations (known as the Michaelis-Menten formalism) of enzymatic kinetics appeared for the first time. (As

already pointed out, Briggs-Haldane's alternative formalism – based on the assumption of quasi-steady state approximation – facilitated the long-standing quest for linearization of the original equations.) The subsequent linearization of these equations by means of various mathematical plots allowed one to identify enzymes also as mathematically idealized objects, or as objects that are inseparable from a mathematical structure. (Though introduced for technical-computational reasons – with the aim of replacing nonlinear regression in modeling observational data, and to eliminate the nonlinear function in the original formalism – the plots of linearization were significantly important to elicit a re-contextualization that envisioned enzyme kinetics in a new way.)

In idealizing to some extent the historical picture, one might elaborate on a historiographic narrative (of enzymology) guided by the hermeneutic-realist thesis that in each particular re-contextualization of reading and representing (the theoretical object of) enzymes a certain phenomenon became saved by means of a theoretical model.

Making a long story short, the ways of tackling the biochemistry's central problem – the problem of whether physiological synthesis is due exclusively to enzymes – led to the enzymes' fourfold (formal, material, structural, and functional) identification in the contexts of biochemical research. As a theoretical object they were contextually read and represented (a) as catalytic entities whose kinetic properties can be formally described and measured through studying quantitatively the reactions they catalyze, (b) as proteins that (with or without cofactors) are able to catalyze each step in the sequences of the metabolic pathways, (c) as molecular structures identified through X-ray crystallography, and (d) as chemical agents that fulfill their functions through the energy changes in the biochemical reactions. In short, enzymology became, at the end of the 1930s, organized in accordance with the four lines of formal, material, structural, and functional envisioning of the theoretical object enzymes. Each of these lines followed its own historical trajectory, and it was soon realized that the unitary envisioning of enzymes requires synthetic contexts of inquiry which cell biology, biochemistry, physical chemistry, experimental genetics, bacteriology, and all other relevant disciplines are still not able to constitute. The divergent lines of envisioning brought into play the skeptical view (attributed to Jerome Lettvin) that enzymes – despite their "multiple identification" and contextual representations – are objects invented by biologists to give accounts of events and processes that otherwise require more difficult thinking and research work.

Yet there was no lack of enthusiastic attempts at constituting synthetic contexts of inquiry. The research projects in comparative biochemistry – promising that the metabolism of a phylogenetically more primitive organism might provide clues to general principles in enzymology – in the 1930s were cases in point. The domain of bacterial physiology was disclosed by practices initiated by such projects (Kohler 1985). It was the overcoming – within this domain – of the reductionist view that bacteria are "bags of enzymes" amenable to being extracted and examined in vitro that prompted the quest for a holistic vision of enzymes. The work on bacterial metabolism had shown that a holistic envisioning can be attained by a kind of

research that (in Hopkins's tradition of biochemistry) was called a "comparative chemical physiology". Ironically enough, the spirit of physiological chemistry – once abolished by enzymology – was partially restored for the sake of a synthetic envisioning of enzymes. (Even the view that the structural and functional organization of protoplasm conditions enzyme activity had been rehabilitated by prominent figures like Joseph Needham and Eric Holmes.)

The idea – championed by Judah Castel and Marjory Stephenson in the first place – behind this kind of research was that the material, structural, and functional unity of enzymes is to be identified not by working with artificial chemical systems, but by studying complex physiological processes of phylogenetically primitive organisms like bacteria. Accordingly, the belief gained currency that bacterial biochemistry may describe and explain physiological phenomena of living cells (irreducible to phenomena observed in artificial systems) whereby the works of enzymes will be envisioned in a holistic manner. In the basic assumption of this research trend (known also as "Cambridge-style enzymology"), enzymes can be identified as biochemical, cytological, and physiological entities by making intelligible the mechanisms through which the cell coordinates its separate systems. A remarkable achievement of the trend was the description of the phenomenon of enzyme adaptation as it correlates with phenomena of physiological adaptation. (Enzyme adaptation is the ability of enzymes to inform cellular physiology to promote synthesis of new enzymes in the presence of their specific substrates.) The representatives of "Cambridge-style enzymology" were inspired by the idea that the chemistry of enzymes is dependent on the adaptive function they serve in the cellular organization, and not vice versa. In spite of this optimistic attitude and of some promising results, adaptive enzymes that possibly are responsible for cellular regulation remained an "intriguing oddity" (Kohler), and the very program of enzyme adaptation became obsolete with the birth of molecular biology.

The discovery of bacterial genetics in the early 1940s led to the constitution of a new context of enzymes' envisioning. A crucial event in this regard was the formulation of the "one gene-one enzyme hypothesis". For the first time the identification of enzymes became an issue of genetics. This was the last chance for unification. According to George Beadle and Edward Tatum (1941, 499–500), genes control or regulate specific reactions by determining the specificities of enzymes. Interestingly enough, they draw on Haldane's hypothesis that genes act through the mediation of enzymes. The basic claim in this view is that "gene and enzyme specificities are of the same order." The authors elaborated on a relatively new experimental practice: X-ray treatment of the ascomycete *Neurospora* that presumably induces mutations in genes concerned with the control of known enzymatically catalyzed reactions. Three mutant strains have been produced: one related to an inability to synthesize pyridoxine; another, the synthesis of thiamine; and the third mutant strain, an inability to synthesize para-aminobenzoic acid. The inability to synthesize pyridoxine is "differentiated by a single gene from the ability of the organism to elaborate this essential growth substance" (Beadle and Tatum 1941, 506). Had one been able to prove that each gene is responsible for the production of a single enzyme that catalyzes a single step in a metabolic pathway, then one would have specified the

theoretical object "enzymes" as that factor that mediates between the process studied by physiological genetics and the processes studied by biochemistry. The experimental practice launched by Beadle and Tatum is nowadays considered to be the birthplace of "biochemical genetics" and a forerunner of molecular biology. Yet the hypothesis "one gene-one enzyme" was strongly modified (if not refuted) soon after the introduction of the new experimental practice. Research work in the period from the late 1940s to the late 1950s shows that it is impossible to envision enzymes as localized units determined by genes. What can be envisioned is the strong dependence of the production of polypeptide chains by genes – a result that promoted the research work in molecular genetics.

The constitution of contexts envisioning enzymes in the period immediately upon the emergence of biochemical genetics and molecular biology was marked by a kind of "division of labor" regarding the fourfold (material, structural, functional, and formal) problematic of identification. One constructed graph and diagram data models describing enzymes' functional properties by acquiring and proceeding data about molecular structures, and looking for formalized theoretical models (including mathematical plots about the kinetics of the catalyzed reactions) pertinent to the constructed data models. However, this cooperation led to new forms of divergence among the lines of identification. The research history of DNA polymerase provides an illustration in this regard. (The research concentrating on the so-called Klenow fragment, which lacks a certain activity of DNA polymerase I, was contextualized by configurations of molecular-biological practices like those investigating the synthesis of DNA molecules from single-stranded templates, while the studies of the activities of the whole enzyme were contextualized via practices dominated by in vivo experimentation on mutants deficient in this enzyme. Thus, the Klenow fragment was envisioned more as a structural entity, while the whole enzyme was identified more by the functions it serves.)

It should be emphasized, however, that the theoretical object "enzymes" is much more homogeneously envisioned in contexts of inquiry than another famous biological object with a hypothetical status: the theoretical object "genes". In characterizing the gene as a "hypothetical construct", Raphael Falk shows that the quest for envisioning the discrete elementary material units of heredity has proceeded within contexts of inquiry that are hardly to be aligned.

Once having been identified as a Mendelian unit serving the function of a means to differentiate the phenotypic variability from the genotypic variability, and later (in the period of "Drosophila genetics") as a "material unit located in the chromosomes" (Thomas H. Morgan) that (again in connection with Beadle and Tatum's hypothesis) determines properties while not being determined by protein's properties, the gene became in the 1960s a clearly identifiable object: a spatial elementary unity of heredity, localized as a sequence of nucleotides of DNA. As is well known, nowadays the conviction prevails that the reference to the gene as a discrete and concrete entity of DNA could not be maintained (Falk 1986, 135). It was Jacob and Monod's model of genetic regulation and especially the models of the "developmental gene" that definitely broke with the atomistic-reductionist view of this object. At first glance, there are (in the history of the biological approaches to

heredity) dissonances between lines of interpretation pluralizing the being of this theoretical object that resemble the discrepancies between the contexts of envisioning enzymes. Thus, for instance, when Herman J. Muller in the early 1920s undertook the attempt at specifying the genes – qua atoms of heredity endowed with the faculty to mutate – with regard to their physiochemical properties, a configuration of biochemical, microbiological, cytological, and physiological practices began to take shape. The constituted context of identifying discrete genes was entitled to actualize possibilities for "extracting" genes as material particles. The opposition to the identification of the gene as the material atom of heredity actually antedates Muller's program. The translation of Mendelian inheritance into the language of Pearson's biostatistics, which brought into being population genetics, was incongruent with the restriction of genetics to cell physiology and the theory of cell metabolism. The discrepancy between the molecular-genetic and the developmental-biological ways of envisioning the gene after the late 1960s is a déjà vu of the historical situation from the early 1920s characterized by the split between "Drosophila genetics" and population genetics.

Falk notes that what may seem more surprising is "that the entity of one molecular biologist is quite different from that of another molecular biologist" (Falk 1986, 133). He nicely discerns four diverging lines of identifying the gene, addressing them respectively as (a) genes as abstract entities (say, Dawkins's "selfish gene") meaningfully constituted in research contexts of population genetics by following more or less an instrumentalist attitude in studying the genetic basis of evolutionary phenomena related to adaptation and selection; (b) genes as material structural entities that involve complexes of different macromolecules; (c) genes as functional biological entities that are responsible for the process of reproduction; and (d) genes as generic operational entities that play roles in complex and integrative living systems (Falk 2000, 339–340). These lines seem to be analogues to the four ways of envisioning enzymes. Nonetheless, there is an essential difference in the ontological status of the two theoretical objects.

To put it in a more traditional idiom, the gene appeared to be a much more hypothetical object than "enzymes". But this observation hardly tells us something that can be useful for further comparison. For Rheinberger, the gene is an object distinguished by "vagueness", and engendered by particular scientific practices. Furthermore, the gene is a theoretical object "embedded in experimental operations" (Rheinberger 2000, 220). By implication, all contextual identifications of the gene require operational criteria. But at the same time, Rheinberger cogently demonstrates that the practices of inquiry engaged with the identification of this theoretical object actually engender a variety of "epistemic things". Being incorporated in these things, the gene – though not having only a "virtual reality" and not reducible to an "intellectual device" – is doomed to be a non-envisionable object in its integral being. This is not the case with the object "enzymes" which in various contexts of inquiry exists through its (contextually dependent) unity of structural, material, functional, and formal identities. Here is the basic difference: The gene is a theoretical object that has no context of inquiry in which its integral being can be envisioned, while the integral being of "enzymes" is envisionable in several contexts,

but the discrepancies among these contexts are not to be overcome in a definitive manner.

In drawing attention to the discrepancies among the contexts of envisioning "enzymes", I am far from asserting that today the theoretical object "enzymes" exists pluralistically in the growing divergence of its four lines of identification and contextual envisioning. To be sure, every working biochemist recognizes enzymes – in her routine laboratory everydayness – as something monolithic and distinguished by a clear empirical identity. Yet, again, if one looks at the possibilities for new contextual identifications, one would see tendencies to growing dissonances – I even dare to say discrepancies – among the four ways of reading and representing enzymes even within the routine of "normal science". Moreover, each of the lines of investigating enzymes discloses and articulates the reality of enzymatic catalysis in a characteristic hermeneutic situation. Even in the period 1920–1950 there were complicated processes of convergence and divergence among the lines of formal, material, structural, and functional envisioning of this theoretical object. In the post-war period the "dispersal" of the object's existence in contexts of its envisioning became intensified. What I would like to stress by making this observation is the impossibility to depict an idealized image of enzymes – supposedly revealing the object's "intrinsic identity" – that might serve as a "regulative essence" to be approximated in all contexts of inquiry. (In stating this, I am countering those hermeneutic philosophers of science who believe that bringing Heidegger's concept of formal indication to bear on the analysis of tendencies of doing research might reveal hidden regulators in the articulation of scientific domains.)

