Argumentation and Education

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Editors

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Theoretical Foundations and Practices

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Introduction

Nathalie Muller Mirza and Anne-Nelly Perret-Clermont

Argumentation constitutes an important dimension of daily life and of professional activities. It also plays a special role in democracies and is at the heart of philosophical reasoning and scientific inquiry. Argumentation has an increasing importance in education, not only because it is an important competence that has to be learned, but also because argumentation can be used to foster learning in philosophy, history, sciences and mathematics, and in many other domains. During the last decade, argumentation has attracted growing attention as a linguistic, logical, dialogical, and psychological process that sustains or provokes reasoning and learning.

As a means of improving students' understanding in the classroom, argumentation can be called upon to trigger learning in many ways. Argumentative practices involve making explicit and public one's own stance and justifying it to another person or to oneself. Argumentation allows for explorative, critical and enquiring approaches to reality: encouraged to test the validity of each other's ideas, the learners are led to formulate objections and counter-objections and to understand a multiplicity of positions. Argumentative practices in science education are interesting because they invite pupils to use and come to understand rules of reasoning that are used in scientific work: pupils search for reasons, examine the available data, test alternative hypotheses, etc., which allows them to discover that science is more about trying to construct and resolve problems in specific theoretical frames than a matter of "discovering" things that might have been hidden since the beginning of the world. This is in contrast with students and laypersons' preconceptions. It implies that confrontation of perspectives is "fair-play" and that submitting to majority world views, prejudices, or status does not contribute to knowledge construction. Argumentative practices are powerful resources to deal with cognitive contradictions, doubts, controversies, complex decisions, etc. They invite participants to engage both in reasoning and in search of information. They require participants to coordinate their actions and reflections and to experiment with a reflexive position that enhances decentration

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capacities. Because learning does not solely mean acquisition of information or the appropriation of ready-made objects of knowledge, argumentation also entails the emergence of new understandings and the creative restructuring of previous ones: the learner is the co-author of a constructive socio-cognitive process in which argumentation holds important functions.

Argumentation is thus of interest to researchers and practitioners in education who are concerned with the social and cognitive processes that promote learning. However, learning argumentation and learning by arguing raises theoretical and methodological questions: How and when do learning processes develop in argumentation? Is it the case for all subjects? How does one design effective argumentative activities? How can the argumentative efforts of pupils be sustained? What are the psychological issues involved when arguing with others? How can what the learners produce be analyzed and evaluated? The argumentative activity requires specific intellectual and social skills and it is often emotional and demanding. Introducing argumentative activities in educational settings is not yet common. It requires attention at different levels. The complex argumentation skills must be given opportunities to develop in the growing child. At the interpersonal level, argumentation means confronting other people's perspectives. People often avoid these kinds of situations, which they tend to perceive as a risk to the self and to the relationship. At the institutional level, argumentative activities are sometimes considered time consuming when curricula are already overloaded. These activities require special social skills from the teachers, as well as ad hoc teacher training and assessment practices. At the cultural level, argumentation means the acceptance that social harmony is not threatened by the expression of a plurality of opinions; that assertions have to be backed up; that authority is not sufficient; and that discussions are permitted even when relationships are asymmetrical.

As a result of this complexity, it is not possible for teachers to just improvise argumentation based learning activities in the classroom. Precise design and adaptive management are needed. This book offers perspectives on these issues in an interdisciplinary effort to develop original theoretical and methodological perspectives using results from empirical research. The authors, active in the fields of theory of argumentation, psychology, and education, provide here elements to understand what happens when argumentation is introduced into the classroom. They share a common perspective on argumentation with special attention paid to communication and context. They also share a common understanding of education as oriented toward the enhancement of individual and collective agency in the development of knowledge, sociability and democratic social responsibility.

The book is organized into two main parts: theoretical foundations and research results are presented in the first part and an examination of existing innovative practices and lessons learned from them constitutes the second part.

The development of argumentation theories in the contemporary epistemological scene is central to the chapter "Argumentation as a social and cultural resource" by Eddo Rigotti and Sara Greco Morasso. They consider, in particular, the pragma-dialectical approach for its focus on the theoretical kernel of the discipline and for systematically eliciting, from this, the connected methodological implications.

The key notion of argument is specified by comparing it to the apparently near notion of demonstrative proof. Analogies and differences are brought to light, and the rather fuzzy but challenging and fundamental notion of *reasonableness* is identified as denoting the main value at stake in argumentative interactions. The authors propose a model of argumentative intervention in which argumentation is conceived as a particular type of communicative interaction. The model aims both at producing and at analyzing/evaluating argumentative interventions. The fundamental claim is that assuring the quality of argumentation implies contributing to a healthy social consensus and promoting cultural development at the individual and collective levels.

The chapter, "Psychosocial processes in argumentation," by Nathalie Muller Mirza, Anne-Nelly Perret-Clermont and colleagues, examines argumentation as a psychosocial practice embedded in institutional, historical and cultural contexts. Argumentation occurs when the conversation flow is disrupted by a disagreement, a question, or an alternative hypothesis. It is not easy to develop this peculiar communication, as it entails complex issues at the personal and interpersonal levels. Even though they are in reality interwoven, several dimensions are distinguished. At the cognitive and individual level, the questions include the following: what are the cognitive prerequisites for engaging in an argumentative interaction? How is the development of argumentative skills taking place in children? Beyond the individual level the authors take into consideration other dimensions that are important, such as the relational and dialogical aspects of argumentation, the status of the partners, and the characteristic of the "audience." The specific demands of the institutional and cultural context in which argumentation takes place are also examined. Developmental, social, and socio-cultural approaches in psychology are thus convened in order to construct a better understanding of this complex practice.

Baruch Schwarz's chapter provides multiple perspectives on the intricate relationship between argumentation and learning. Different approaches to learning impinge on the way argumentation is conceived: as a powerful vehicle for reaching shared understanding, as a set of skills pertaining to critical reasoning, or as a tool for social positioning. Each perspective has harvested empirical studies that have stressed the importance of argumentation in learning. In spite of the pluralistic stance adopted, this chapter attempts to draw connections between the findings obtained in the different perspectives. In a separate part, it considers the specific role of argumentation in the learning processes and outcomes for four subject areas: in mathematics, studies are presented that show deep gaps between argumentation and proof; in science, experimental studies are reviewed to examine whether and how argumentation promotes conceptual change; in history, the chapter considers the role of argumentation in challenging narratives and in claiming a position; and lastly, the chapter describes the new wave that characterizes civic education programs toward the instillation of argumentative practices in democratic citizenship.

Under the title "Argumentation and the social construction of knowledge," Michael Baker deals with two questions: firstly, what might students learn by engaging in argumentative interactions? And secondly, by what cognitive-interactive processes might they achieve this? An approach to understanding argumentative interactions, produced in problem-solving situations, is outlined and shows them

essentially as attempts to solve an interlocutionary problem, i.e., that of deciding which putative problem solutions to accept or not, by drawing on additional knowledge sources (termed "[counter] arguments") that potentially change the degrees of the acceptability of solutions. This process goes hand in hand with the exploration of a dialogical space and with the negotiation of the meaning of key notions underlying the debate. The analysis of an example of argumentative interaction, involving two adolescent students in a physics classroom, reveals this exploratory process, together with the essentially unstable nature of students' viewpoints, given that they are engaging in argumentation with respect to ideas that are still under co-construction.

Baruch Schwarz and Jerry Andriessen, in their common chapter "Argumentative design," discuss the educational architecture of argumentative activities. Productive argumentative activity may be encouraged, for example, by elicitation procedures, with argumentative scripts, by confronting subjects with hypothesis testing, and by pairing peers that have differences of opinion. What are the main results that research has delivered in such cases? A second section of the chapter is devoted to the designed use of collaborative technology for fostering and representing argumentation. Experiments using scenarios which feature a blend of technology and human interaction are discussed.

Beginning the second part of the book, Neil Mercer's chapter, "Developing argumentation: lessons learned in the primary school," argues three main points: first, that one of the most important aims of education ought to be to develop children's capability for argumentation; secondly, that teachers can make a significant contribution to this development; and thirdly, that the development of children's use of language as a tool for argumentation helps the development of their individual intellectual capabilities. To do so, Neil Mercer first discusses the importance of children's engagement in dialogue for the development of their thinking and understanding. He then considers education as a dialogic process in which both the talk between teachers and learners and the talk among learners have important roles to play. Finally, he describes some classroom-based research which has enabled teachers to encourage the development of children's use of spoken language for thinking and arguing effectively together, and which has also provided empirical support for the relationship among thought, language, and social activity, as claimed by the Russian psychologist Lev Vygotsky.

The practice oriented contribution, "Argumentation in higher education," by Jerry Andriessen presents one case of using interactive media for supporting collaborative argumentation by university students. The discussion is descriptive, focusing on the scenario and the tools that are used and on examples of actual discussions by students. Some basic mechanisms of employing argumentation are illustrated by students using computer tools (chat, forums, graphical tools) for producing an argumentative essay. This chapter shows some of the characteristic constraints that are involved in implementing argumentative learning in university practice.