As a matter of fact, the story about the pluralist being of this theoretical object is much more complicated. At the beginning of the 1980s an "event" took place in enzymology that had much more far-reaching implications than any re-contextualization that has had happened before. I am referring to implications not only for the domain, but for the role which biochemistry might play in understanding the genesis and nature of life on Earth. (By "event" I mean not the appearance of a new context, but a radical change of the horizon of possibilities for doing research whereby the whole domain becomes disclosed anew.) Phrased alternatively, the "event" was not on the same level at which the new readings and representations of the domain's central theoretical object had happened in the preceding 70 years. The changes which it provoked were on a much bigger scale than those on which the emergence of any of the four lines of enzymes' envisioning – and the corresponding forms of the domain's textualizing – had been created. What took place was the introduction of a new theoretical object – "ribozymes (RNA catalysts) and ribonucleoprotein enzymes" – in studying the catalysis of biochemical reactions. Though engendered by the experimental search for new structural and biochemical data models that might represent new facets of protein enzymes, the way of introducing ribozymes as a theoretical object was not to be subsumed under the heading of re-contextualization within the historically established interplay of practices and possibilities. It was rather a "revolutionary twist" in the meaningful articulation of enzymology. As a result, it became clear that the central dogma of this domain – all

metabolic reactions are catalyzed by proteins (folded chains of amino acids) and cofactors (non-protein molecules) – is no longer valid.

In 1982 a team of researchers published in the journal *Cell* a paper devoted to the phenomenon of "self-splicing RNA". The paper describes data obtained by means of experimentation with the production of a kind of RNA that underwent splicing (a modification of the pre-messenger RNA molecule that is necessary for the production of protein through translation). The authors dared to conclude that splicing activity is intrinsic to the structure of the RNA, and that enzymes are unnecessary for this reaction.[31] According to this conclusion, a certain portion of the RNA has enzyme-like properties that enable it to break and reform phosphodiester bonds. Twenty-five years after these experiments (when meanwhile the studies on the catalytic functions of RNA had become a well-established subdomain of enzymology), Thomas Cech – the leading figure of the 1982 research team, who shared the 1989 Nobel Prize in Chemistry for his research in the catalytic properties of RNA – wrote that when the team announced the initial experimental data about the self-splicing RNA with enzyme-like properties, "it required a bit of daring to speak of catalytic RNA" (Cech 2008, vii). It was discovered (before the end of the 1980s) that the molecule of the catalytic RNA – just like the molecule of any protein enzyme – must be correctly folded into the conformation required for catalytic activity. The careful selection of data in this period brought into play a significant molecular-genetic result: ribozymes are (at least some of them) introns (nucleotide sequences within genes) that must be regarded as being able to encode proteins required for the processing of DNA and RNA. Thus, ribozymes as introns are "multitalented molecules", and not "junk".

In 1994 the first three-dimensional structure of a catalytic RNA was published, thereby providing the initial structural data for representing the phenomenality of the new catalytic mechanisms. This step in the "legalization" of ribozymes as an autonomous theoretical object had the same importance which the chemical identification of protein catalysts had shown for the legalization of enzymes. (At the end of the 1990s, the belief gained currency that the data collected by cooperation of structural and functional studies of ribozymes could be organized to represent catalytic phenomena that on their part would be saved by means of mechanistic theoretical models. However, growing disagreement between biochemical and structural data compromised to some extent this belief.)

A crucial point in the emancipation of the subdomain was the experimental construction of data models for an important observable phenomenon: the ribosome is characterized by a catalytic activity whose active site (for a certain reaction) is composed entirely of RNA. Saving this phenomenon by means of a theoretical model would have meant the non-derivability of the theoretical object "ribozymes" from the "behavior" of other theoretical objects. The question as to whether such a model – through which the ribosome as a whole can be interpreted as a ribozyme –

[31] Shortly afterwards, another research team working at Yale University discovered a similarly independent catalytic RNA when experimenting with a certain enzyme in the bacteria *Escherichia coli*.

has been suggested remains a controversial issue. Nonetheless, a growing progress in the subdomain's emancipation was achieved through describing the so-called "RNA structural motifs" (i.e., the structural-molecular mechanisms of catalysis), which are strongly independent of protein enzymatic motifs.[32] (I am not inclined to conceive of the RNA structural motifs as theoretical models. As stereochemical descriptions these motifs are closer to data models. It is no accident that researchers are looking for a "mechanistic understanding" of the RNA motifs which do not have a formal structure in which data models can be embedded. Historically seen, however, these motifs [patterns of catalysis] served the function of quasi-theoretical models through which several phenomena were saved. Of course, genuine theoretical models were also constructed. A case in point are the models of biochemical mechanisms for RNA-catalysis.)

The rationale for the introduction of the new theoretical object was the need for saving not only observable phenomena, but also diverse "unobservable phenomena". Accordingly, several classes of theoretical models have been suggested since the year 1982. Among the observable phenomena saved by means of such models were, for instance, those which supposedly demarcate self-acting ribozymes from true enzymes. The existence of unobservable phenomena has been indicated by the appearance of unexpected experimental data. These are phenomena which appear as stable features of the experimental output, but cannot be directly observed without using instruments. Generally, the researchers begin to believe in the existence of these phenomena when the replications of experiments show patterns in the production of unexpected data. A case in point was the phenomenon of an ancestral RNA-based protein synthetic apparatus.[33] However, the unobservability of these phenomena should not be equated with what in high-energy physics is counted as being unobservable phenomena. Indeed, in both cases organizing the unexpected

[32] A typical motif is the "hammerhead RNA catalysis". In this motif, two RNA strands work in concert, one of which becomes cleaved, thereby enabling a trans-acting catalytic regime. The multiple turnover (i.e., the number of the substrate's molecules that a ribozyme can convert, via its catalytic site, to product) obeys the same rate equations which characterize the enzyme kinetics.

[33] The possibility of saving this phenomenon through a theoretical model precisely opened a window into the way of studying ribozymes as playing a key role in the evolution of life on Earth. All traditional theories of the macromolecular genesis of life face a "chicken and egg" dilemma since both proteins and translation systems seem to require for their own origin the prior existence of the other. (In the 1960s and 1970s several biologists asked how did DNA make the proteins and replicate itself, before it had made some enzymes for which it needed some enzymes.) Ribozymes provide a way out of this dilemma: If there is a kind of RNA that is simultaneously an informational and a catalytic macromolecule, then this kind might be considered as a remnant of the "RNA world" that might have existed around 3.5 billion years ago. The proponents of this hypothesis admit that the "RNA world" would have been short lived, being swiftly replaced by polypeptides that it would have produced (see Tarasow et al. 1997; Unrau and Bartel 1998; Lilley and Eckstein 2008; Joyce 2002). This is why some of the ribozymes that currently exist are regarded as possible "molecular fossils" or "relics". It is an open question as to whether structural and functional data obtained from the study of these fossils might be used as data models for representing theoretically savable unobservable phenomena that are capable of confirming the "RNA world" hypothesis. (In another formulation of this hypothesis, DNA- and protein-based life was preceded by a kind of RNA that acted as both a genetic material and cellular enzymes.)

experimental data in data models is the first step in saving unobservable phenomena. Yet the relationship between data models and theoretical moments is not the same in both kinds of scientific inquiry.

Michela Massimi nicely pinpoints the specificity of the unobservable phenomena – each of them initially registered as an unexpected value of a function or a parameter – in high-energy physics.[34] (The range of possible expectation values is determined by the models of a pertinent background theory.) According to her, an unobservable phenomenon "is not idiosyncratic to the context in which it originally appears, but it emerges from different contexts, namely, from other functions involving completely different parameters and data" (Massimi 2007, 248). It is a long way from working out experimental outputs (through statistical selection and computer simulation) to representing an unobservable phenomenon via data models (that are capable of measuring parameters), and finally envisioning a theoretical object by means of saving the represented phenomenon within a theoretical model. (A satisfactory or reliable data model must "guarantee" that the unexpected value is not due to experimental errors or side factors.) This long way involves a proof of a genuine validity (i.e., a validity in multiple contexts of experimentation) of the unobservable phenomenon which indicate the theoretical object's existence. An additional difficulty stems from the justified assumption that the theoretical model might envisage – in saving the unobservable phenomenon – not the intended theoretical object, but "hidden parameters" and/or the behavior of other theoretical entities. Obviously, there is a need for an effective procedure for identifying (envisioning) the intended object within the experimentally represented unobserved phenomenon.

In most of the biological domains of inquiry (including the domains of biochemistry and molecular genetics) the data models cannot be represented as substructures of theoretical models' formal structures. (Even when the formalism consists in dynamic equations, it is hard to organize the data models as "empirical algebras".) Van Fraassen's requirement of "embeddedness" – the theoretical models' empirical interpretations must fit data models whereby the latter becomes embedded as substructures in the theoretical models – as providing a sufficient condition for saving phenomena is only met in a small number of phenomena conceptualized in theoretical biology. (Phenomena of enzyme-substrate reactions that obey the Michaelis-Menten equations are a germane case in point.) A weaker and more tolerant criterion/requirement is in need when one discusses the appropriateness of the data outputs' theoretical interpretations in the biological domains. At the same time, weakening this criterion shortens the way from experimental outputs to envisioning a theoretical object. The experimental output which supposedly represents an unobservable phenomenon is directly related to the theoretical object. (The whole development of enzymology until the birth of molecular biology was characterized by envisioning

[34] A case in point of unexpected values – carefully analyzed by Massimi – was the number of hadronic events in the October Revolution from the fall of 1974 as related to the envisioning of the psi particle.

enzymes by directly relating them to the ways in which unobservable phenomena on a molecular level had been saved by structural, functional, and kinetic models.)

Theoretical models relevant to saving unobservable phenomena of RNA catalysis have been constructed in recent years. These are models explaining catalysis in terms of proton transfer (as this mechanism is typified by redox reactions). Initially, there was a skepticism about the possibility that the transfer of protons would be important to the mechanisms of ribozyme catalysis, which typically have thousands of atoms (Bevilacqua 2008, 12–13). Yet an accumulation of evidence removed the initial skepticism. A great merit of the proton-transfer theoretical models is that they are capable of saving catalytic phenomena by not assuming/postulating the existence of intermediates that bear charge on bridging oxygen atoms. These models implement a statistical thermodynamic formalism that illuminates the coupling between folding of the catalytic molecule and shifting of the value of pK_a (the negative base-10 logarithm of the acid dissociation constant of a solution). The phenomenon of folding is saved through explaining the thermodynamic change in the transition from the unfolded state to the folded state as resulting from protonations that are shifting the pK_a value. Such a theoretical model provides a formal structure in which data models obtained through kinetics experiments (with reactions catalyzed by smaller ribozymes that involve proton transfer) might be embedded. (These experiments aim at measuring the speed and rate of the reactions.)

In the initial two decades of studying ribozymes, there was a tendency to draw sharp contrasts between the catalytic apparatuses of RNA and protein enzymes. Interestingly enough, a contrary tendency – resulting from a commitment to a new horizon of possibilities – has begun to dominate the spirit of investigations in recent years. The focus of research has shifted on the possibilities of articulating the "ribonucleoprotein machines". These are "machines" characterized by "multiple-turnover catalysts" acting via sequences of catalytic proteins and RNA – a kind of "division of labor" – regarding the active site of the catalysis. Appropriating the new possibilities of inquiry through new configurations of practices led to the basic idea of a continuum of such machines: an idea that restores the conceptual, formal-semantic, and experimental unity of enzymology.[35] (The cases in which small self-cleaving ribozymes are acting independently of proteins both in vivo and in vitro are much less than the cases in which ribozymes of diverse groups can act as pure RNA catalysts under in vitro conditions bur require a variety of protein chaperons in vivo.) The domain again seems to be homogeneous on the levels of both objectified factuality and objectifying/textualizing facticity. However, precisely this kind of "normalizing" of the research work in enzymology brought into play radical ideas about the "early RNA world", i.e., ideas that the ribosome has retained its catalytic strategy during the evolution of a prebiotic translational ribozyme into a modern ribo-

[35] Here is a typical statement of leading researchers: "Rather than being divided into ribozymes and protein enzymes, biological catalysts occupy a true continuum, from RNA machines without or with protein cofactors, to RNP with RNA active site, to RNP machines with protein active site, to many protein enzymes with nucleotide-base cofactors, to pure polypeptide catalysts" (Hoogstraten and Sumita 2007, 319).

some. I would not say that the new ideas triggered a kind of hypothesis about the evolution of macromolecules. A much more correct approach to this "event" would be a description in terms of a re-contextualization that integrates practices of evolutionary biochemistry in the articulation and objectification of enzymology. Envisioning ribozymes in this context requires answering questions of (1) how RNA-only catalysts may have been expanded by adding proteins; (2) whether the modulation of the activity of the ribosome by the protein factors does indicate specific phenomena of the co-evolution of genetic information and catalytic function; and (3) whether the diversification of the ribozymes' active center by including protein groups is representing a step in evolution from the RNA to the protein world (Rodnina 2008, 287–288).

5 The Object-Structure Distinction in a Hermeneutic Key

Guiding in the considerations of this section will be the following assumptions of hermeneutic realism. (1) Theory change in the historical development of science is a radical transformation that consists of a series of re-contextualizations. (2) Within the facticity of inquiry, theory change – no matter how revolutionary it is – does not destroy all previous contexts in which theoretical objects have been envisioned. Nonetheless, some re-contextualizations may change principles of invariance and groups of symmetries in the theoretical structuration of objectified factuality. (3) In the aftermath of theory change, theoretical objects are recast and envisioned in a new characteristic hermeneutic situation of inquiry, i.e., in accordance with a new tendency of choosing possibilities for doing research and contextualizing the process of inquiry. Recasting theoretical objects in "post-revolutionary" contexts does not transform them into new entities, but rather enhances their specificity and individuality. Following the assumptions (1–3) should enable a way of discussing the object-structure distinction that is alternative to the modes of discussing it by sticking to the picture of science's historicity as determined by the no-miracles argument and the pessimistic meta-induction.

In a paper devoted to the ways of identifying the objects of quantum field theory, Tian Yu Cao (2003, 9) succinctly epitomizes the famous ontic dilemma accompanying the recent debates on structuralism in the analytical philosophy of science. According to him, one should either – in the spirit of mathematical Platonism – dissolve the physical objects (described by measurable properties) in a net of mathematical relations, or elaborate on more refined mathematical relations, thereby identifying their constituents (relata) as objects with a content inexhaustible by the mathematical structure. Against the background of this dilemma, the hermeneutic realist argues that the choice of committing either to the primacy of structures that remain unchanged under groups of transformations, or to the ontic independence of objects distinguished by measurable properties depends entirely on the characteristic hermeneutic situation of the domain's meaningful articulation and objectification. There is no conclusive solution about how to make this choice. Furthermore,

as already stressed, there is no mathematical structure that is independent of a characteristic hermeneutic situation. In other words, the structural knowledge about the nets of basic formal relations in the natural world is always situated in and transcended by the facticity of inquiry. The characteristic hermeneutic situation both enables the changeability of all cognitive structures in science, and stabilizes the process of inquiry by preventing it from falling into a state of permanent revolution. Making the analysis of hermeneutic situations a central issue licenses the hermeneutic realist to avoid both the hypostatization of structures (formulated by the basic theories' formalisms) and the reification of science's theoretical terms.

The considerations of the preceding section give me the chance to juxtapose the hermeneutic realist doctrine of science's theoretical objects with the main views in the realism debate about the fundamental (observable and unobservable) objects' existence. Scientific realism assumes that the theoretically defined objects (like all other objects of inquiry) are not only physically real, but also independent of the structures which are laid bare by the theories' basic formalisms. They are autonomous entities in the ontic sense. More specifically, the intrinsic identity of the fundamental physical objects cannot be ruled out. All relations in physical reality that can be codified in (mathematical) structures supervene on the objects' properties which supposedly build up the objects' intrinsic identities. The objects are irreducible to parts of (or position in) physical structures. Furthermore, scientific realists admit that the reality of the unobservable fundamental objects is not to be defined (solely) by means of theories' invariances and symmetries. In confronting different sorts of scientific structuralism, scientific realists argue that no coherent ontology can be achieved if one repudiates the independent existence/reality of fundamental objects. In this argument, the identity of the object's totality of properties "forms a continuum with its 'structure', and knowing the one involves and entails knowing the other"[36] (Psillos 1999, 150). According to Stathis Psillos, when scientists specify a certain entity as a causal agent, they endow it with a certain causal structure. To show how an entity is structured does not amount to arguing that it is dissolved in a structure. The need of non-structural information for championing any form of structural realism provides the kernel argument of Psillos's criticism. If one adds to this observation that the information about how the (theoretical) objects become structured is to be acquired from studying the contextualization of these objects within the meaningful articulation of domains – and not only from analyzing the properties they obtain by taking part in the mathematical structures of theories – then one would be able to figure out the hermeneutic-realist view about the independence of (theoretical) objects from (mathematical) structures.[37]

[36] The criticism of the structuralist renouncement of objects' independence of structures comprises not only ontic, but methodological arguments as well. Among the latter is the argument that in focusing only on the structural component, one is not able to provide an adequate explanation of theories' explanatory and predictive success (Doppelt 2011).

[37] In meeting this objection, French and Ladyman (2003a, 35–36) point out that Psillos's way of describing the nature of objects is supporting an alternative form of structural realism rather than undermining it altogether. For them, "Psillos's argument may undermine the epistemic form of structural realism, which holds that all we can know is structure with real objects hidden forever

Formally seen, the hermeneutic realist shares some views with both standard and structural realists. (I am saying "formally" since a comparative analysis in this regard can only be carried out at the expense of ignoring the unsurmountable difference between the positions admitting the primacy of the epistemic relation and the positions that assume the primacy of the being-in-the-world.) Like the standard realists, the hermeneutic realist champions the ontological autonomy of theoretical objects. Yet the arguments for this autonomy she employs differ essentially from those of scientific realism. Roughly, the standard realists equate the objects' ontic autonomy with objects' presence in a static-discrete factuality that precedes meaningful articulation, while the hermeneutic realist insists on the objects' autonomous being in the facticity of scientific inquiry. To reiterate, the insistence on objects' alleged intrinsic identities rehabilitates a kind of metaphysical essentialism that contradicts the existentialist tenets of hermeneutic realism. It is the argument of the theoretical objects' "inexhaustibility" – as a specification of the argument of "situated transcendence" – that provides a vindication of their ontological autonomy.

In combating essentialism about (and reification of) theoretical objects, the hermeneutic realist approximates an aspect of the position of structural realism. To be sure, the latter can be developed as a position that is entirely independent of any form of Platonism. It is not necessary to represent physical objects as mathematical entities in order to claim that only objects thus represented can turn out to be structures (Saunders 2003, 129). The point made by structural realists is that all objects are structures. (Some structural realists admit that objects are like nodes in a graph. Thus considered, the entities embedded in structures still retain a status of "thin objects" (Ladyman 2007).) The structuralist claim about the inseparability of objects from structures is nourished on developments in science in the first place. Thus, the indistinguishability of particles is typically illustrated in both classical statistical mechanics and quantum mechanics. However, this illustration is not to be used as a general argument: It would be absurd to claim that permutation symmetry is applicable to all formally described scientific objects. On a more plausible argument for the inseparability of objects from structures, the metaphysical claim that all (scientific) objects are structures is to be defended in connection with the Quinean claim that metaphysics is continuous with physics. If, metaphysically considered, all scientific objects are physical objects, and, methodologically considered, there are in physics only structural objects, then all scientific objects are inseparable from structures. Accordingly, the metaphysical conception about the ontic status of objects is continuous with a methodological state of affairs in science.

There are also respectable voices suggesting that the logical (Fregean) notion of object is inadequate to the ontic treatment of objects inseparable from structures. Structural realists are divided when addressing the question as to whether they should seek a non-logical notion of objecthood (Saunders 2003, 132). They are also not unanimous when at stake is the issue of whether there is a place for "thin objects" in a structuralist ontology (Wolff 2012). But they are united in arguing that their

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from our scientific gaze, but supports an ontic form which reconceptualises the objects themselves in structural terms."

position is not a combination of mathematical Platonism and a softened form of antirealism (French and Ladyman 2003b). The same combination is countered by the hermeneutic realist when at issue is the contextual being of science's theoretical objects: On the one hand, the fact that all theoretical objects are mathematically representable does not make them mathematical entities; and, on the other hand, the fact that all theoretical objects are envisionable by means of data models, each of them embeddable in a mathematized theoretical structure, does not imply that objects are nothing else but "nodes" in these structures.

The hermeneutic realist admits that if a theoretical object would become fully de-contextualized, it would be transformed into a purely "structural entity": an entity embedded in a mathematical structure. But this is only a part – and yet not the most significant one – of the story. Thus de-contextualized, the object is exclusively subjected to a formal criterion of existence: the structure in which it is embedded describes what it holistically represents up to isomorphism. The latter qua a formal criterion of existence prohibits one to single out represented objects. The fundamental physical objects become indiscernible – an observation supported again by several theories in mathematical physics (French and Ladyman 2011). With this shared observation the formal parallels between structural realism and hermeneutic realism terminate. *Any re-contextualization of theoretical objects that envisions them through employing new readable technologies and spaces of representation individualizes them*. The proliferation of contexts of envisioning entails a progressive individualization of these objects. This claim does not necessarily run against scientific structuralism since structural realists are careful about avoiding an identification of indistinguishability with individuality. However, the hermeneutic-realist conception of re-contextualization decisively differs from the structural-realist view concerning the nexus of structural approach to objects and historical continuity of structure. There is an overestimation of symmetries and invariances in this view that is implied by the following posit: If one is engaged with reading off ontology from current science, then one has to admit a structural view about the development of science. As is well known, the way in which structural realists tackle the pessimistic meta-induction essentially informs their insistence on the continuity of structure. Let me in this regard return to motifs of John Worrall's (1989) original formulation of the position of structural realism.

Worrall builds his argument by observing that standard realism is crucially dependent on the claim that theory change has been essentially cumulative. The scientific realist believes that even after their replacement in the future, the presently best scientific theories will continue to appear approximately true. There is a transitivity assumption involved in this belief, which is obviously untenable: Any presently accepted theory will continue to look approximately true in the light of the further theories in the sequence. Standard realism is not compatible with the existence of radical theoretical change in the development of science. The scientific realist is prompted to believe in accumulation in the historical development of science by giving credence to the putative formula that – on the empirical level – the new theory is an extension with modifications of the replaced theory. However, the argument of the pessimistic meta-induction states that the empirical content of the

replaced theory (as a once-accepted theory) is in most cases carried over to the new theory, but its basic theoretical claims are not. Worrall's impetus to outline the position of structural realism as an alternative to both antirealism and standard realism was the quest for reconciling the pessimistic meta-induction with the no-miracles argument. His formula for having "the best of both worlds" consists in accounting for the "empirical success of theoretical science without running afoul of the historical facts about theory change" (Worrall 1989, 111). The observation that the mathematical equations of the replaced theory reemerge as limiting cases of the mathematical equations of the new theory adduces evidence that there is approximate continuity of structure, which is what the structural realist aims at. Continuity or accumulation is one of structure (form), not of content. But why should the whole debate agonize between the no-miracle argument and the pessimistic meta-induction? My answer is that one is doomed to be captured by this situation, if one is not able to find a way out of "squeezing" reality within normative codification of theory-factuality relations.

Those who claim that the picture of historical theory change implied by the pessimistic meta-induction is inaccurate are right. The multitude of aspects of this claim looms large, and I am not going to discuss it here. What I only want to stress is that radical theory change ought to be addressed in connection with the cascade of re-contextualizations that build the "fine structure" of each historical theory change. In demonstrating that structures of classical physics can explain quantum phenomena, Alisa Bokulich defends a position that is, in a sense, contrary to that of structural realism: There is no continuity of structure since the classical structures (like periodic orbits and their stability exponents) do not exist in quantum systems, but nevertheless these structures can genuinely explain quantum phenomena (like wave function scarring), thereby ensuring a kind of continuity on the level of empirical content. Bokulich (2008, 224–231) bestows the possibility of combining structural discontinuity with content-continuity on (what she calls) "model explanations" (i.e., explanations by means of dynamical structures that provide models for phenomena, stressing at the same time some counterfactual dependence between the explanatory model and *explanandum*). There is an interesting – although underdeveloped – hermeneutic dimension in Bokulich's argument. She appeals to the "deeper understanding" of the role of the classical structures. This understanding should empower one to forge model explanations. What her study shows is a re-contextualization involved in a radical theory change that is not subjugated to the structural realist formula.

The hermeneutic realist also disputes the structural-realist continuity of structure. She counters the structural realist combination of radical discontinuities at the level of conceptualizing empirical content and continuity at the level of mathematical structure. Her counterargument rests on the insistence that scientific development is at all levels amenable to discontinuities due to cases of significant re-contextualization, and – because of the hermeneutic fore-structuring – there is always interpretive continuity no matter how radical theory change is. Accordingly, the hermeneutic realist denies that re-contextualization necessarily preserves structure's symmetry. There are no symmetries that can resist radical changes effected by

cases of far-reaching re-contextualization. In other words, in certain cases of re-contextualization a discontinuity of structure's symmetry across the change of the configuration of practices emerges. In these cases, re-contextualization changes the presumably invariant and cumulative structure. Yet even a case of re-contextualization that breaks with the structure of a theory in such a radical manner does not favor a Kuhnian incommensurability, since there are several other re-contextualizations of the old theorizing's components involved in theory change that assure a resilient translatability within the whole transition. At the same time, it is this translatability that enables one to introduce various versions of the correspondence principle related to different forms of the reemergence (as limiting cases) of not only the mathematical equations of the old theory, but also its concepts, interpretive techniques, strategies of representations, etc., within the new theoretical practices. As a consequence, the picture of historical continuity and accumulation becomes much more pluralistic and complicated than the pictures attributing cumulativeness to empirical content and/or theoretical form.