How can argumentation skills be improved by engaging students in argumentative practices where they are helped to assume a healthy critical attitude and provide reasons for their positions? What are the synergies of learning to argue and arguing to learn? "The Argumentum experience" by Sara Greco Morasso, originates from

these questions and relies on the experience of teaching argumentation at university level in the framework of the Swiss Virtual Campus project Argumentum (http://www.argumentum.ch). After presenting the aim and structure of Argumentum, this study focuses on a specific experience of argument production and analysis that occurred in the pedagogical scenario of argumentation classes at the master's level. Finally, the chapter elaborates on the lessons learned from this experience.

By drawing upon existing theoretical and empirical resources to discuss the successes and difficulties encountered in trying to introduce or sustain argumentative activities in learning settings, the authors of this book hope to contribute to the promotion of a large program of research. In their opinions, considering argumentation as a key activity at the heart of many developmental processes, in individuals and in society, opens the way to a deeper reconsideration of teacher training, curricula, and also of the nature of human knowledge and its potential advancements.

Part I
Theoretical Foundations

Argumentation as an Object of Interest and as a Social and Cultural Resource[1]

Eddo Rigotti and Sara Greco Morasso

Abstract The development of argumentation theories in the contemporary epistemological space is shortly outlined and the pragma-dialectical approach is, in particular, considered for its focus on the theoretical kernel of the discipline and for systematically eliciting, from this, the connected methodological implications. The key notion of *argument* is specified by comparing it to the apparently near notion of *demonstrative proof*. Analogies (discursiveness, inferentiality, procedurality, critical approach) and differences (things that could also be in a different way, pragmaticity, use of ordinary language, implicitness) are brought to light, and the rather fuzzy but challenging and fundamental notion of *reasonableness* is identified as denoting the main value at stake in argumentative interactions. The authors propose a model of argumentative intervention in which argumentation is conceived as a particular type of communicative interaction. The model aims both at producing and at analyzing/evaluating argumentative interventions. Three core aspects of the argumentative intervention are highlighted in the model: the social *context* of communicative interaction, both in its institutionalized and in its interpersonal components, which is seen as the environment of argumentative activities; the *inferential structure* of argumentation, in its dialectical and relational components; and the *quality* of argumentation (distinguishing sound and manipulative argumentative moves). The fundamental claim is that assuring the quality of argumentation implies contributing to a healthy social consensus and promoting cultural development, at the individual and collective levels.

Keywords Argumentation, Reasonableness, Argumentation studies, Argument schemes, Loci, Argumentum Model of Topics, Manipulative processess

[1] We are indebted to Joëlle Stoudmann for the very accurate and competent language revision.

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1 Argument: In Search for the Hidden Meaning of the Word

The Latin word *argumentum* covers a fundamental notion of Argumentation theory. This word, which is immediately recalled by equivalent terms in many modern languages (English *argument*, Italian *argomento*, French *argument*, German *Argument*, Russian *argument*), is a noun derived from the verb *arguo*. We find in its lexical structure the key to its semantic content; thus, analyzing the way it is built constitutes a significant help to approaching our subject. The word is formed by the verb *arguo* and by the suffix – *mentum*. Now, the Latin suffix – *mentum*, bound to a verb, refers, in general, to the process of realisation of the action which the verb represents, indicating, in particular, the way and the means or instruments with which the action is realized. One should think of examples such as *documentum* (a device used to inform), *monumentum* (a device used to remember), *adiumentum* (a device used to help), *alimentum* (a means used to nourish). In the same way, the word *argumentum* can be understood as "a device to *arguere.*"

The Latin verb *arguo* has entered numerous modern languages (English *to argue*, Italian. *arguire*, French *arguer*), changing its values perceptively. Nevertheless, it has kept one fundamental meaning, that of *pointing out*, of *bringing to acknowledge* and, therefore, also of *proving*. In other words, it basically seems to indicate the process of "helping" the interlocutor recognize something by (directly or indirectly) giving him the necessary justification. In this respect, we have a particularly interesting case, when the meaning of "showing something" is used as "demonstrating the guilt of" or simply *accusing*. In this case, the focus is on an aggressive and polemic implication, which is not infrequent in argumentation: thus the Latin words *argumentor* and *argumentatio* incorporate the value of discussing, debating polemically. This meaning is entirely expressed by the English verb *to argue*, which is often used in the sense of "*discussing heatedly*" and even as synonym of *to quarrel*.

In the noun *argumentum* anyway, the fundamental value of *reason*, *evidence* and *proof* prevails, although other values are not completely absent.[2]

The fundamental value of *arguere*, as "to bring to recognize" the reasonableness (i.e. the grounds) of a standpoint, was already established in the ancient rhetoric. Cicero's definition of *argument* is the following (Cic. Top. 2, 7, see Reinhardt 2003):

ARGUMENTUM EST **RATIO**, QUAE **REI DUBIAE** FACIT **FIDEM**

Here the argument is seen as a procedure demonstrating the credibility of an uncertain statement which needs to be proved. Therefore, the argument rests on something that is already established in order to demonstrate the truth of a still uncertain hypothesis (Quint. 5, 10, 11, see Winterbottom 1970).

ARGUMENTUM EST RATIO **PROBATIONEM** PRAESTANS, QUĀ COLLIGITUR ALIQUID PER ALIUD, ET QUAE, QUOD EST DUBIUM, PER ID QUOD DUBIUM NON EST, **CONFIRMAT**.

[2] Since the argument is considered to be the central and substantial element of the discourse, the element on which the whole discourse is based, in the case of narrative texts, "argument" is used to indicate the story, understood as the kernel of a narrative text.

2 Argumentation and Reason

The word *ratio* appears in both definitions. It is incorporated in many modern cultures in derived terms (*reason*, *ragione*, *raison*). This word carries a complex content, which should be further discussed, also from a philosophical point of view. The term *ratio*, as well as the other derived terms in modern European languages, presents a variety of meanings. Reason, understood in many traditions as distinctive human faculty, could be defined, in general, as the instrument or organ which enables us to establish a relation to reality. In this relation, there is a strong relationship between reason and language. Both concepts are embraced and kept together by the Greek term *logos*.[3] Other values emerge in the vast polysemy of this term, e.g. the value of *calculus*, also implied by the Latin *ratio*.[4] Another usual value is that of connection or rapport, in mathematical sense; Cicero's definition of argument would become, in this interpretation, particularly perspicuous: an argument is a connection enduing reliability to a questionable thesis.

Within modern argumentation theory, the English word *reason* definitely is a keyword, not only because of its fundamental value as mentioned above, but also in the sense of *"the reason why,"* and is understood as a justification (why something we believe should be claimed) rather than as a cause (why something happens). Here reason is understood as the legitimating basis supporting a standpoint. In other words, reason coincides with why one believes it to be worth supporting a certain opinion (judgement, evaluation, etc.). From the primary value of the term *argument*, it emerges that to argue is a form of discursive move in which we do not limit ourselves to expressing or communicating ideas, opinions, proposals, wishes, projects, etc., but we want to justify them, prove them by reasoning. Thus, in argumentation, we commit ourselves to maintaining a critical attitude in front of ourselves and the others.

Obviously, one cannot expect to prove or to discuss everything. It is unreasonable to ask for proof of or to question evidence. Thus, it would be unreasonable if someone who was in Berne yesterday answered to a question like: "What was the weather like yesterday in Berne?" with such an answer: "The weather forecast said it would be cloudy in Berne." Instead, if the question were: "What will the weather be like tomorrow in Berne?", it would be reasonable to report the weather forecast, as the future can never be considered a fact; and it would be reasonable to answer in an argumentative way, referring to the "authority" of the weather forecast on TV. Thus, there are statements that are based directly on our experience and others that are based on reasoning. Furthermore, one should consider that there is an essential link between the moment of arguing and the reference to evidence: by using argumentation, we try to trace an uncertain discourse, which per se does not have a basis, back to another discourse. At this point, this discourse can be either based

[3] For an explanation of the role of *lógos* in communication, see Rigotti and Cigada (2004), in particular chapter IV. In his moral tractate *De officiis,* I, 50 Cicero proposes a nice hendiadys (*ratio et oratio*, "reason and discourse") for rendering in Latin the complexity of the Greek word (see Winterbottom 1994).

[4] The Latin language indicated a bookkeeper by using the expression *a rationibus* (in charge of accounts).

directly on evidence or justified by argumentation. This argumentation could be based on further argumentation. However one cannot endlessly continue with this chain of argumentation: our discourse, sooner or later, has to link with evidence. However, even if we are not always aware of it, our knowledge and our decisions are often based on a large amount of inferences: elaborating a judgment, evaluating advantages and disadvantages of alternative actions, deliberating about something (as in the case of politicians having to establish which languages must be studied by pupils in primary education), but also evaluating the dynamics of an event that occurred many centuries ago (as historians must do), and many other situations, require that we apply inference on the basis of some evident data.