In each particular re-contextualization, theoretical object(s) is/are envisioned anew. With regard to the pluralistic picture of continuity just mentioned, there is no theory change (no matter how radical it is) that can threaten the existence of these objects. To reiterate, the growing individuality of theoretical objects is coupled on re-contextualization within the facticity of inquiry. Stated more sharply, it is the ongoing re-contextualization of the process of inquiry that makes a theoretical object something distinct from the structure in which it is embedded. (Needless to say, this posit is much better illustrated by the articulation of domains in biology than physics.) Placing emphasis on re-contextualization evokes a change of perspective. The focus is redirected from the structure of knowledge in which objectified factuality is conceptualized to the facticity of inquiry in which the contextual envisioning of theoretical objects is sustained. My basic point is that there is interpretive continuity – or continuity through re-contextualizing what is read and represented-as – on the level of facticity that owes its existence to a shared horizon of possibilities for envisioning the same theoretical objects across the discontinuous change of structure and content. Interpretive continuity within the facticity of inquiry is completely elusive to the pictures of the historical development of science implied by the no-miracles argument and the pessimistic meta-induction. By the same token, there is no room for addressing the theoretical objects' growing individuality in conceptions that defend their theses only by making use of these arguments.

Summing up, though very often theoretical objects have been introduced by means of a mathematical structure, these objects exist in scientific research through their ongoing re-contextualization. There is no room in structural realism for addressing the multilayered subject of re-contextualization.[38] This is why the (ontic)

[38] There are in the tradition of scientific structuralism some interesting attempts at making room for autonomous objects in structural ontology. Thus, Brading and Landry (2006) suggest an innovative interpretation of the relationship between presentation (of structure) and representation (of objects), which makes possible the move from a "semantic is" to an "ontological is" in scientific

structural realist is compelled not only to dissolve the fundamental objects' ontic autonomy, but to hypostatize the formally described basic structures. Van Fraassen (2006, 297) argues that in order to have knowledge of structure by being committed to a structuralist position, one has to take into account the context dependence of all operations involved in the formal identification of the structure under investigation. This would prevent one from hypostatizing the structure. Of course, an accent upon the context dependence only does not provide a rationale for rehabilitating the ontic autonomy of theoretical objects. Van Fraassen vigorously rejects such an autonomy. For him, there are only two sorts of entities which science deals with: observable things, events, and processes, on the one hand, and abstract structures studied in mathematics, on the other.

In opposing the reification of formal relations and/or the hypostatization of basic theoretical structures, the hermeneutic realist agrees with the critical arguments of constructive empiricism. Van Fraassen (1980, 56–59) appeals to the hermeneutic circle when trying to foreclose such a reification. Yet the intra-theoretical hermeneutic circle he puts forward is wrongly set up, since it is restricted to the aim of demonstrating theory's empirical adequacy in saving phenomena. To repeat an argument I have already brought forward, what is ignored in constructive empiricism (or empiricist structuralism) is the "situated transcendence" of all interpretative intra-theoretical relations. I agree with the criticism which makes the case that van Fraassen's scenario of saving phenomena overlooks the possible manifestation of unobservable phenomena in data models. By concentrating on the practice of saving unobservable phenomena, Michela Massimi (2007) manages to call into question the view that the only aim of science is to provide semantically complete mathematical interpretation of observable phenomena. The analysis of this practice demonstrates that theoretical entities and experimental data evolve together, and this evolvement – so her argument goes – shows that there is more to saving phenomena than constructive empiricism may imply. In particular, consider Massimi's analysis of how the introduction of the unobservable phenomenon of a new resonance in a certain data model enables one to see that the way of making sense of quarks as theoretical objects is not to be separated from the way of constructing models from experimental data. This analysis reveals "unobservable reality" whose theorizing requires something more than empirical adequacy of theoretical models.

Massimi's argument against constructive empiricism is in line with the criticism raised from the viewpoint of hermeneutic realism that van Fraassen does not do justice to the whole range of practices of saving phenomena that are irreducible to practices of theory construction. Transforming van Fraassen's intra-theoretical hermeneutic circle of saving phenomena into a trans-theoretical circle that takes place

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theorizing. Brading (2011) argues that by identifying the phenomena with data models, one trivializes the step from presentation to representation. In this regard, she suggests a strategy for a relaxation of the isomorphism requirements. Yet these attempts – however interesting they might be – are restricted to modifications and innovations in the formal ontology of structuralism and the semantic view of scientific theories. Like the views they criticize, they do not touch upon the problematic of how science's theoretical objects exist in scientific practices.

within the whole interplay of practices and possibilities for articulating a scientific domain specifies the contextual configurations of practices as loci of revealing theoretical objects' individuality and ontological autonomy.

Let me conclude this section by reiterating the main point of hermeneutic realism about theoretical objects' dual existence as it is informed by the interplay of practices and possibilities in scientific inquiry. Such an object is scattered over potentially infinite contexts in which it can be read and represented. In each of them theoretical object(s) is/are partially revealed and envisioned by the respective readable technologies and representations. At the same time, in each context certain possibilities on which the object's existence is "inscribed" become actualized. However, the possibilities can never be exhausted. The more of them that are appropriated, the wider becomes the horizon of new possibilities for the object's contextual identification. Seen from the practitioners' perspective, in each context of inquiry the theoretical object – in its constant "absent presence" – displays possible facets that could be revealed in a coming context. From this perspective, the theoretical objects' meaning constantly goes beyond the current state of affairs in the research process.

6 A Preliminary Concept of "Text"

The considerations about the embeddedness of objects in structures, and the contextual autonomy of theoretical objects are intimately tied in with hermeneutic realism's central concept of "text" (as it was adumbrated in the Introductory Chapter). The preliminary form of this concept should refer to two things: first, to a concept of "text" that is maximally close to established semantic approaches to texts of diverse sorts; and second, to the salient kind of "texts" in science, i.e., "texts" constituted under the conditions of maximally de-contextualized objectification. With regard to the established semantic images of texts, the hermeneutic-realist concept of "text" basically differs from these images by assuming that the semantic meaning (represented most clearly by the Fregean triangle) is subjected to the hermeneutic meaning (or that meaning which is presented through the operation of the "hermeneutic-as" in reality's articulation). From the viewpoint of this subjection, the structurally enclosed (self-sufficient) and semantically complete texts are an extreme (and idealized) case that borders the spectrum of contextualized "texts". This is the idealized case of heavily formalized texts in which the interpretive fore-structuring is fully "extinguished". By contrast, all "texts" are characterized by different degrees of dominance of the hermeneutic meaning over the semantic (structured by models) meaning, and in that sense they deviate more or less from the idealized case mentioned. This brings me to the next point.

The salient kind of "texts" in science are those constituted in mathematical physics. At the same time, these "texts" are distinguished by the highest degree of semantic autonomy that makes the interpretive fore-structuring in the process of textualizing as well as the articulation of hermeneutic meaning almost invisible. The

"texts" constituted outside of the domains of mathematical physics are expressing weakened forms of the "texts" in these domains which maximally approximate the idealized case. (Thus characterized, the latter might be dubbed "minimalist texts".) Hence, the preliminary concept of "text" refers to a state (and outcome) of textualizing that minimally deviates from (and minimally weakens) the idealized case of structurally enclosed and semantically complete texts. If the enclosed and complete texts express the zero-point, then the "texts" covered by the preliminary concept manifest the minimal degree of interpretive openness. They are the "texts" which hardly "bear evidence" of their interpretive fore-structuring in the articulation and objectification of scientific domains. The preliminary concept should prepare the analysis of how the "minimalist texts" can further be weakened in domains in which the dominance of hermeneutic meaning is stronger.

According to the preliminary concept, a "text" contains at least one model (among possible theoretical scenarios) constructed in a manner that allows one to define (in mathematical terms) a certain kind of morphism between a model's formal structure and a data model. Furthermore, at least one phenomenon becomes saved through embedding that rests on this kind of morphism. The "text" is semantically autonomous if and only if it contains at least one "empirical algebra" of data embedded in a theoretical model, and the embeddedness provides both semantic and empirical interpretation of a theoretical object. Phrased differently, though not all phenomena – reported in the "text" – might be saved by fulfilling the requirement for having a kind of morphism, the "text" containing knowledge about objectified factuality must involve at least one relation between a data model and a theoretical model which is formulable in terms of a structure-preserving scheme translating from one algebraic group to another. Otherwise, the "text" would lack a proof for its relative semantic autonomy. (Yet, regardless of this formal criterion, the talk of a relatively autonomous "text" is not to be addressed in formal-semantic terms, and is not to be confused with a requirement of semantic completeness as defined by theorems of the formal-semantic model theory. Such a requirement would be too strong [and restrictive] to be fulfilled in the interpretive textualizing of scientific research, which articulates "exceeding meaning" that cannot be captured in a formal way by embedding one structure into another.)

Approaching texts – in discursive analysis and other fields of textual research – by means of formal semantics allows one to draw a definitive demarcation between text and context as both of them are identified as structures (van Dijk 1977, 228–229). If both of them were identified in this way, then the text-context relation would look like a structure-preserving map from contextual to textual structure. I will show that the demarcation based on structuralist assumptions has no place in the approach distinguished by attaching primacy to textualizing over the texts with a fixed meaning. In the perspective of hermeneutic realism, the semantic autonomy is – even for "texts" strongly formalized and isolated from the interplay of practices and possibilities – subsidiary and relative to the hermeneutic openness and the constitutive incompleteness of the process of inquiry. In this perspective, textualizing is a paradigm of constituting hermeneutic meaning. In a claim already discussed, in textualizing a domain of research, the readable technologies are not reproducing

meaning already produced before (or independent of) their implementation. In other words, reading by means of scientific readable technologies is an ongoing textualizing that constantly transcends the formation of a stable textual structure. In accordance with the paradigm of constitutional analysis advanced in this study, textualizing constitutes meaning by appropriating the possibilities projected by the configuration of practices. Textualizing is not a codification – in the sense of linguistics – that determines how to create "texts", but a constitution of textual-contextual wholes through which a domain of reality is disclosed and articulated.

The aforementioned formal criterion for semantic autonomy is *mutatis mutandis* applicable to all "texts". On a corollary to it, each "text" has to incorporate a minimal structure of formal relations interpretable in properly structured data. In raising a claim on the dependence of the interpretability of the "texts" on their formal structuration, I approach the much broader issue of how mathematics operates within the "texts" constituted in scientific inquiry. There is in the realism debate an array of positions regarding the role of mathematics. The array is located between two extreme poles: (a) the mathematics does not track physical reality; and (b) the mathematics unveils the essential aspects of physical reality. Christopher Pincock's (2007) views are close to (a), while some radical versions of ontic structural realism approximate (b). With regard to the claim about relative semantic autonomy, certain non-radical versions of (both epistemic and ontic) structural realism are of special importance. These versions insist on the need of embedding data models into theoretical models' mathematical structures, but leave at the same time enough leeway for weaker theoretical scenarios that avoid a formal description of the inter-models' relations up to isomorphism. Thus, Otávio Bueno and Steven French (2012, 86) make the case that all roles mathematics plays in empirical science depend on "the ability to establish inferential relations between empirical phenomena and mathematical structures." These relations include partial isomorphism and partial homomorphism, but also weaker kinds of relations that cannot be represented as functions, group morphisms, linear transformations, or any other kind of morphisms.

From a semantic point of view, the preliminary concept of "text" is equally tolerant to the ontic existence of objects and structures. Yet the "text" might involve procedural specifications of data models' theoretical interpretation that accentuate either on the structure (involved in the interpretive theoretical scenario) or on the relata of the structure's relations, treating them as "minimal objects". Introducing such conventional specifications does not imply any claim that objects are metaphysically primary (and structures are secondary), or vice versa. (As already pointed out, attaching more importance to structures or to objects is in the first place not a question of speculative metaphysics, but an intrinsic issue of scientific inquiry that hinges on the characteristic hermeneutic situation.) Obviously, if there is no room for a non-formal interpretation, and the latter is reduced to a description of abstract structures up to isomorphism, then any specification of objects would be impossible. Hence, the way of representing the relata as having properties that make them objects independent of the relations involved in a structure is only admissible for the interpretation of sets of data and phenomena via theoretical scenarios that are loosely formalized and have some leeway for conceptual innovations. Envisioning

a theoretical object by saving phenomena through such a scenario provides a greater chance of identifying what is envisioned as a factual entity.

In sticking with the preliminary concept, one posits that within a "text" a group of symmetries and principles of invariance – necessary in particular for the covariance of the domain's basic equations – makes the "text's" structure syntactically coherent. The introduction of such groups/principles presupposes that the domain's whole objectification within the co-interpretative relations of data models and theoretical models (theoretical scenarios) will be accomplished in a unitary way. Admittedly, the same symmetries and invariances govern the constitution of objectified factuality in all "texts" of a domain. Actually, this claim is chiefly valid for the "minimalist texts" in mathematical physics. For all other "texts" it should not be adopted without reservation. As argued earlier, symmetry transformations must not be regarded as immune to the changes in the interplay of practices and possibilities. There are no groups of symmetries that might survive all kinds of re-contextualization. In other words, symmetry transformations are not on a meta-level with respect to the production of objectified factuality within scientific inquiry's facticity. A further discussion of this statement should be placed in a broader context in which the empirical relevance of symmetries and invariances is at stake.

In the standard position in the philosophy of science, global symmetries – as typically exemplified by classical mechanics – have direct empirical significance, but local symmetries (as exhibited, for instance, in general relativity) have no empirical counterparts. Vis-à-vis the fact that in physics theories with global symmetries are superseded by theories in which these symmetries are "localized", one attaches an additional importance to the claim of the standard position. In challenging this position, Hillary Greaves and David Wallace (2014, 62) argue that it would be "extremely odd if we have a theoretical explanation of an empirically-observable symmetry while we stuck with the less accurate theory, but nothing of this explanation remained once we passed to the larger symmetry group in the more accurate theory."[39] This criticism of the standard position has essential consequences for hermeneutic realism. The tendency to replacing global symmetries with continuous groups of local transformations adduces evidence for the revisability of symmetries within the interplay of practices and possibilities. It also shows that different "texts" of a certain domain might involve different symmetry groups.[40]

In the preliminary concept, in each "text" a theoretical object – as defined within theoretical models and scenarios – is partially interpreted both in an empirical and

[39] Greaves and Wallace cogently demonstrate that local transformations correspond to empirical effects in just the same way in which the global transformations in classical physics have empirical consequences. From the viewpoint of hermeneutic realism, proving that there are no groups of transformations without empirical counterparts means that these groups do not "control" and constrain the production of objectified factuality "from without", but are intrinsic to the integral circularity of a domain's meaningful articulation.

[40] Symmetry considerations always play a considerable role in textualizing. Yet the quest for symmetries in the research process is not to be absolutized. Inquirers are satisfied in some cases with theoretical models (and mathematical plots) that lack symmetry. See in this regard Franklin (1989, 22–25).

a semantic way. (The combination of two kinds of interpretation is the elementary form of what I call a "contextual envisioning of theoretical objects".) The empirical interpretation shows the theoretical object's existence in the domain's objectified factuality, i.e., its existence through data models that represent phenomena by measuring parameters. The semantic interpretation specifies a formal relation between the theoretical models – through which a theoretical object is conceptually defined – and the relevant data models. Thus considered, the semantic interpretation is suitable, but only for formalized theoretical models that are able to embed in their structures data models as substructures. In other words, it is suitable for envisioning theoretical objects incorporated in "minimalist texts". Each "minimalist text" obligatorily involves at least one semantic interpretation of a theoretical object, in which the theoretical interpretation of a data model and the empirical interpretation of a theoretical model are united and explicated in terms of a formalized relation between algebraic structures. Therefore, the semantic interpretation of the conceptual structures expressing a theoretical object is an aspect of the relative semantic autonomy of a "minimalist text". (The example with the contextual envisioning of enzymes as theoretical object shows that the non-minimalist "texts" of enzymology provide empirical and semantic interpretations of this theoretical object without necessarily specifying structure-preserving maps from structural or functional models of enzyme kinetics to data models of enzymes behavior.)

Now, the idea of the relative semantic autonomy of the "texts" is to be defined in an alternative manner. I argued that there are in the research process a lot of particular items that are read under specific conditions. Among the items meaningfully constituted by being read, one should include measurable data, outcomes of calculations, calibrated instruments, parameters of experimental systems, reports of observations, control parameters of phase diagrams, data models, theoretical models, mathematical formalisms, and concepts, etc. No item ready-to-hand within a contexture-of-equipment in scientific inquiry can escape the need of being read: Something exists as an ingredient of scientific inquiry to the extent to which it might be read through a readable technology of conceptualization, formalization, instrumentation, experimentation, and calculation, etc. Yet neither of the aforementioned items (as represented in particular spaces) manages to constitute within its contexture (and space of semiotic representation) a unit that is semantically autonomous: The constituted unit is semantically dependent because it is in need of a further reading. (Any particular item that is read in a contexture-of-equipment suffers from a semantic insufficiency that consists in the impossibility to define the meaning per se of the item.) The need mentioned is met when the circulation of meanings (of particular items) becomes relatively enclosed by the formation of a context of inquiry as it is incumbent on the constitution of a relatively semantically autonomous "text". It is the relation between the relevant context and the "text" that maintains the relative semantic autonomy of the "text". This alternative manner of defining the idea and notion of semantic autonomy places more emphasis on the "text"-context relation than on the semantic interpretation of the basic structure incorporated in the "text". Accordingly, it should be regarded as more adequate to the kinds of "texts" that significantly differ from the "minimalist texts".

As will become clearer in the Concluding Chapter, there is a notion of a "minimalist" relevant context that corresponds to a "minimalist text", i.e., the "text" which approximates the idealized pole of enclosed, complete, and totally formalized texts. A sine qua non for having a "minimalist context" is that the circulation of readings and semiotic representations within the respective configuration of scientific practices is essentially organized by complete cycles. If this condition is met, the relevant context is maximally secluded with respect to the intercontextual dissipation of the contextualized meanings. Phrased alternatively, a relevant context that is characterized by a maximal involvement of the circulating meanings in complete cycles maximally forecloses the intercontextual dissipation of these meanings. By definition, a context characterized in this manner is a "minimalist context". (Thus, a condition for having a relevant context at all is the formation of at least one complete cycle of meanings constituted by reading and representing within a configuration of scientific practices.) The "minimalist context" is the one which is maximally dense of meanings circulating in complete cycles of shifting meanings and semiotic representations, and maximally tight to the basic structure incorporated in a "minimal text". The less the degree of relative autonomy of the relevant context (within the domain's intercontextuality), the greater the openness to inter-contextual circulation of meanings.

Before bringing this chapter to an end, I should like to take up a motif developed in the Introductory Chapter: the motif of the levels of representing-and-reading-as-textualizing in scientific inquiry. Reading and representing are instrumental in all manipulations within any contexture-of-equipment. Reading and representing are applied by the activities composing a practice to what is immediately ready-to-hand in practice's contexture. Yet reading and representing change their function on the level of the interrelatedness of practices in a domain of inquiry. Within the contexts constituted by configured practices, reading and representing are textualizing what is disclosed by this interrelatedness. The process of textualizing is no longer dealing with directly manipulable things. However, I claimed in the Introductory Chapter that it would not be correct to localize reading and representing in the interspace between the instrumental contextures and the contexts of inquiry: Reading and representing do not occupy an intermediate position (between direct manipulation and textualizing) in the meaningful articulation and objectification of a domain. Because reading and representing are ubiquitous in scientific inquiry, they are not somewhere in-between. Reading and representing operate on the level of instrumental manipulation as well as on the level of contextual envisioning of theoretical objects. But on each level they serve strongly specific functions. While unifying the interpretation and the representation-as of what is obtained in a contexture-of-equipment, reading and representing constitute "texts" within the interplay of practices and possibilities, given that the same interplay constitutes – through configuring practices – the relevant contexts. The important point of these considerations is that – like the "texts" – the contexts do not preexist the process of textualizing. The contexts are constituted within this process through the ways of extending the reading-and-representing beyond the particular contextures-of-equipment.

Concluding Chapter: "Texts", Relevant Contexts, and Textualizing

Although a "text" could primarily be recognized as a complex body of knowledge, given that it is isolated from the process of textualizing, the concept of "text" is not a kind of pre-epistemological concept. In hermeneutic realism, "text" is an ontological concept characterizing scientific inquiry's facticity. (The discussion of the preliminary concept was entitled to show that the "minimalist texts" are recognizable even within the strategies of epistemological justification. But this recognition can only be attained by assuming that interpretive fore-structuring is an intratheoretical relation between theoretical terms and theory-laden data.) The hermeneutic realist specifies—with respect to the concept under discussion—the ontic-ontological difference as a difference between semantic and hermeneutic meaning of the "texts". The former presupposes knowledge, structured in models, about objectified factuality. Furthermore, this knowledge is enclosed within a framework of objectification. The hermeneutic meaning—as engendered by the interpretive fore-structuring—refers to the "text's" way of being in facticity of scientific inquiry and the domain's meaningful articulation. While the preliminary concept of "text" draws on an approach seeking to find a balance between hermeneutics and epistemology/semantics, the full-fledged concept requires enriching the hermeneutics of textualizing with deconstructionist motifs.

Authors who try to bring the interpretation of texts to bear on the philosophy of the natural sciences employ, as a rule, a strategy entitled to show that textual interpretation, psychological interpretation, and the interpretation of those natural scientific objects which are distinguished by evolution in historical (non-mathematical) time are "the same project addressed to different objects" (Dennett 1990, 177). In contrast to the approach of these authors, the hermeneutic realist does not start by analyzing complete (finished) texts. Her assumption is that textualizing-through-reading-and-representing has ontological primacy over the constituted "texts". Accordingly, the hermeneutic realist is first and foremost interested in the ontological hermeneutics of textualizing, and not in the exegetical hermeneutics of texts

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already written.[1] The former is interpretive theory of meaning constitution, whereas the latter reproduces meaning already produced. (The distinction between these two types of interpretive enterprises roughly coincides with Heelan's distinction between strong and weak hermeneutics.) The hermeneutic-realist approach to the constitution of "texts" is entirely focused on the trans-subjective hermeneutic circle of a domain's meaningful articulation, and most definitely rules out all assumptions of the so-called hermeneutic intentionalism: The "texts" do not embody authoritative (individual or collective) plans, schemes, intentions, or goals. The constitution of any "text" comes into being by a trans-subjective triad of fore-having, fore-seeing, and fore-conception operating in the interplay of practices and possibilities, and this triad can be tracked in the constituted "text". Tracking the interpretive fore-structuring not only of a "text" but also of its relevant context—under the assumption that the "text" documents actualized and non-actualized possibilities of the production of objectified factuality within the facticity of inquiry—enables one to enter the intercontextuality of a scientific domain.

The question that will be addressed in the coming considerations is as follows: If, roughly, the "text" is a contextualized textual structure as fore-structured in the interplay of practices and possibilities, then what ought to be the adequate treatment of the relevant context of configured practices? The configuration is distinguished by a relative stability in the routine of inquiry, but it is by no means a structure of a certain type. By implication, even if the "text" were restricted to a textual structure, it would be impossible to approach the "text"-context relation as based upon a certain kind of morphism. The context is to be visualized by metaphors like "perpetual circulation" and "moving cycles". In fields of textual research such as discursive analysis, where the distinction between text and context is of prime importance, one follows an established paradigm. According to this paradigm, the term "context" is used to refer to processes that are irreducible to the mere "verbal environment" or the meanings immediately surrounding a text (Sinclair 1997, 34; Widdowson 2004, 52–56). Furthermore, studies in such fields distinguish between co-textual and contextual relations, the former concerned with the textual structure and the latter with discourse. Nevertheless, the authors of these studies assume that the very relations between text and context form a structure (even if only a dynamic one), a structure that is reflected in the linguistic properties of the text. It is this assumption that the hermeneutic realist wants to dispense with when addressing the notion of context. Moreover, she strongly advocates the view that the "text"-context relation cannot be formalized.

Tentatively, a context is constituted by a synergy of practices' readable technologies and a circulation of representations embodied in semiotic systems. Leading in the clarification of the notion of a context relevant to a "text" should be the observation that the meanings articulated within the "text" already exist in a certain way within the context. In criticizing Rorty's textualism, I made the case that—however

[1] This is why Eric Donald Hirsch's distinction between "meaning" and "significance" has no place in hermeneutic realism. In fact,—leaning on Gadamer's arguments—the distinction is to be rejected also within the scope of the textual exegesis.

strong the deconstruction of external referents might be—the distinction between "text" and relevant context is not to be effaced. Now, I am in a better position to argue for the need of this distinction. The meanings within the "text" are either incarnated in the objectified factuality (the meanings as actualized possibilities) or as potential meanings are informed by the horizon which fore-structures the textual structure. In both cases, the "text's" meanings are identified by means of (actualized or non-actualized) possibilities. They are potential and actual meanings of a structure in its ongoing fore-structuring. Although the latter cannot be captured and delineated by means of formal semantics, the meanings articulated within the "text" (and the "text's" whole meaning) are, in a sense, "stabilized". By contrast, the meanings generated and existing in the relevant context are constantly unstable and circulating within more or less established cycles. (Tentatively, the analysis of a "text's" fore-structuring has to address the interplay of practices and possibilities, whereas the analysis of the relation between a "text" and its relevant context focuses on the circulation of meanings within a configuration of scientific practices.)