A correct reasoning and a faithful adherence to evidence represent the two fundamental components of critical commitment. And critical commitment is essential for the good quality of endless intellectual operations and practices that involve arguing in its individual and collective use, such as understanding the meaning of a message, explaining a natural fact or a human behaviour, clarifying a doubt, making decisions, taking position in a controversy or debate, settling a conflict, deliberating about something, counselling, increasing knowledge,[5] establishing an opinion, persuading oneself or others, etc.

The way we have defined argumentation seems to hold both for argumentation and for mathematical proof. In fact, in both argumentation and proof, one passes from the truth value of one proposition to the truth value of another proposition, namely one determines the truth value of a proposition which is unknown, starting from the truth value of another proposition which has already been established. Since antiquity the fact that an argument is a type of proof has been observed.[6] Nevertheless, we must not neglect the fact that, beyond the important similarities in the applied procedures, significant differences can be found. In the following, the analogies and differences between these two concepts (see Fig. 1) will be highlighted.

3 Argumentation and Proof: Analogies

A first aspect that argumentation and proof share is ***discursiveness***: they form a *discourse*, namely a text (oral or written) which is necessarily articulated in more than one communicative move. This is especially evident for mathematical proofs: there is no proof that is not articulated in a hypothesis, a thesis, and in a proper

[5] In this volume, Baker shows the relevance of argumentative interaction in the process of social construction of knowledge. In particular, the paper explores the resolution of the so-called "interlocutionary problems," i.e. of "problems that are embedded in social practices […] that may be both formulated and solved in language exchanged in interaction." Andriessen, in this volume, describes an educational activity designed for enhancing university students' understanding of scientific texts, through the use of graphical tools aimed at supporting argumentation. By discussing the strengths and weaknesses of such an activity, Andriessen shows the importance of a well-thought argumentative design.

[6] In the first lines of Aristotle's Rhetoric, *pistis*, as trustworthiness, created in the process of argumentation, is defined as a sort of proof.

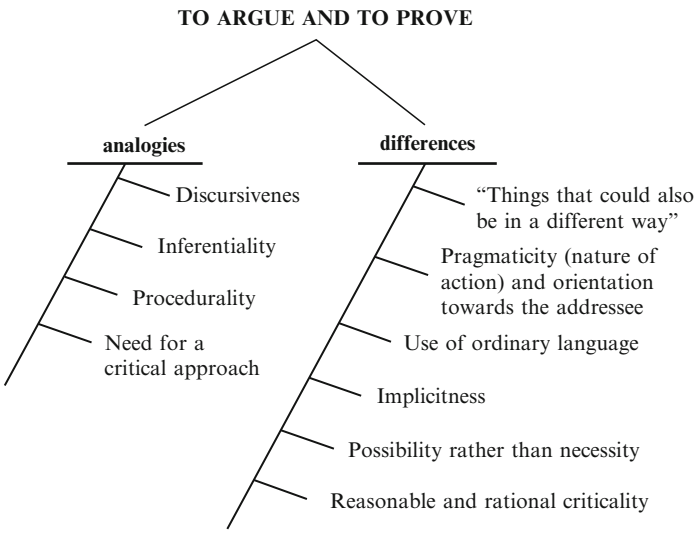

Fig. 1 Representation of analogies and differences between argumentation and proof

proof. As for argumentation, the model of Stephen Toulmin (1958)[7] highlights the property of discursiveness, structuring the argumentative strategy in a series of discursive moves, conceived as answers to the critical questions of a potential interlocutor. Thus, the arguer must first of all base his standpoint (*claim*) on a foundation (*warrant*) that justifies it. Furthermore, he must base the relationship between foundation and thesis on a law or general rule (*backing*) according to a sequence of moves that form the discourse. The model elaborated by Toulmin can be presented in a diagram (see Fig. 2), which is illustrated below, by means of an example:

> Giuseppe must be renting his beautiful apartment, because he does not earn enough to own it, and one needs a very high income in order to afford a luxurious apartment that is very expensive. Unless… he has inherited something or won the lottery.

A model like Toulmin's, which underlines the dimension of the discursiveness, seems to be contradicted by many single communicative moves, which nevertheless have an argumentative nature. For example:

– MARIA: Are we going out?
– LUIGI: It's raining cats and dogs.

Luigi's answer, in this brief dialogue, seems to be accomplished in one single linguistic act; indeed, it hides an articulated discourse, which can be made explicit and which can be represented in Fig. 3.

Luigi expresses only the circumstance (*Datum*) that justifies his decision not to agree with the proposal to go out. This circumstance is part of a chain of reasoning which has brought him to this conclusion. The conclusion (*Claim*), the *Warrant*, the

[7] Toulmin's model was presented in the book "The uses of argument," published in 1958.

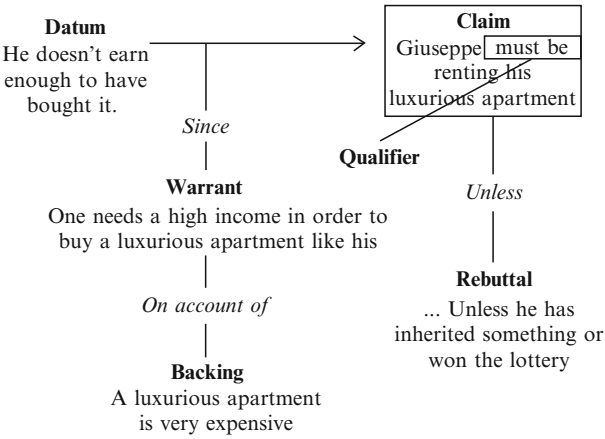

Fig. 2 An application of the model of Stephen Toulmin (1958)

Backing as well as the other steps of this reasoning remain implicit here. At this point, we can say that in argumentation the omnipresent feature of discursiveness can be latent, i.e. implicit. On the opposite, in the case of mathematical proof we have one or more *hypotheses* (corresponding to the *Datum* in Toulmin), a *thesis* (corresponding to the *Claim* in Toulmin) and finally a *demonstrative process* (which corresponds to Toulmin's *Backing* and *Warrant*). This brings us from the hypothesis to the thesis, thanks to a precise number of steps which are explicitly formulated and justified. In mathematical proofs, the articulation of the subsequent steps is always manifest because proofs try "to approach the ideal of communicating the relevant inferential path in an entirely explicit way – although these texts do adopt procedures of synthetic quotation for referring to axioms and conclusions of former proofs, as these procedures are explicitly declared, the principle of explicitness is observed" (Rocci 2006).

Both argumentative discourses and proofs have an *inferential* nature, as they derive the value of truth of a proposition from the value of truth of another proposition. This obviously leads to a connection between the truth-values of the two propositions, namely the truth-value of the one depends on the truth-value of the other. If someone affirmed that Dante Alighieri wrote the *Divine Commedy* in 1340, we could object that this is not possible, as Dante died in 1321; and it is not possible for a person to be at the same time dead and writing, or performing any other activity. It is surprising how decisive inference appears to be, not only in the development of the human knowledge, but also in communal life and in everyday communication. At the level of knowledge, even if the number of statements obtained, thanks to the observation of experience – namely of *data* – is infinite, one can establish a lot more indirectly, by *inferring* knowledge from other knowledge. It often occurs that the same information is a fact of experience for one person, while for many others

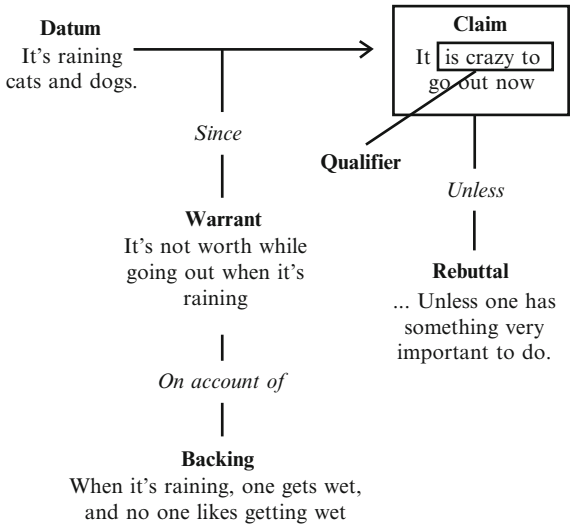

Fig. 3 Application of Toulmin's model (second example)

it is obtained by inference. The whole scientific activity is based on a balance of observation and inference (Schwarz in chapter "Argumentation and Learning" of this volume).