The last statement can be unfolded thusly. The meanings in the context are dissipated in a twofold sense. First, they are always already intercontextualized (i.e., potentially dispersed over all possible contexts of a domain's articulation). Second, these meanings are generated by the intracontextual circulation of spaces of representation and translatability of semiotic systems. By the same token, the readable technologies constituting a context of inquiry do not form a linear succession but work by forming repetitive cycles. (The starting point from a certain readable technology turns out to be the point of return of reading and representing within a configuration of scientific practices. Thus, (a) the meanings obtained by reading experimental results are interfered with meanings related to analytical devices of conceptualization that (b) on their part intefere with meanings resulting from designing a computer simulation as (c) it is devised to provide a reading of meanings stemming from a theoretical model by means of which phenomena discovered, represented, and measured by data models are saved, whereupon (d) a possibility for new calculations begins to be actualized, which leads to the need of calibrating anew certain instruments in order to construct a new experimental system, and so on.) The meanings circulating in a context relevant to the constitution of a "text" and obtained through reading/representing particular items are organized in these cycles of shifting readable technologies and deferring (and overlapping) spaces of representation. For the same reason, the whole meaning of a relevant context is constantly generated—never becoming fixed, rigid, and merely present—by the transferability and translatability of semiotic systems within the cycles of alternating readable technologies.

The cycles might be interrupted by Kuhnian anomalies—a case already discussed on another occasion—or more drastically, when the chosen possibilities for doing research prove to be unachievable. The routine appropriation of possibilities opened within a context of inquiry is a process that only in exceptional cases causes essential innovations (in the normal scientific work) that provoke re-contextualization. (Think about the emergence of new contexts coming into existence when the possibility of replacing nonlinear equations with linearizing mathematical plots

becomes actualized, or conversely, when a linear equation is replaced by a formalism that violates the principle of superposition. The former case is illustrated by the linearization of the Michaelis-Menten equation, while quantum decoherence exemplifies the second case.) But even the forms of revolutionary re-contextualization do not interrupt all cycles of shifting readable technologies and semiotic representations as they are established in the original context in which a domain of reality is disclosed. The relocation of such cycles from one to another context of inquiry assures plasticity of the process of inquiry. There is, however, a case of drastic re-contextualization that merits special attention. It is precisely the case of choosing a possibility that turns out to be unachievable. The subsequent creation of a context *ab ovo* may undo all existing cycles of shifting readable technologies and semiotic representations. In this case, the "logic of practices" (or practices' endogenous reflexivity) enables continuity in a domain's articulation by changing the regime of temporalizing the research process. Re-contextualization evokes practices that have been more or less "suppressed" (and "forgotten") in due course. Bringing forgotten practices back to the domain's articulation restitutes cycles of readings and representations. Reviving such practices in connection with contemporary problems projects at the same time new possibilities that can be actualized by constituting novel contexts of inquiry. Thus, the reminiscence of forgotten practices opens the horizon of a new future of textualizing and meaningful articulation.

To stress again, the fore-structuring in the articulation of a domain is also a regime of temporalizing the temporality of inquiry. The hermeneutic meaning of a "text" is not static (fixed) but exists through the temporalizing of its constitution within the horizon of temporalization projected by the interplaying practices and possibilities. The claim that in the process of textualizing the "texts" have only a relatively autonomous (semantic) meaning correlates with the thesis that there is no mere (a-temporalized) presence of extratextual entities that might play the role of a transcendental signified. In hermeneutic realism, there is no presence pre-existing the temporalizing of temporalization. Assuming such a presence is a precondition for positing the existence of extratextual entities as alleged *denotata* that escape from both the interpretive fore-structuring and the contextual cycles of meanings within the synergy of readable technologies.

From the viewpoint of the analytical philosophy of science, Peter Kosso—an excellent student in both the philosophical foundations of physics and the philosophy of archeology—also describes the cycles through which I approach the notion of a relevant context. He reaches the conclusion that the epistemic structure in the natural sciences is essentially circular, and this "circularity is a methodological twin of the hermeneutic circle used in social science to understand what people and their actions mean" (Kosso 1996, 169). In so doing, he favors the first-person perspective: The description of the circular epistemic structure of the objectifying sciences—so his argument goes—can be accomplished from the individual perspective of a participant as it is constrained by physical and conceptual equipment. Quite in the spirit of the "context of justification", the epistemic cycling is explained by the reciprocity of the flows of justification from observation to theory, and from theory

to observation. Kosso's program is to a certain extent inspired by a long-standing tradition that tries to run the gamut from objectivist methodology to different sorts of hermeneutic intentionalism, claiming that this gamut should take place in all scientific disciplines. But Kosso is critical about this tradition. For him, there is no such gamut: The hermeneutic circle expresses the structure of knowledge and justification in all types of science. Though pleasant sounding to the hermeneutic realist, this claim simply inaugurates the use of hermeneutic terminology for scrutinizing figures (like Clark Glymour's bootstrapping) and devices of analytical epistemology and philosophy of science. However, the reason I am mentioning Kosso's program is not to criticize it, but to draw attention to a distinction that up to now was not made explicit.

Kosso is prone to equate (in his words) "the hermeneutic structure of understanding and justification" with the cycle of reciprocal flows of knowledge production. If one looks at the interpretive circle as a "structure", then this equation might be vindicated. Yet, from the viewpoint of hermeneutic philosophy, the equation does not make sense: While an epistemic cycle has a closed trajectory of producing objectified factuality, the interpretive circle is a potentially ceaseless movement of meaningful articulation. (This is why Heelan prefers to speak of a continuous "hermeneutic spiral".) Leaning on this posit, I strongly distinguish between the cycles of reading and representing within a contextual configuration of practices—as these cycles characterize the relevant context of the constitution of a "text"—on the one hand, and hermeneutic circularity taking place in the interplay of practices and possibilities, on the other. Several cycles of sequentially applied readable technologies in a context of inquiry become "written down" in a "text", while its meaning as a whole remains fore-structured by the integral hermeneutic circle of the domain's articulation. Interestingly enough, Kosso (1996, 174) tries to address natural scientific theories as cognitive constructions analogous to "claims about the larger meaning of the text, the plot of the narrative." He does not miss the opportunity to stress that what is meaningful in scientific inquiry always points beyond itself. But I do not see how this openness of inquiry's interpretive circularity is to be reconciled with the definitely closed cycles of reciprocal justification.

Since each scientific practice functions as a readable technology, what becomes contextually represented is already meaningfully constituted by being read. Reading and representing-as—taken to be a special (or generalized) case of the hermeneutic-as—work in concert in the constitution of meaning within a domain of inquiry. To reiterate, a "*text*" *is the outcome of reading and representing within a context of configured scientific practices*. (This formulation does not imply that the "text" itself is within its relevant context. I will spell out later the suitable argument for this.) Any "text" at once records and documents "hermeneutic events" occurring in the facticity of inquiry and incorporates what is produced within this facticity: the structured knowledge about objectified factuality obtained by saving phenomena and envisioning theoretical objects within a scientific domain. All processes that mediate between the facticity of interplaying practices and possibilities, on the one hand, and the production of objectified factuality, on the other—as well as between instrumental contextures-of-equipment and contexts of configured practices—are

also "written down" in "texts". (Among these processes are the entanglement of contextures with contexts, the interpretive fore-structuring of what is objectified by an open horizon of possibilities, the formation and maintenance of a characteristic hermeneutic situation through the correlation of practices' endogenous reflexivity and practitioners' reflexivity, and the processual inseparability of a domain's meaningful articulation and procedural objectification.) Therefore, "texts" document the integrity of domains of reality as a processual-empirical unity of factuality-within-facticity.

As the discussion of the preliminary concept made clear, the contextual constitution of a "text" inevitably contains a kind of objectification that creates objectified factuality related, for instance, to such quantifiable variables as mass values, charge asymmetries, decay modes, production cross sections, and distributions. Within a "text", characterized by a high degree of semantic autonomy, the factual existence of objects and structures amounts to manifolds of values of quantifiable variables that might be represented, for instance, by phase diagrams. In the process of inquiry, the kind of objectification (involved in the "text") is still situated within (and fore-structured by) the domain's meaningful articulation.[2]

[2] There is something highly instructive in Sokal's hoax published in *Social Text*. The very title illuminates what the hermeneutics of science should look like from the viewpoint of naturalist objectivism. The "transformative hermeneutics of quantum gravity"—an expression contained in the title—implies that hermeneutics is part and parcel of the phenomenon of "quantum gravity" as existing in its objective factuality. In the hoax's plot, hermeneutics is factually unveiled in the phenomena as conceptualized by the synthesis of "non-linearity, relativistic space-time, and differential topology". Naturalizing hermeneutics in the sense of incorporating it in the natural world's phenomena is, for Sokal, the only way in which the hermeneutics of science might work. Phrased differently, the interpretative subjectivity is a constitutive dimension of the natural world. (As a matter of fact, if the hermeneutic philosophy of science would naturalize hermeneutics in this way, it would become a part of what it severely criticizes: the "New Age" interpretation of science.) Sokal's "transformative hermeneutics" operates within the space of epistemological relations between natural phenomena and interpretive subjectivity. He ridicules a particular kind of interpretive cultural studies by starting from a caricature of hermeneutics. Sokal starts from this caricature because he absolutizes the epistemological framework of relating interpretative subjectivity to natural phenomena. Placed in this framework, hermeneutics is doomed to be naturalized in a grotesque way. By contrast, hermeneutic realism starts from a trans-subjective hermeneutics that—in a way similar to Rouse's non-objectivist naturalism and Barad's agential realism—transcends any hypostatized opposition between (interpretive) subjectivity and (metaphysically present) objectivity. This hermeneutics is to be assigned neither to the interpretative activities of epistemic subjects nor to the natural phenomena, but to the constitution of "texts" within the interplay of practice and possibilities in scientific research. Sokal's criticism (of whatever) does not have the resources to address this kind of hermeneutics. It is no accident that in *Impostures intellectuelles* Sokal and Bricmont do not pay attention to the tradition of the hermeneutic philosophy of science. Leading figures of that tradition like Patrick Heelan or Martin Eger, who are respected mathematical physicists, or important scientists who support (and even contribute to) the tradition like James Cushing, Abner Shimony, and Gunther Stent are not mentioned at all. Instead, there are boring comments (with unnecessarily long quotations) on authors who do not have any significance to the hermeneutic philosophy of science. It is another question that the criticism of the postmodernist misuses of scientific ideas (and the political attacks on science from positions of "radical democracy") is always a welcome initiative, regardless of whether there is a peace treaty after the science wars.

The meaningful articulation and objectification of a scientific domain begins with the constitution of an initial "text" in which the characteristic hermeneutic situation of the domain's disclosure is also "written down". All subsequent "texts" constituted in their relevant contexts of inquiry will remain always open to re-contextualization, i.e., to further revisions and extensions in the horizon of possibilities for doing research. Like all meaningful entities constituted in the process of inquiry, a "text" never becomes a pure presence. Any "text" exists through the contextually shifting readable technologies which constantly re-create it through the contextualizing configuration of practices. Stated otherwise, a "text" exists not in spite of the deferral of spaces of representation but because of it. Unless withdrawn from the ongoing interplay of practices and possibilities, the meaningfulness of any "text" is dependent on the circulation of meanings within the cycles of its relevant context. The ongoing shift of readable technologies and the deferral of spaces of representation that disseminate meanings, both intra- and intercontextually, are doubtless motifs of a deconstructionist story. However, it is a story that is completely integrable in the general hermeneutic story about textualizing the domains of inquiry.

The same deconstructionist story can be resumed and continued on the level of intercontextuality: The meaning of a "text"—within the process of textualizing—is scattered over the domain's whole intercontextuality due to the potentially infinite re-contextualization of the "text". (The potentially infinite re-contextualization also concerns a case I did not discuss in this study: the networking of domains of inquiry through re-reading of a "text" that passes over the included domains. This case refers to that form of intercontextuality which runs across various scientific domains. Thus, the multiple re-reading of a "text" originally constituted in enzymology may launch this form of intercontextuality. For instance, the "text" documenting the way of envisioning the processive enzyme DNA polymerase I as ubiquitous in prokaryotes became repeatedly revised within enzymology, and re-contextualized in domains like molecular evolution, immunochemistry, comparative physiology, bioenergetics, endocrine biochemistry, epigenetics, studies of morphogenesis, and so on. That doesn't even mention the immense number of clinical and biotechnological domains in which "texts" of enzymology are re-read. The networking of domains through such re-contextualization of "texts" is a typical process of technoscience. It is necessary to carry out a separate study for addressing the question as to how the form of intercontextuality across domains extends and provides new arguments for the claim of interpretive internalism.)

Stressing the priority of textualizing over textual structure amounts to insisting on the hermeneutic fore-structuring not only of this structure, but also of the "text"-context relation as this persists in the appropriation of possibilities. This relation involves three moments: the circulation of semiotic representations, the partial incorporation of these representations in the textual structure, and the dissemination of meanings beyond the textual structure. Like the hermeneutic fore-structuring, these three moments become "written down" in the "text". But obviously, they are not written down in units (like sentences) of natural or formalized language subjected to grammatical and formal-logical rules. They are rather written by means of

the "graphemes" left through the dissemination of meanings. Writing something down that cannot be represented by firm linguistic expressions because it is itself deprived of a firm presence takes the form of a "tracing game". In a similar manner, Rheinberger (1997, 223–226) treats the "écriture" created by scientific practices constantly producing differences in the process of inquiry. He asks, in particular, the question of how the historical existence of an experimental system in molecular biology—an in vitro system of protein biosynthesis—is written down in spaces of representation, semiotic systems, technological artifacts, and social contexts of knowledge production. (The experimental system—which he describes as "graphematic texture"—is an analogue of the concept of "text".) In a conclusion he draws, text—the experimental system as creating meanings through its reproductions and innovations—and context become conflated in the way in which a prolific experimental system turns into ensembles of changing interactions.