Inference plays an extremely important role both in the cognitive and in the communicative dimensions. Concerning information derived from empirical data, as soon as they have passed from the direct witness to an addressee, they do not represent for the latter experienced data: the addressee can believe this information if he values the information source. Even this kind of information, thus, derives from a particular case of inference: "All the information coming from x is true, p is information coming from x, therefore, p is true." This is based on the well-known *argumentum ex auctoritate* (*argument from authority*), an argumentative procedure which, although it is very often employed, turns out to be rather risky in many of its applications.

The role of inference in communication is twofold. On the one hand, it intervenes in the constitution of many messages which are partially or totally argumentations or proofs. On the other hand, inference intervenes in the communicative process as well. Actually, we have already seen that in argumentation, many moves or passages remain implicit, thus they do not directly become manifest but are left to be deduced – almost to be guessed – from other information that is often incomplete. This is true not only for argumentation, but generally for any communication (verbal and non-verbal). The process through which the receiver reconstructs the sense of a message, starting from a discourse which is usually full of gaps, is an inferential process. The message is integrated according to the *Principle of charity* (or *Principle of good will*), i.e. postulating implicit discursive structures which

allow the reconstruction of a globally acceptable sense and which respect the semantic congruity, the logical coherence, the pragmatic congruity and the dialogical rules. The term *communicative inference* defines the inferential processes used by the receiver in communication in order to integrate the message. The term *communicated inference* defines the proper argumentative and demonstrative processes that are conveyed as part of the messages.[8]

In order to see the relevant role that is played in argumentation and proof by the underlying (abstract) ***procedural*** structure, it is of use to identify such a structure in apparently different inferences.

Let us consider the following examples:

A: Where there is no water, there is no life.	A: Canines are carnivorous	A: When at night the sky is cloudy, there are no stars
B: There is no water on Mars.	B: The fox is a canine.	B: Tonight the sky is cloudy.
C: Therefore, there is no life on Mars.	C: The fox is carnivorous.	C: Tonight there are no stars.

It is rather evident that these three examples of reasoning do not derive their strength from the fact that one fragment of reality is considered instead of another, but from a procedure that, being essentially identical, is instantiated by our examples in different domains. We could informally describe this procedure in the following manner:

If, for every x for which P holds, Q also holds,
and there is an x for which P holds,
for this x, Q also holds

The inferential strength of these inferences does not depend on the fact that x are places (*where*), times (*when*) or living beings (*foxes*) and that P and Q are implemented by different aspects, but on the logical form of the propositions. In other words, the strength of the inferential procedure is not bound to the actual states of affairs whereof the situation consists, but rather to the structure of those states of affairs and to the relationships between them.

In this relation, it is important to distinguish inferential validity and truth. The three examples of inference that were illustrated above are all formally valid. Let us return to the first example: if it is true that there is no life where there is no water (and it seems reasonably true to assume this), and it is also true that on Mars there is no water (although there seems to be contrary evidence to this fact), it is certainly true that on Mars there is no life, given that the inferential procedure was realized in an exemplary way, namely the truth of C is proved if A and B are true. In our example,

[8] For a more detailed account of the notions of *communicative inference* and *communicated inference*, see Rocci (2006), in particular pp. 418–424.

the truth of A and B does not seem to be given and therefore I cannot concede the truth of C. But the inferential procedure is correct (valid), even if it cannot demonstrate the truth of the conclusion, given that one of the premises is false.

At this point, it is clear that in order to have a good reasoning, a valid inference is not enough. The premises from which the reasoning moves should be anchored to incontestable evidences.

For the argumentation to be correct it is also essential to verify the *semantic coherence* of the terms used in reasoning. As Aristotle pointed out, it is important that the same term is not used with different meanings in the same reasoning, in order not to be misleading[9]; thus, it is necessary to undertake a semantic analysis of the terms in order to verify the correctness of the argumentation.[10] Such analysis must sometimes be rather sophisticated because the polysemy is hidden by the structure of language. Let us consider the following example:

(A) Rare things are expensive
(B) Houses at a good price are rare
(C) Houses at a good price are expensive

Conclusion C is overtly contradictory in itself. Therefore, someone might be tempted to use a similar procedure to say that "argumentation is not important" when talking about serious aspects of life, like economics; thus, argumentation would be discredited (but, from another point of view, even economics could be discredited). An improper use of argumentation is surely possible, but this must not induce us to think that argumentation is irrelevant. It would be as if someone, noticing that having wrong nutritional habits is unhealthy, stopped eating… In the reasoning

[9] It is worth quoting here the whole passage by Aristotle (Topica I, see Ross 1958): "It is useful to have examined the number of meanings of a term both for clearness' sake (for a man is more likely to know what it is he asserts, if it has been made clear to him how many meanings it may have), and also with a view to ensuring that our reasoning shall be in accordance with the actual facts and not addressed merely to the term used. For as long as it is not clear in how many senses a term is used, it is possible that the answerer and the questioner are not directing their minds upon the same thing: whereas when once it has been made clear how many meanings there are, and also upon which of them the former directs his mind when he makes his assertion, the questioner would then look ridiculous if he failed to address his argument to this."

[10] During the Middle Ages an example was suggested, which underlines the difficulties that can emerge from the semantic ambiguity of the terms used in argumentation: "A: Quidquid *currit* habet pedes; B: Sequana *currit*; C: Ergo, Sequana habet pedes." A functional translation of this example into English could be: "A: Everything that *runs* has legs; B: The engine *runs*; C: The engine has legs." But there are also more 'updated' examples, like the following: "A: In order to *read* one needs eyes; B: My computer *has read* the file you sent me; C: My computer has eyes." Of course, these examples may appear quite trivial, and being misled by them seems unlikely. However, we might think of cases in which semantic ambiguity has really caused misunderstandings in various contexts. For instance, the democratic system of Switzerland nowadays has a structure very different from the one that the Deutsche *Demokratische* Republik (DDR) had until 1989… And, nonetheless, both systems claim or claimed to be *democratic*.

mentioned before, the ambiguity is linked to the use of the verb *to be*, which incorporates two different meanings in A and B. In order to eliminate the ambiguity, the premises could be paraphrased as follows:

(A) When the number of objects being sold is smaller than the number of objects being looked for, these objects *tend to cost a lot* (because the seller generally wants to earn as much as possible from the sale and therefore favours the buyer that will pay more…)
(B) The number of houses that are for sale at a good price is smaller than the number of houses being looked for.

Therefore, in B, *to be* indicates the ascertainment of a fact; in A instead, *to be* indicates a law of tendency ("they *tend to be* expensive"). Indeed, here are also objects for sale that are less numerous than the persons wanting to buy them, and which are not expensive (because they are not known to all the possible buyers, because buyers have very personal wishes, because many people want to sell quickly because they need the money immediately, because not all sellers are moved exclusively by the principle of profit).

From two premises of this kind we cannot derive any conclusion stricto sensu, unless this conclusion is very vague and has a reduced logical claim, like the following: "Houses at a good price tend to become expensive if they are demanded by many people." At this point our procedure would become correct, and even gain reasonableness:

(A) When the number of objects being sold is smaller than the number of objects being looked for, these objects *tend to* cost a lot (because generally the seller wants to earn as much as possible from the sale and therefore favours the buyer that will pay more…)
(B) The number of houses that are for sale at a good price is smaller than the number of such houses being looked for.
(C) Houses for sale at good prices *tend to* become expensive when the potential buyers come to know of the offer.

At times, being critical is understood as enjoying the fact of questioning everything, of finding moot points in standpoints (especially someone else's). The image of *criticism*, in the sense of criticizing, refers to polemic and to a reasoning activity which is aimed at discrediting the interlocutor. Thus a critical attitude is often associated to a polemical character. Instead, *the need for a critical approach* in argumentation and proof arises mostly from the need to find adequate reasons for one's actions, decisions, convictions, theories… The two pillars of critical commitment in all its manifestations are *adherence to evidence* and *correct reasoning.* They constitute the two fundamental aspects of reason's commitment to adhere to reality in its various aspects: one can be more or less critical in scientific research, in everyday life, in making individual or collective decisions, or in the evaluation of ethics or aesthetics.

A direct implication of the adherence to evidence is the application of the correct method when approaching the object. If I want to calculate the distance from the Earth to the Moon, I will use a certain kind of data, certain instruments and a certain

kind of reasoning as well as computational procedures. However, if I want to decide how to arrange the furniture in my living room, I will take other aspects into account (such as my personal taste and the criterion of comfort, which were not relevant in the first example), and use different instruments (I will use the rule instead of the telescope). In short, the method to tackle a problem critically depends on the nature of the problem itself: therefore, criticality is defined as the application of a method which is adequate to the object being considered. Thus, also in scientific disciplines, different methods correspond to different objects of investigation: scientific research in history is not less critical than scientific research in mathematics or geometry, even if they are very different (Schwarz, chapter "Argumentation and Learning" of this volume). Furthermore, a critical commitment is also requested for the management of interpersonal relationships, for the construction of social consensus, etc. In all these domains, the actualisation of the concept of critical commitment depends on the object one has to deal with.

4 Argumentation and Proof: Differences

Beyond the numerous traits and characteristics that argumentation and proof have in common, and which we have briefly described in the preceding paragraphs, it is important to focus on the specific traits of each of these reasoning procedures, in order to identify the specific traits of argumentation.

Argumentation and proof tend to apply to different spheres. Proof *does not* intervene, in general, when we are dealing with facts that are in a certain manner but could also be in another[11] (the fact that the house belongs to x and not to y, the fact that a certain person is married or not, the fact that a country is at war with another or quietly in peace, the fact that a judge convicts or absolves someone, etc.). Rather, it intervenes when we need to establish the structure of reality (constant acceleration when in free fall, the relationship between angles in triangles, the speed of light, the speed of sound…). Argumentation is reason applied to life in its actual communal or private dimension: in most cases, it does not concern knowledge but action, which does not operate in the sphere of general principles and solid structures but in *the field of things that are in a certain manner but could also be in another* and that can be changed, made, or destroyed by human intervention. I cannot change the timetable of the sun, but I can produce artificial light; I cannot change the seasons, but I can produce cold and heat; I can build houses, set up informative systems, I can harm or help others, favour or damage the natural balance, support a healthy or a perverse consensus, settle a conflict or provoke it…

Thus the proper scope of argumentation is the area of *communal life and of human action*. Argumentation itself actually is an action or, to be more precise, an interaction of communicative nature (Rigotti 2003). As such, argumentation is

[11] Aristotle speaks, in this connection, of "things that could also be in a different way" (see Ross 1959).

generated from a strategy of intervention aimed at changing the social context, in other words directed at influencing the addressee's opinions and behaviours. Argumentation does not limit itself to increasing the cognitive world, but becomes an intervention that involves the human interaction in a more comprehensive manner. Argumentation can be considered as a special kind of communicative *exchange*, where reasons are provided in change of the agreement of a *decision maker*. In fact, the nature of interaction of the argumentative intervention, which is aimed at affecting also the arguers' pragmatic and social spheres, implies that the discourse is intrinsically oriented towards an addressee, which is more properly a decision maker (gr. *krités*[12]). However, we cannot speak of an influence *tout court*: when the reasonableness of an opinion is demonstrated, the addressee is invited to make a free decision and to adhere to the other's opinion if he believes in its reasonableness. The process of proof – in its classical use in the scientific discourse – aims at an essentially cognitive goal: I do not demonstrate a theorem or a physical law primarily in order to convince somebody, but in order to develop an objectively scientific discourse, i.e. a discourse whose justification lies within the discourse itself. Argumentation, however, is used and realised in order to found an opinion for someone, namely in order to persuade someone of the validity of an opinion. I prepare an argumentation when I need to persuade someone to decide in a certain way on something that concerns me. This holds, somehow, also in that apparently soliloquial argumentation that takes place in inner deliberation (Perelman and Olbrechts-Tyteca 1958), where the single subject alternates the roles of protagonist and antagonist. Muller Mirza et al., in this volume, present the interactive and dialogical dimension of argumentation as an essential feature of this activity, which essentially involves the relationship between two (or more) human beings.[13] As shown by Schwarz in chapter "Argumentation and Learning" of this volume, even scientific proofs, when they are presented in the didactical context, need to be "transformed" into argumentative processes that take into account the learners' position and their personal path towards understanding and persuasion.

The decision maker is always present in the conception of an argumentative discourse; argumentation does not only have the task to ascertain the truth, as in proof, but also to show and display the truth of a standpoint to an interlocutor, who can then decide to consider it or not, while making his decision. One always argues *for someone*, namely for a decision maker who can be a single person, a group of persons or even the arguer himself when thinking something over before making a decision. The addressee of the argumentation is therefore not an external listener to the discourse, but a true stakeholder, who has interests in the argumentation as it is up to him to decide: the decision maker is the voter who has to vote for this or that candidate, the student who has to choose this or that university, a person living in a

[12] The term *krités* (eng. *decision maker*) derives from the Greek verb *kríno*, which literally means "sieving." The *krités* is the person that sieves a discourse, extracting the truth it contains, and evaluating it in order to make a decision.

[13] By this, we do not want to underestimate the importance and the specificity of individual reasoning, which should in any case be distinguished from proper argumentation. This latter involves the subject's public assumption of a standpoint and, thus, of a commitment in front of an audience.

big city who has to decide whether to take the subway or the car, etc. but also the bank that has to decide whether to concede a loan, the editorial staff of a newspaper who has to decide which news to put on the front page.

Proof is entirely conceived in the language of the discipline of which it is part (technical terms, charts, symbols, formulas…). In an argumentation, *ordinary language largely prevails*, even if it can present technical terms – for example, from the legal, financial, economic areas, etc. – when used in specialised contexts. Yet, the argumentative procedures are managed by words of the ordinary language; these words are often imprecise but familiar and basically understandable to everyone. In other words, argumentation is logically structured (as we will see in the continuation of this chapter), but it becomes manifest through ordinary language. If this, on the one hand, allows the use of argumentation in the construction of society, in the generation of consensus, in the pacific management of conflicts, etc., it is on the other hand true that the use of ordinary language may cause imprecision, ambiguity and therefore also misunderstandings.

Considering the trait of discursiveness, we have seen that its explicitness can be absent in argumentation, while it is essential for proof. In fact, proof has the task to highlight and to show the inferential procedure in all its steps. *Argumentation is largely implicit*. It is interesting to observe that in argumentation, instead, the degree of explicitness of the inferential procedure depends on a communicative principle which specifies the Gricean *maxim of quantity* (Grice 1975) for argumentation: it is essential to display only as much as one holds necessary in order to assure the comprehension of the procedure for a particular interlocutor. To say more than what is necessary is immediately understood either as unreasonable behaviour (doing something without reason) or as a lack of esteem for the addressee, who is thus considered to ignore the well-known facts or not to know how to reason properly (Tardini 2006, pp. 88–89).

Let us consider the following example. Sabrina is certain that Frédéric loves his home town, Basle, very much, and she wants to convince Walter of this. Sabrina cannot construct a logical proof that can unquestionably lead to the conclusion that Frédéric loves Basle; there are no theorems that demonstrate Frédéric's love for this town. Sabrina will therefore probably construct an argumentation to support her opinion:

> *Frédéric never leaves Basle, not even for the summer holidays!*
> *He always talks about his town in a very enthusiastic way, he collaborates with the local newspaper, and last year he even ran for the city council.*

Sabrina's standpoint is based on a reasoning in which, moving from the implications to the cause, feelings are interpreted as being the causes of behaviours, which are conceived of as the implications or signs of the feelings. Thus, constant presence, frequent proud discourses about and cultural and institutional engagement are presented as signs of Frédéric's attachment to Basle.

The reasoning in itself sounds exemplary; however, it is not a proof. In fact the evidences that are mentioned (witnessed) by Sabrina could be questioned, but, more importantly, the inference moving from the implications to the cause is far from ensuring incontestable truths, even though it can be adequate for providing reasonable hypotheses. Indeed, ascertained that a feeling of attachment "produces"

such behaviours, Walter could object that these behaviours are actually produced by other causes, claiming that Frédéric does not leave Basle during the holidays because he needs a summer job, or that his collaboration with the local newspaper does not necessarily constitute evidence for his attachment to the town, but could be a sign of his passion for journalism. However, it is not the logical strength that is missing in Sabrina's reasoning. The difference with a proof is in the nature of data and of the inferential procedure invoked, which is per se predisposed to produce falsifiable conclusions,[14] thus standing in the field of *probability*, and not in the domain of certainty. Moreover, not only feelings, like the attachment to a place or the love for a person, but much that concerns human and social life, like relationships between persons, decisions to make, convictions and beliefs, values… cannot be tackled with the laws of logic alone. The task of argumentation is to promote the reasonableness of human action and interaction and to ensure a critical foundation to the consensus supporting any social reality.

5 Reasonableness as a Keyword of the Argumentative Interaction

The dimension of criticality (encompassing adherence to evidence and correct reasoning) involves, in argumentation, a complex interplay of relevant aspects. As distinguished from proof, argumentation (as reasoning directed mostly towards human interaction, and thus strictly implying the social dimension) must satisfy the complex requirement of *reasonableness*. We owe to van Eemeren and Grootendorst (1994, 2004) the focus on this trait of the argumentative discourse, which is relevant for a philosophical foundation of argumentation theory. Reasonableness cannot contradict or exclude rationality; more properly, it exceeds rationality, as it also involves a more comprehensive and more articulated attitude of the human reason.

The reasonableness demand, that is essential in argumentative discourse and distinguishes it clearly from, say, mathematical proof, presupposes the need for rationality, as logical consistency and coherence: namely as non-contradictoriness of reasoning, guaranteeing the truth of conclusions derived from true premises.