On Rheinberger's account, the production of differences in the experimental system produces new "epistemic things" by suppressing existing ones, thereby ruling out the possibility to single out epistemic things as immutable referents. Since his concern is not with the formation of stable structures of knowledge and how they are fore-structured in the process of inquiry, his attention is concentrated on the "tracing game" which prompts the conflation of text (the production of differences) and context. Adding the dimension of the production of objectified factuality within the facticity of inquiry requires placing the "tracing game" in the process of textualizing, as this process fore-structures the "text"-context relation without collapsing the presumptions on which the difference between them rests. Rheinberger's insistence on a conflation of text and context aims at dissolving the difference between them into the flow of differences produced by the experimental system. This is why, for him, the "tracing game" turns out to be the only game in town. In hermeneutic realism, the production of differences, and tracking and tracing, is not to be absolutized. This production does not have a priority over the interpretive fore-structuring, but takes place within it. The "tracing game" should be restricted to the "text"-context relation.

The continuous sequel of turning signified into signifier also contributes to the unity—but not the conflation—of "text" and context. What is read in a certain space of representation takes on meaning not from things that are beyond the research process but from what is read in other spaces of representation. Within a configuration of readable technologies—as a context of inquiry—the circulating meanings as a "tracing game" are situated within (and transcended by) the same horizon of possibilities which fore-structures the textual structure. Thus, the fore-structure which belongs to the "text" turns out to be a horizon transcending the relevant context. Accordingly, it would not be correct to say that the "text" is within the context. Circulation of meanings, interpretive fore-structuring of a textual structure, and meaningful articulation are three "equi-primordial" processes that exclude any "spatial imagery" in describing the "text"-context relation. In view of the interdependence of these three processes, the best way of describing the relation in question is in terms of a relation of complementarity: One might exclusively focus on the "tracing game" and the circulation of meanings within the relevant context, thereby

losing sight of textual structure's fore-structuring; or one might concentrate entirely on the constitution of the textual structure within the interplay of practices and possibilities. These are the two extreme alternatives. Between them there is a spectrum of intermediate variants that more or less take into account both what is going on in the context and what becomes structured within the "text" as its constitution excludes the external referent.

Textualizing "embraces" the three equi-primordial processes. This is why it is the terrain on which the entanglement of the contextures-of-equipment with contexts of inquiry takes place. Textualizing is the creation of "texts" in their continuous interpretive fore-structuring and re-contextualization. Due to this fore-structuring, the process of textualizing proves to be a continuous and potentially infinite process in the same way in which re-contextualization is such a process. The potential meaning projected on a horizon of possibilities for further contextualization exceeds the meaning of any contextually constituted "text" in scientific research. Because the exceeding meaning is potentially scattered over contexts of reading/representing the "text", the hermeneutics of research-as-textualizing is to be supplemented by deconstructionist motifs and plots, some of which were already mentioned.

I argued that the track of contextual envisioning—as this track takes place within the circulation of particular meanings—of at least one theoretical object becomes "recorded" in a "text". A relatively autonomous "text" existing through a synergy of readable technologies retains the hermeneutic meaning of theoretical object(s) by recording its/their dual being as (a) inscribed on a horizon of possibilities and (b) contextually envisioned. What becomes recorded is a contextual envisioning as an "event" in the production of factuality within the facticity of inquiry. But by incorporating semantically interpretable theoretical models, the "text" also assigns relatively stable semantic content to (the conceptual forms of) theoretical object(s). Yet if the contextual envisioning and identification of theoretical objects turn out to be incompatible with established presuppositions operating in a domain's articulation, then the horizon in which the object's potentiality-for-being is inscribed might become a horizon of disclosing and articulating a new domain (or subdomain) of research, as was illuminated with the case of splitting the domain of enzymology in the early 1980s.

Finally, the concept of "text" makes sense when the interpretive fore-structuring within horizons of possibilities and the contextualization within configured practices are "at work", i.e., only when the "text" is addressed as part and parcel of the facticity of inquiry. What is left after withdrawing the outcome of textualizing from this facticity is the linguistically codified knowledge of scientific publications. However, the transformation of "texts" into this knowledge is a complicated sociocultural process distinguished by quantifiable and measurable parameters that might be studied by means of scientometrics. Roughly, withdrawing, retrieving, or isolating "texts" from the facticity of inquiry is based on regular procedures that lead to the development of standard scientific knowledge, i.e., knowledge incorporated in scientific publications of various sorts and institutionally legitimized, most of all, by the publications' reviewing system.

Doubtless, the issues of the constitution of regular scientific texts-as-publications (papers, reviews, annual reports, working drafts, monographs, textbooks, and so on) and the formation of author-text-audience spaces and traditions within the institutionalized socio-cultural system of science require a type of (à la György Markus's) cultural-hermeneutic study that should be accomplished in cooperation with the programs of rhetorical hermeneutics and the literary-critic theory of interpretive reception. This type of interpretive study is essentially different from the type of hermeneutic phenomenology that focuses on the scientific domain's textualizing and the concept of "text" as a dynamic unity of objectified factuality and objectifying facticity. Nonetheless, one should not exaggerate the differences. The alleged gap between the two hermeneutic enterprises is surmountable if one takes into account that the aforementioned transformation is also an event in the "universe of interpretation". The transition from "texts" to texts-as-scientific-publications is mediated by procedures that do not break with interpretive practices projecting their interrelatedness upon horizons of possibilities. The procedures of withdrawing "texts" from the facticity of inquiry have a being of their own in institutional practices (e.g., practices of instituting a new journal conveying the ongoing results in a new domain of research) and possibilities for acknowledging the status of scientific knowledge of what has been withdrawn. Actualizing such possibilities, on its part, rests on practices of expertise executed again in regimented discursive spaces of the academic life.

Thus considered, studying the practices of withdrawal and the formation of standard scientific knowledge—as well as the evaluative practices of expertise—in the cultural spaces of author-publication-reader interactions, and the impact of these spaces on the educational reproduction of scientific domains mediates between (Heelan's "weak") cultural hermeneutics of scientific institutions (cum the formation of esoteric and exoteric scientific audiences) and (Heelan's "strong") ontological hermeneutics of disclosing, articulating, and objectifying scientific domains.

I will conclude these sketchy comments on the concept of "text" by singling out seven traits that stipulate necessary conditions for entering a full-fledged discussion on the issue of textualizing:

1. There is in each "text" knowledge about procedurally objectified factuality obtained by contextual proceeding of data collected through a manipulation of what is ready-to-hand within contextures-of-equipment. Since the production of factuality assumes the integral hermeneutic circle of a domain's meaningful articulation—as it involves the hermeneutic circles of (a) data acquisition and their statistical selection, (b) construction of data models that describe and measure phenomena, and (c) saving phenomena via models that contextually envision theoretical objects—the manipulation of what is ready-to-hand always already proceeds within the horizon of anticipation and expectation of a domain's total objectification. Once disclosed within the interrelatedness of contextualizing practices, the domain's textualizing lays this horizon out whereby the anticipation and expectation it informs become part and parcel of the fore-structuring of objectified factuality. Being itself fore-structured by the integral hermeneutic

circle, any "text" documents the interpretive fore-structuring in the production of the domain's factuality.

2. Each "text" renders evidence of how its relevant context participates in the entanglement of instrumental contextures-of-equipment with contexts of inquiry. More specifically, the "text" conveys information about how semiotic systems stemming from "remote" contextures become immediately involved in the circulation of meanings within cycles of its relevant context. The "text" covers—from the perspective of its relevant context—aspects of the whole semiosis of a domain's articulation as this semiosis is informed by the contextures-context entanglement. This conclusion is to be extrapolated to the contextual production of knowledge as the process of production (and not only the produced knowledge) is "written down" in the "text". In contrast to the semiotic aspect, however, the epistemic aspect of entanglement is documented regressively, starting from "graphemes" inscribed in the relevant context and going back to the dispersal of pieces of local knowledge produced in "remote" contextures. (In this formulation, a "grapheme" could be a small sequel in the production of objectified factuality as well as a complete cycle within the contextual synergy of readable technologies.) It would be correct to state that the "text" contains pieces of local knowledge produced in contextures-of-equipment together with the whole knowledge obtained in the relevant context. The knowledge incorporated in the "text" is always contextually structured knowledge. The pieces of local knowledge are absorbed in the nonlocal, contextually structured knowledge. The "text" conveys no information about the "indexicality" of manipulations producing knowledge in contextures-of-equipment. However, the "text" conveys information about the relationship between the pieces of local knowledge and the whole contextual knowledge. It is again not information conveyed in explicit (linguistically organized) knowledge, but is rather written down in "graphemes" signifying events in the entanglement of instrumental contextures-of-equipment with contexts of inquiry. (For instance, fitting a mathematical plot derived from a basic formalism to appearing patterns of data is a "grapheme" signifying such an event.) Any "text" documents possibilities of how the entanglement of contextures with contexts works by dispersing the local knowledge of each particular contexture-of-equipment in various contexts. The relevant context specifies a unique constellation of pieces of local knowledge that become absorbed in the nonlocal knowledge incorporated in the "text". It is a constellation that comes into being through actualizing possibilities within the contextual configuration of practices. Since the "text" documents non-actualized possibilities, it conveys information about potentially existing alternative constellations of pieces of local knowledge.
3. Each "text" contains the explicit knowledge constituted within the contextual configuration of scientific practices. Within the "text", the kinds of explicit knowledge are inseparable from knowledge's implicit fore-structuring. Accordingly, one can identify explicit cognitive structures within the "text" to the extent to which these structures result from actualized possibilities and remain embedded within horizons of possibilities that are not yet appropriated.

In each "text" at least one (observable or unobservable) phenomenon represented by data models (measuring parameters) becomes saved via a theoretical scenario (presumably distinguished by a mathematical plot).[3] I am using here the expression "theoretical scenarios" which is broader than that of theoretical models. (The latter are pertinent only to what I called "minimalist texts" in accordance with the preliminary concept. The theoretical interpretation of data models by means of theoretical models that transform the data models into their empirical substructures is to be found only in a limited number of cases, chiefly restricted to mathematical physics.) I reserve the expression "theoretical scenarios" for all cases in which the way of saving phenomena does not make the data models substructures of formal-theoretical structures, thereby leaving some leeway for a non-formal theoretical interpretation.

4. Regardless of whether it is procedurally isolated (and represented as standard scientific knowledge) or remains in its relative autonomy as it is intercontextualized, each "text" is temporalized by its hermeneutic fore-structuring. Treating a "text" as a relatively autonomous body within the "temporalizing of temporalization" taking place in the interplay of practices and possibilities is a sine qua non for differentiating between semantic and hermeneutic meaning of a "text". (In a stronger claim, the temporalizing of this hermeneutic meaning within the horizon of temporalization is tantamount to the "text's" interpretive fore-structuring.) In contrast to the semantic meaning, which as a static presence lacks temporal characteristics, the hermeneutic meaning—as potentially dissipated over the domain's whole meaningful articulation—is composed of (a) the possibilities for the "text's" future contextual readings, (b) the past trajectories of its constitution and its past contextual readings, granted that the "text's" having-been entirely depends on which futural possibilities would become appropriated and actualized, and (c) the "text's" present identity for those who presently read it by choosing futural possibilities and singling out past trajectories. The unity of an open future projected upon possible readings, a having-been in a plurality of possible past trajectories, and ongoing making-present through possible constructions of identity on the part of current readers envision the "text's" hermeneutic meaning which is always already *in statu nascendi*. Accordingly, each regime of the "temporalizing of temporalization" is a hermeneutic fore-structure of a "text" (Ginev 1999a, 2012).
5. Since the semantic interpretation of theoretically structured knowledge is an obligatory moment for having a "text", there is no "text" that can avoid a

[3] The prediction of an unknown phenomenon through such a scenario also requires the experimental construction of an appropriate data model. The theoretical prediction of an unknown phenomenon must clearly be differentiated from the (already discussed) experimental discovery of an unobservable phenomenon waiting to be saved via a theoretical model. Though predicted by a verified theoretical model, the unknown phenomenon might have not received an acceptable representation through a data model. Thus, the difference is to be summarized thusly: When expressed through data models, the unobservable phenomena are waiting for appropriate theoretical models, whereas the theoretically predicted unknown phenomena wait for the construction of acceptable data models that are capable of expressing them.

characterization in terms of a semantic notion of truth. The semantic autonomy of a "text" concerns the structure of knowledge about objectified factuality. At the same time, this knowledge is structured in accordance with norms and criteria about epistemic features like validity, coherence, systematicity, conceptual simplicity, and justifiability as these norms and criteria work in the relevant context. Therefore, the characterization of a "text" in terms of a semantic notion of truth depends on the normativity about the epistemic features assigned to the textual structure. Yet characterizing a "text" in terms of both normative-epistemic codification and semantic truth plays only a subsidiary role. Each "text" is first and foremost distinguished by a kind of hermeneutic truth (i.e., truth as aletheia in a process of reality's meaningful articulation).[4] The latter consists in the way in which the "text"—as it is constituted in a characteristic hermeneutic situation—at once reveals and conceals the totality of meaningful articulation of a scientific domain in its potentiality-for-being. In each "text" certain possibilities projected by the domain's interrelatedness of practices become actualized. The "text" positively defines a domain's hermeneutic meaning in terms of the actualized possibilities by pushing away other possibilities and announcing still other possibilities to be unachievable. Through the way in which it shifts and de-actualizes possibilities, the "text" defines a domain's meaning negatively. By displacing possible meaning that is part of the total potentiality-for-meaning of a scientific domain, the "text" conceals the latter in a certain way. (It is another question that a re-contextualization of the "text" might recast and revive the displaced possibilities, thereby presenting them as interesting and achievable ones.) Truth achieved through textualizing and revealed by "texts" is the revealing and concealing of reality in a characteristic hermeneutic situation. (The semantic truth of theoretical scenarios is incorporated in "texts", while the hermeneutic truth is revealed by "texts" as inseparable from the process of textualizing.) Thus considered, the hermeneutic truth is about the way in which the potentiality-for-being of objectified factuality shows itself within the facticity of that mode of being which enables the objectification of domains of reality. Since the hermeneutic truth is a non-epistemological notion, it may coexist (within a "text") with all kinds of (correspondent, coherentist, consensualist, pragmatist, etc.) epistemic truth.