However, rationality is not sufficient to found all the possible cognitive and pragmatic decisions a human being is anyhow obliged to face. The rational discourse can reach a necessarily true conclusion only when starting from necessary premises; but, as we have seen, argumentation has to do with the realm of human interactions,

[14] Properly, from a formal point of view, the inferential procedure applied corresponds to a very fallacy, based on a wrong construction of the syllogistic reasoning named *secundum consequens*. This procedure can however prove that the invoked cause is a possible cause of the considered fact, and so it acts as a possible hypothesis. As a matter of fact, a particular version of this procedure plays a fundamental role in the scientific method.

ruled by possibility rather than by necessity. Consequently, rationality can only help us acknowledge what we are forced to recognize, in order to avoid contradictions with evident data or with already demonstrated truths. However, as complete knowledge of all the implications of the decisions to be made is unavailable to the human mind, one often has to go beyond rationality and face a certain degree of risk. Let us consider the case of a physician, who must infer the patient's possible disease from the visible symptoms, and consequently decide on a therapy to cure it. Similarly, after the therapy has "proven" its capacity to cure the disease, the physician's inferences about the disease and about the effectiveness of his therapy cannot be properly proven. The physician, thus, undertakes a risk when proposing a therapy, and the patient assumes this risk when accepting the therapy. The decision is however (fortunately) often *reasonable*, considering that if the physician refuses to intervene because of the absence of rational procedures founding the decision, the patient is in any case unlikely to heal.

It is easy to realize how many of these risky situations we face in our experience, where a sort of "timer" imposes us to make a reasonable decision in a limited amount of time. We could conclude, following van Eemeren and Grootendorst (1994, p. 12), that "we believe rationality to be a necessary but insufficient condition for reasonableness."

The authors of this chapter have studied, together with Andrea Rocci, the meaning of the term *reasonableness* (Rigotti et al. 2006b). Some important results emerging from the semantic analysis concern the verb "to reason," which is less frequently associated to the notion of mathematical reason (*calculus*) than to the application of reason in reasoning (making inferences, drawing conclusions…) in the context of an interaction; in particular, thus, "to reason" refers to the application of reason in argumentative discussions, as it clearly emerges from examples like the following: "You're not going to try and reason with them?". The adjective *reasonable* can be applied to a human being or to the sphere of human action, i.e. to the use of reason in practice. In the latter case, *reasonable* can be said of a human desire or of a human action; in this second case, more specifically, it can refer either to the decision to act, like in "It was held that her refusal was reasonable," or to the processing of the action, or to the manner of the action. Here, of course, communicative or argumentative actions, like inferring, concluding, supposing, claiming are also included. In the former case, when *reasonable* is said of a human being, this adjective indicates either a person's transitory or permanent attitude towards action. Thus, in an expression like "reasonable mood," the reasonable attitude appears to be very local and transitory; on the opposite, an expression like "reasonable character" tends to indicate a positive stable trait of the person, which can be interpreted as a proper *virtue*. Reasonableness, in this case, is indeed the virtue of acting reasonably.

In this connection, we should consider two relevant problems. First, a notion like that of *reasonableness* is per se evaluative and normative; therefore argumentation theory could be accused of neglecting the real argumentative practice. Our analysis, which is largely based not on texts expounding argumentation theory, but on "natural argumentations," has highlighted that reasonableness is a demand emerging in real argumentative practices: he who decides to reason cannot consider reasonableness

as irrelevant. In other words, normativity is an unavoidable implication of the reasoning activity.[15]

A second problem concerns the claimed difference of "logics," "reasoning standards" or "thought patterns" between different cultures, which would emerge from the textual organization of the argumentative interventions put forward by people belonging to different cultures. The accurate and insightful review of the tradition of "contrastive rhetoric" in intercultural communication proposed by Rocci (2006, pp. 411–415) highlights the weaknesses and biases of such accounts. Rocci (2006) also suggests alternative explanations of the seemingly patent cultural differences in reasonableness, by taking into account, on the one hand, the necessary cultural grounding of argumentative strategies,[16] which, in order to be persuasive, must move from premises (incorporating local keywords and values) shared by the arguer and his or her interlocutor; and, on the other hand, the embeddedness of argumentation in social contexts, which strongly influences the development of argumentation by imposing specific goals and behavioural modes to the interaction.

We shall now move to briefly analysing several distinctive traits that we could consider proper signs of reasonable behaviour in all human activities, beyond the respect of the rational dimension.

Firstly, maybe the most typical and comprehensive sign of reasonableness is the effort to *take into account all factors that are relevant for the concerned issue*. Let us imagine, for instance, a language teacher who corrects her students every time they make a small mistake whilst learning this language. Such pedagogical method can actually prove completely unreasonable if the students get discouraged and eventually decide to give up their study of the language. Thus, a decision that appears perfectly adequate, considering its narrow context, can turn out to be unreasonable when considering a wider context. On the other hand, our decision should not be based on irrelevant factors: if two friends have to decide whether to go on holiday for a week to England or to Argentina, they will consider the differences between England and Argentina, but not all of them; they will consider factors such as the landscape, possible activities, the climate, the season, the cost of the trip but they will not talk about how much it would cost to buy land, or about how the stock exchange is performing in England or in Argentina, because this aspects are wholly irrelevant for this decision.

The arguer should consider the *hierarchy of goals* (*teleological hierarchy*) he is pursuing, by neglecting any minor incompatible goal. A goal can be considered as minor either because it is less important for one's life, or because it is simply instrumental in order to achieve another proper goal; in this second case, the instrumental

[15] By the way, it is also worth mentioning the empirical studies conducted by van Eemeren, Garssen and Meuffels, who have tested the pragma-dialectical notion of reasonableness by analysing the perception of bad (fallacious) argumentative moves in everyday arguers (some of the results are outlined in van Eemeren et al. 2003). It emerges from these studies that moves that are considered fallacious in argumentation theory are also mostly perceived as unreasonable by ordinary arguers.

[16] As we shall see, an argument is a complex construct consisting of a dialectical component, largely "universal," and of an *endoxical* component, strictly bound to the contextual culture.

goal is not pursued in itself, and once any other more appropriate instrument becomes accessible, it can be abandoned.

A corollary of the respect of the teleological hierarchy concerns communication. For example, he who argues can feel in the right to be approximate (fuzzy) on secondary points, where precision is useless. For instance, a reasonable answer to the question: "How far is Lugano from Neuchâtel?" could be: "About 300 kilometres" or "it takes more or less 3 and a half hours by car." Here, strict precision – "It takes 3 hours, 32 minutes and 31 seconds" – could sound obsessive and, though being rationally admissible, would be wholly unreasonable.

When describing certain parts of reality, I can choose to focus on various traits of it: for example, I can classify students in a class by the colour of their hair and their hair-do, or by the sound of their voices or their stature, and each of these descriptions can result equally helpful for certain purposes. I can furthermore categorize living beings according to their colour, putting white living beings on one side (white pigs, white humans, white rabbits, white kittens…) and black (crows, black pigs, black cats…) or red beings (red fish, lobsters, red hens…) on the other. I can define each of these beings in a different way: e.g. I could define the human being as a "reasonable living being," a "primate that talks" or as a "featherless biped," and each of these definitions may be appropriate for certain contexts and may allow to distinguish the human being from the other beings without ambiguity. In this sense, all these definitions can be considered rational. Yet, when I ask myself what a human being actually is, I notice that definitions such as "reasonable animal" or "primate that talks" have a higher degree of *categorical adequacy*, as they reach the essence of the human being more directly, and better describe those beings that I consider human.[17] One could, for instance, categorize living beings according to their gender, leading to the distinction between male and female beings; one could then subdivide these categories into species, and have, for instance, "female human beings," "female cows," "female grasshoppers" and so on. However, as it was objected to us by a student in one of the argumentation classes held at the University of Lugano, such a categorization does not respect the specificity of the different femininities that are proper to these beings. In other words, being a *woman* is having a very specific feminine human nature, which is not the same femininity as that of cows or grasshoppers.

The respect of categorial adequacy also implies the choice of an adequate level of abstraction in describing a given situation. Both considering too high and too low a level of abstraction is unreasonable: on the one hand, one loses the adequate consideration of the specific case one is dealing with; on the other hand, one is too dependent on the single case considered, a thing that does not allow to generalise those aspects which are not proper of the specific situation but of a broader category.

[17] The challenging text by Walter Demel (1992) titled "How the Chinese became yellow" (*Wie die Chinesen gelb wurden*) interestingly points at how an unessential and even questionable feature of human beings (the colour of their skin) was "discovered" and transformed into a distinguishing feature at a certain time in history by the emerging racist ideologies.

As for the first case, imagine that Mr. Johnson enters a pub and, without taking his hat off, drinks five pints of beer and gets drunk: nobody would seriously conclude that we should never drink beer without taking our hat off! In relation to the second case, consider the following statement: "Selling cigarettes to teenagers must be forbidden; otherwise the companies producing cigarettes would earn too much money." In this case, a general rule "companies producing cigarettes should not earn too much" is applied to a specific situation where, actually, other specific reasons would more appropriately support the claim. A similar case is the following: "Primary school teachers should not ask for a rise in salary, since obtaining it would damage our home product." Can this general rule be reasonably applied even if it only concerns a particular category of workers (primary school teachers) asking for a rise in salary? Is it reasonable to apply it without considering other specific factors (do these teachers actually *need* a rise in salary? why are they asking for it *now*? is a substantial salary equity respected in comparison to analogous categories of employees? etc.).

An argumentative move that is unsound in a certain context might be adequate and legitimate in another. Here again, the difference does not lie in the rationality of the move, but rather in the reasonable comprehension of the context. In a first sense, an argumentative move can be adequate for a certain communicative practice, whereas it might be improper in another practice.[18] For instance, a scientific discussion aiming at resolving a certain mathematical problem excludes the use of threats; however, the use of threats is perfectly admissible and actually used as a rhetorical instrument, for instance, in processes of international negotiation. In a second sense, the *adherence to actual circumstances* also includes a precise and comprehensive "feeling" of the context where the argumentative intervention takes place. This "global feeling" allows the arguer and the decision maker to understand whether a certain argumentative move is sound in a given situation. For instance, the *argument from authority* (*argument from expert opinion*) can be perfectly sound in some cases. However, there are cases in which the use of the argument from authority is unsound: firstly, when the source of the authority is not really an expert of the considered field: for instance, a *football player* is not necessarily the person to trust if he is chosen as a testimonial for advertising a new *car*! Secondly, when the field considered is such that appealing to an authority is meaningless: for instance, it is unreasonable to say that, for a right-angled triangle with short sides of length a and b and long side of length c, it is true that $a^2 + b^2 = c^2$, *because Pythagoras said that*; a reasonable attitude implies that one verifies this through a geometrical proof.

Finally, what defines a reasonable attitude is the commitment to finding a resolution of the difference of opinion that is worthy of the *human quality of the interlocutors*. First of all, when trying to make a reasonable decision or to verify the truth of a certain opinion, "*two heads work better than one*." In fact, interlocutors can help each other in taking into account an important aspect that one of them might have neglected, or in discerning manipulation, or in keeping a reasonable level of abstraction in defining a situation, etc. Secondly, each interlocutor, in an argumentative exchange, is committed to assuming a reasonable attitude. The argumentative

[18] Douglas Walton and Eric Krabbe have explored this topic in their well-known volume "Commitment in Dialogue" (1995).

interaction, thus, aims at promoting reasonableness *by definition*. Thirdly, a direct implication of this is that the arguer does not want to obtain his/her interlocutor's assent at any cost; in fact, consent is not built through violence, but rather by using language and reason for discussing and evaluating possible arguments.[19] In conclusion, reasonableness, as it is reached through an argumentative interaction, involves the respect of the other's reason and freedom. Within the perspective of Pragma-Dialectics (van Eemeren and Grootendorst 1994, 2004), the concept of reasonableness is closely linked to the discussion between two arguers: where the standpoint of one is subject to the critical control of the other, it is more likely to achieve a reasonable consensus, and to create a foundation for one's own actions and beliefs.[20]

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[19] Cicero (de Officiis I, 50, see Winterbottom 1994) had already noticed that the possibility of engaging in argumentative discussions distinguishes human beings from beasts, which can only rely on strength (violence): "Eius (humanae societatis) autem vinculum est ratio et oratio, quae docendo, discendo, communicando, disceptando, iudicando conciliat inter se homines coniungitque naturali quadam societate, neque ulla re longius absumus a natura ferarum, in quibus inesse fortitudinem saepe dicimus, ut in equis, in leonibus, iustitiam, aequitatem, bonitatem non dicimus; sunt enim rationis et orationis expertes." We can propose the following translation: "And the tie of human social life is constituted by reason and discourse, which create consensus and unite human beings in a sort of natural society by teaching, learning, communicating, critically discussing and making common decisions. And nothing else distinguishes us more clearly from the nature of beasts, in which we say, for instance, that there is a certain force, as there is for horses or lions; but we do not say that there is any justice, fairness, or goodness, because they lack reason and discourse."

[20] Within the Pragma-dialectical approach, reasonableness is one of the philosophical bases of argumentative analysis: "Providing an illuminating analysis of what may count as reasonable argumentation is probably the most general goal all argumentation theorists have in common" (van Eemeren and Houtlosser 2002b). These authors start by criticizing two notions of reasonableness that seem inappropriate for the field of argumentation: (1) The first way of understanding reasonableness is defined as *geometrical view* and presents argumentation as a process of proof, analogous to geometrical proofs. This perspective does not tolerate differences between argumentation and proof: "The geometrical view of argumentation is an integral part of the demonstrative tradition, which is, in fact, anti-argumentative." (2) The second perspective, defined as the *anthropologic-relativistic perspective,* considers rationality and reasonableness as concepts linked to culture, therefore relative. A set of implications are generated from this position, which are difficult to accept: what is rational or reasonable for someone could not be the same for another; rationality and reasonableness change in time, and we cannot define argumentation as "rational" or "reasonable" *per se*, because everything depends on the culture it refers to and on the historical moment. From this point of view, argumentation, which is by definition a "rational instrument for convincing other people," loses its value: if it is not possible to agree on what is reasonable, argumentation is useless. The perspective put forward by van Eemeren and Grootendorst is defined as *critical perspective*. According to this approach, reasonableness can be reached through critical discussion, namely in the argumentative practice in which the interlocutors try to examine a certain thesis: "This critical perspective focuses pre-eminently on discussion; it encourages the systematic submission of the one party's standpoints to the other party's critical doubts. In this way, an explicit argumentation is elicited. This, in turn, can be called into question until the difference of opinion is resolved in a manner that is acceptable to the parties involved. In this perspective, all argumentation is regarded as part of a critical discussion between parties that are prepared to abide by an agreed discussion procedure." Therefore, reasonableness is guaranteed by two factors: (a) The *intersubjective validity*, namely the acceptance of the argumentation by the participants to the critical discussion; (b) The *problem validity*, namely the adequacy of the argumentation with respect to the rules which guarantee the resolution of the difference of opinion. Therefore, a reasonable argumentation is: "An effective means of resolving a difference of opinion in accordance to discussion rules acceptable to the parties involved." (van Eemeren and Grootendorst 2004).

6 Scientific, Cultural and Social Relevance of Argumentation

We have said that proof prevails in scientific discourse; this, however, does not imply that argumentation is absent in scientific discourse, or that any developed proofs don't contain typical aspects of argumentation (see on this point Schwarz, this volume). For example, when scientific discourse is the content of didactical activities, it immediately takes on aspects that are typical of argumentation, as we have seen. First of all, didactical language, as such, has to create a mediation between the specific language of the subject and the ordinary one, but above all it has to consider the addressee's knowledge and interests and respect his/her freedom and reason – all of which is typically argumentative. Also a mathematical proof, as the one we have quoted, has its own argumentative dimension… moreover, such a dimension would become more evident if we considered the formulation of the geometric proof in the ancient tradition, where there has been a clear perception of a precise argumentative interaction (a real dialogue) between teacher and disciple. But the interaction between argumentation and proof becomes clear, for many reasons, in a series of scientific subjects, ranging from physics to history (Schwarz, chapter "Argumentation and Learning"). The hypothetical-deductive method, shared by many different subjects, activates processes of hypothesis formulation, verification, building of authoritative discourses into the scientific community (theories), that have a lot in common with argumentation processes. We could say that the scholar participates in a ongoing dialogue with two fundamental interlocutors: the inquired reality and his own scientific community. Finally, the conceptual instrumentation of some scientific disciplines itself is essentially argumentative, since these disciplines inquire into the human domain (history, law, psychology, ethics, political sciences, etc.). Notions as source, motivation, norm, sanction and many others which are used in these subjects are essentially argumentative.

It is surely difficult to exaggerate the role of argumentation in human communication. Argumentation is not present only when we are interested in verifying data, in expressing our own feelings and reactions (desire, anger, admiration, surprise, etc.) or in giving sheer information, but every time we want to explain, justify – in short, when we ground what we say, argumentation comes into play. As we have seen, argumentation is also present, disguised as communicative inference, in the interpretative process, which cannot be restricted to recognizing phonetic data, which we simply decode, but aims at reconstructing the meaning. Argumentation is an essential component of our language, both when intending to understand reality, and when intending to change it; argumentation is particularly present in relation to social reality. It is through argumentation that communal life is structured, that categories for judgement (values) are built, that consent is created and conflict generated and solved. Language used in argumentation creates social reality. To "create a community spirit" by creating exchange and interaction is actually the essential function of communication and, in particular, of argumentative interaction: to argue means to create consent, agreement and common commitment. But the task of creating a community does not end with the effectiveness of communication. Also the quality

of the obtained consent is relevant and is guaranteed by building consent through the shared use of reason, as Schwarz expounds in chapter "Argumentation and Learning" of this volume, by pointing at the relevance of argumentation to civic education and learning. Argumentation is the possibility to build a reasonable communal life at different levels (from the interaction between two people, to society), which is not immune from the risk of deception and manipulation, but which has the instrumentation to protect itself from unreasonable consent. Argumentation actually is the discourse that provides its reasons, that justifies the arguer's decisions, beliefs and positions. In particular, the relationship between argumentation and democratic society is essential, democracy being what the authors – and many others – consider the most just and reasonable form of social organization, the reasonable society par excellence. Argumentation is the substance of democracy,[21] which is different from other social systems exactly because its only legitimated power is that of the word, since words are the only tools we have, in order to build free consent and live together freely.