6. Each "text" bears evidence about the characteristic hermeneutic situation in which the domain has been disclosed. This is evidence concerning the way of de-contextualizing the objectified factuality through (practices of) idealization which—however radical it is—leaves open possibilities for a re-contextualization of the knowledge about the produced factuality. De-contextualization is most

[4] Roughly, the semantic notion of truth as well as the epistemological concepts of correspondent, coherentist, consensualist, operationalist, pragmatic, and other types of truth refer to the truth-characteristics of linguistically expressed units of factual knowledge, whereas *aletheia*—the revealing (and concealing) of reality in a characteristic hermeneutic situation—is the truth-characteristic of facticity. The concept of hermeneutic truth is an ontological concept which takes into account the finite-contextual revealing/concealing of a "text" within the potentially infinite processes of textualizing and re-contextualization.

typically illustrated by the construction of measurable parameters through mathematical idealizations. As a dimension of a characteristic hermeneutic situation, de-contextualization should not be confused with what earlier was described under the heading of a withdrawal of the "text" from the domain's ongoing articulation: a withdrawal that is a requisite for having standard scientific knowledge. De-contextualization always takes place in practices, and its outcome is constantly amenable to being read and represented in contexts of scientific inquiry. (Strictly speaking, de-contextualization is a state that scientific inquiry's re-contextualization periodically re-creates when modifications of the mathematical formalism take place.) There are "texts" that incorporate objectified factuality inseparable from the readable technologies which have produced it. Admittedly, these are "texts" constituted by a process of textualizing for which it is impossible to draw a demarcation between objectified factuality (supposedly determined by the relations between data models and theoretical models/scenarios) and the readable practices of experimentation, instrumentation, conceptualization, formalization, etc. The readable technologies remain in this case "engraved" on the objectified factuality. Since the non-detachability of readable technologies requires a radical reflexivity on the part of inquirers, these "texts" might be considered as reflexive ones. The reflexive "text" is capable of controlling and changing its relevant context. (The theoretical structure framing the objectified factuality in a reflexive "text" draws on a certain complementarity of alternative descriptions caused by the non-detachability of the readable technologies.) For most of the "texts", however, the readable technologies are completely detachable.

7. Each "text" contains—through referring to its past and future re-contextualization—a "story" about the domain's ongoing meaningful articulation. This trait is closely related to—and has to be further elucidated in connection with—the trait (4). More specifically, it is a story that—if reconstructed and narrated in an appropriate manner—would make explicit a regime of the temporalizing of temporality within the domain's articulation. Accordingly, each "text" of a domain is capable of suggesting a historical plot of the domain's articulation. In this sense, each "text" documents something of (what I called) pre-narrativity of the domain's articulation. This term was introduced in connection with the intention to bring the regimes of the temporalizing of temporality to bear on the analysis of the choices and actualizations of possibilities. A choice opens a futural leeway for articulating the domain. The chosen possibilities on their part single out a series of past choices. This series as a trajectory of past events can be narrated only after the actualization of chosen possibilities takes place. The temporalizing of temporalization in the constitution of domain's hermeneutic meaning rests on the fact that the trajectories of the past events are dependent on the horizon of futural possibilities. A choice of a possibility for doing research might be regarded as an endpoint that finalizes a story about a line of domain's articulation that can be narrated. Each "text" involves at least one story of this kind that can be reconstructed through a proper analysis. (Developing the historical plot I mentioned rests on the analytical reconstruction of the story

which the "text" documents.) Temporality of meaningful articulation and intrinsic historicity are principal features of each "text". The process of textualizing potentially contains all stories, i.e., the whole pre-narrativity of the domain's articulation. Each "text" contains an indication of how the story (stories) it documents can be continued through new choices.

Taken together, (1–7) are formulated in a direct opposition to Heidegger's celebrated thesis (from his 1929 inaugural lecture at the University of Freiburg) that science is incapable of investigating what is not objectifiable in accordance with its criteria of objectification. What eludes these criteria is the "no-thing" which has no being in scientific experience. This is why science views the no-thing as a ghost. (The no-thing is by no means—so goes the basic argument of the lecture "What is Metaphysics"—reducible to the act of negation as expressed by "is-not". As Heidegger's polemics with Georg Misch shows, no-thing is rather the ontological ground for having an act of negation.) Heidegger's thesis about no-thing wrongly assumes, I believe, that scientific research might only deal with objectified factuality. Accordingly, scientific conceptualization turns out to be unable to reflect upon the facticity of *Forschung* as generating and interpretatively fore-structuring the objectification of factuality. Heidegger ignores the fact that scientific research is by no means indifferent to its facticity, its situated transcendence, and its own hermeneutic situations.

Of course, one might object to this verdict by stressing that the aforementioned fact is irrelevant to Heidegger's thesis (Glazerbrook 2000, 12). Given that facticity of scientific research consists in the interplay of practices of inquiry and possibilities for doing research, the thesis would not have been vulnerable by the observation that scientific inquiry tends to become more and more reflexive with regard to the ways of production of objectified factuality within this interplay. This observation does not imply that scientific inquiry would be able to conceptualize what could have never been given in its positive experience (i.e., the thematic scope of its objectification and conceptualization), which is the deep sense of Heidegger's thesis. What is only a pure negativity in the factual/conceptual scope of this experience—so the argument for a possible objection against my criticism goes—is the meaning of being which no scientific inquiry could conceptualize. I agree that this objection is completely consistent with Heidegger's views and his dichotomous reading of the ontic-ontological difference. The objection assumes that the reflection upon the facticity of scientific inquiry and the reflection upon the meaning of being are essentially different enterprises. (By the same token, the ontic-ontological difference is not to be equated with the difference between objectified factuality and the facticity of inquiry.) I disagree with this assumption. Refuting it would disprove Heidegger's thesis.

In order to show that this thesis is disprovable, let me reverse it by asking the following question: What would happen if science were willing to investigate and to know all (or at least something) about the no-thing? (For Heidegger, science wants to know nothing about the no-thing, and for this reason, it can do research on things but cannot think.) Obviously, if science were intended to get knowledge

about the no-thing, it would not try to integrate a sort of existential analytic in its strategies of conceptualization. Instead, it would have to start an incremental translation of the no-thing into the thing-languages with which it operates. But what would have been amenable to translation? The obvious answer is what makes some things reveal themselves contextually. The hermeneutic situations of inquiry are the no-thing that enable the contextual revealing/concealing of things. Even if these situations become conceptualized, their conceptualization would not alter their status of being no-thing. (The conceptualization would only make intelligible the way in which the no-thing conditions the possibilities of revealing the things in the contexts of inquiry.) My claim is that the characteristic hermeneutic situations of inquiry are nothing else but the more important special case of Heidegger's no-thing: the "creative no-thing" within the scope of science's objectified "things". (They instantiate the work of no-thing whereby the domains of reality are disclosed-to-be-objectified.)

Each "text" documents a way in which the facticity of inquiry fore-structures the production of objectified factuality in a characteristic hermeneutic situation. This is a way in which being becomes disclosed in the interpretive circularity of a meaningful being-in-the-world—a way in which the no-thing becomes "textually" manifested. Thus, each "text" constituted in scientific inquiry's facticity speaks—documents, records "something"—about the no-thing.[5] Finally, it follows from the foregoing considerations that the ontic-ontological difference operates in a non-dichotomous manner in each "text" of scientific inquiry—a claim that basically revives motifs of Misch's criticism of "fundamental ontology", although it is also directed against Misch's attempt at a radical dissolution of the ontic-ontological difference.

The thesis that the whole process of inquiry—in which a scientific domain becomes both meaningfully articulated and objectified—is a process of textualizing should not be equated with the (poststructuralist) thesis that there is nothing outside of the text. In a premise of this thesis, there is no demarcation between text and context that might resist a deconstruction. The rationale for adopting this premise consists in the observation that there are no contexts pre-given to the text's construction. Since the text creates its context, the possibility of drawing a theoretically significant line of demarcation seems to be foreclosed. Moreover, insisting on such a line would be a gesture of endorsing a kind of metaphysics of presence—the

[5] Let me draw attention to the fact that this argument against Heidegger's thesis does not necessarily appeal to the "active conceptualization" of hermeneutic situations in scientific inquiry. The claim that Heidegger ignores the potential of reflexivity of scientific inquiry—a form of reflexivity that takes into consideration the characteristic hermeneutic situations—does not imply that scientists actively elaborate on devices for conceptualizing these situations. As already pointed out, having recourse to the hermeneutic situations of inquiry does not make scientists hermeneutic philosophers of science. But the ways in which these situations are reflexively taken into consideration show that scientific research is capable of "thinking" what—for Heidegger—should be unthinkable for science. "Taking into consideration" is not tantamount to "actively conceptualizing" because it is the relatedness of inquirers' reflexivity to practices' endogenous reflexivity that brings the characteristic hermeneutic situation to light. This enlightening essentially differs from conceptualization.

contexts are metaphysically present before the construction of texts takes place. A radicalization of this view leads to the idea of intertextuality: Since the contexts are always already involved in the texts, there is no diversity of contextualized texts, but a continuum of interpenetrating texts. The view that the text does not border on something extratextual also becomes radicalized: The text does not border on other texts as well; rather it keeps a record of (and becomes recorded in) a potentially infinite number of other texts whose traces are to be discovered in the text's deconstructive reading. Accordingly, to deconstruct the allegedly codified structure of a text amounts to reading the latter intertextually. Interpreting a particular text amounts to engaging in a "tracing game" within the intertextual continuum.

To reiterate, leading in the hermeneutic-realist discourse is not the thesis that the text creates its context, but the claim that textualizing within the facticity of inquiry constitutes both the "texts" and their relevant contexts. (However open a "text", and however minimalized its basic structure, it cannot dispense with the contextualizing synergy of readable technologies and cycles of semiotic representations. Even in the special case of the constitution of reflexive "texts" that actively participate in the ways of carving their contexts out—and make use of complementarity in framing the objectified factuality—the "texts" and contexts do not become conflated in the course of inquiry.) It is the way of adding a "hermeneutic dimension" to the poststructuralist deconstruction—a dimension on which Gadamer insisted in his unfinished dialogue with Derrida—that helps one to restore the legitimacy of the division between text and context without making concessions to the metaphysics of presence. The motifs of the interplay of practices and possibilities as fore-structuring textual structures along with motifs of reading-and-representing as entangling contextures-of-equipment with contexts of inquiry provide a demarcation without reifying (a) the text, (b) the context, or (c) any kind of dividing line drawn between them. What becomes fore-structured is a body of knowledge constituted by contextual actualizations of possibilities for doing research. What at once contextually situates and transcends this body is the open horizon of "exceeding possibilities" for reading and representing within the particular (contextualizing) configuration of readable technologies and spaces of representation. It is the openness of this horizon that creates the co-referentiality of any particular context with all possible contexts taking place in a domain's meaningful articulation. "Supplementing" the deconstructionist story about the dissipation of text's meaning with motifs related to the interpretative fore-structuring also adduces evidence for the irreducibility of the hermeneutic-realist concept of intercontextuality to the poststructuralist concept of intertextuality.

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