Democracy's inventors – the Athenians of fifth century B.C. – had grasped the value of argumentation in the building of democratic consent and of a critical attitude able to defend from manipulation. Athens' democracy was based on absolutely free discussion among citizens, aimed at creating the necessary consent for the civil community's choices about the right and the profitable. The place for discussion typically was the assembly (*ekklesía*), where everyone had the right to express their own opinion with total freedom of speech. The power of the word was the heart of democracy and it was also necessary to become an authoritative citizen. Total freedom of speech did not however immunize the Athenian democracy against the risk of manipulation: if argumentation skills are only aimed at pursuing the efficacy of communication, in other words at persuading the addressee at all costs, then democracy is at risk. We can actually interpret the predominant trend in sophistry as an attempt to create the "strongest discourse," regardless of its objective value ("to make the weakest discourse win and the strongest lose"), as a deviant development of argumentation. It's meaningful to observe that we link the term *sophism,* the typical form of manipulation, to *sophistry*. The deep, systematic considerations of the greatest Greek philosophers during the fifth and fourth century B.C. (Socrates, Plato, Aristotle) on this risk led to the building of a model of public communication based on efficacy and reasonableness. In this way, the important doctrinal *corpus* of classical rhetoric was established and this same *corpus* of classical rhetoric has actually been the first model of public communication: classical rhetoric is the first model of public communication which gives a central role to argumentation. Although the danger of manipulation was perceived, it was impossible to limit

[21] In a recent paper, López and Vicuña (2006) describe the origin of their interest in argumentation not only as a scientific object of study, but also as an instrument for "an education for democracy" in Chile, where the dictatorship by Augusto Pinochet had just ended. They observed that creating democratic institutions (free elections, etc.) was not enough, if they were not supported by the citizens' argumentative participation.

oneself to the disapproval of democracy as a form of social organization based on communication: then, as today, the civil community needed argumentation to live free. The Logic-oriented rhetoric, that Aristotle discussed in *Topics* and *Rhetoric,* aimed at redeeming the various socially relevant forms of communication – juridical, political and evaluative – from the risk of manipulation.

7 Studies in Argumentation: A Concise Overview

So far, we have considered argumentation as a particular communicative activity which is part of human social life. However, in the different human cultures, argumentation is present not only as a practice that is relevant for their development and their transmission through time, but also as a subject of reflection.[22] In this second sense, argumentation has been gradually systematized, being first configured as an art and then as a proper science.

In the Western tradition, this process, first of all, took place in the ancient dialectic and rhetoric. Their contribution to the scientific study of argumentation is still relevant, and is largely considered in the modern theory of argumentation. However, there is no proper continuity between rhetoric and theory of argumentation, since there has not been an uninterrupted evolution between rhetoric and modern argumentation.

As modern times approached, rhetoric seemed to doze off, almost as if it had completed its task, and argumentation seemed to have returned to be a practice exercised without critical awareness. Therefore, the new start, in relatively recent times, of the study of argumentation in the scientific domain, which has led to the construction of models and theories, can be considered a sort of "Renaissance of argumentation." The year 1958 is normally considered as the origin of this renewed interest in argumentation, since two important books have been published in that year: Stephen Toulmin's *The Uses of Argument*, and Chaim Perelman and Lucie Olbrechts-Tyteca's *La nouvelle rhétorique*. Both studies were inspired by the need for understanding the use of reason in social practices, beyond the context of geometrical rationality.[23]

Toulmin, in particular, opens his work by discussing the merits of logic beyond its disciplinary self-development: "They are problems which arise with special force not within the science of logic, but when one withdraws oneself for a moment

[22] Here, it is worth mentioning the analysis of the Jewish argumentative tradition and of its pedagogical implications proposed by Zittoun (2007). The Indian logical and argumentative tradition is also often quoted for its similarities with the Western development of these disciplines (see Hamblin 1970: 177–189, and Sen 2005). Recently, an entire volume of the international journal Argumentation has been devoted to Buddhist argumentation (see in particular the introduction by Tillemans 2008).

[23] In the framework of this concern, it is also worth mentioning the works by Jean-Blaise Grize, who founded in 1969 and then led the "Centre de Recherches sémiologiques" at the University of Neuchâtel. See in particular Grize (1982).

from the technical refinements of the subject, and inquires what bearing the science and its discoveries have on anything outside itself – how they apply in practice, and what connections they have with the canons and methods we use when, in everyday life, we actually assess the soundness, strength and conclusiveness of arguments" (Toulmin 1958, p. 1). Toulmin's well-known model for the analysis of argumentative structures is thus meant to explain the use of reason in everyday practices of argumentation. This model has already been introduced here, where we have highlighted its merit of clearly distinguishing the standpoint (claim) from the various passages necessary to its backing. Furthermore, it also has the advantage of presenting the whole argumentative process as an ongoing dialogue between an arguer and a *challenger*, who asks the reasons for the arguer's claims; such a perspective evidences the dialogical nature of argumentation. As van Eemeren (2003, p. 3) explains, despite the initial hostility of philosophers and logicians, Toulmin's model was soon enthusiastically welcomed by American speech communication scholars, and started to be used, also in the domain of the social sciences, for educational purposes. Thus, despite some theoretical disadvantages, such as the complete neglecting of logic and pragmatics (van Eemeren 2003), the model has remained a popular didactical tool and a valuable instrument for explaining some fundamentals of argumentation.[24]

Perelman and Olbrechts-Tyteca propose, with their *La nouvelle rhétorique*, "an inventory of frequently-used 'argumentation techniques'" (van Eemeren 2003).[25] They start from the attempt of recovering the ancient rhetorical tradition and abandoning a pure rational (Cartesian) view of reason (Perelman and Olbrechts-Tyteca 1958, p. 1). According to these authors, every argumentation is developed towards a certain addressee or audience (Perelman and Olbrechts-Tyteca 1958, p. 7); moreover, the validity of argumentation depends on its acceptance by the audience. This view can indeed be regarded as a relativistic stance, because the adaptation to the audience turns out to be, in Perelman and Olbrechts-Tyteca's view, the ultimate criterion for evaluating argumentation (see the discussion of this point in van Eemeren and Grootendorst 1994, p. 17),[26] even though the audience to which the arguments are addressed can be not only particular, but also universal. The notion of *universal audience* remains however vague, and it is rather obscure why and how it could offer a more objective criterion of validity.

The fact that Perelman and Olbrechts-Tyteca mainly had in mind the juridical domain, when they considered, in their book, the role of reason in social practices, significantly contributed to its success amongst lawyers (van Eemeren 2003, p. 4).

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[24] The clarity of the model has made it a very popular tool, also in the domain of knowledge visualization and knowledge management; representations based on this model are used also in business contexts (Eppler and Burkhard 2007).

[25] Such an inventory relies on classical works, like the *Topics* by Aristotle.

[26] See also the distinction between the concepts of *rational* and *reasonable* presented in Perelman (1979, p. 119): "But a rule of action defined as reasonable or even as self-evident at one moment or in a given situation can seem arbitrary and even ridiculous at another moment and in a different situation."

The success of this book, which also temporarily touched communication scholars, followed that of Toulmin's book, probably also because *La nouvelle rhétorique* was originally published only in French (an English translation appeared in 1969).

Two significant traditions that largely contributed to the development of modern argumentation theory, developed in particular in Canada and in the United States, are the *informal logic* approach[27] and *critical thinking*. Though these approaches are mutually related, critical thinking originates from the educational concern of helping students to develop a reflective, critical attitude of mind (Ennis 1962; Paul 1982, 1989; Johnson 1992; see also van Eemeren et al. 1996, p. 165) while informal logicians, moving away from the perspective of formal logic, are out to improve the quality of argumentation in real argumentative practices (Kahane 1971; Thomas 1973; Scriven 1976; Blair and Johnson 1987; Groarke 2007). More in particular, informal logic was originated by an educational ideal, which started from the "attempt to replace the artificial examples of good and bad argument that tended to characterize earlier logic texts[28] "with examples taken from real argumentative practices, such as political discourse, advertising, media, legal practice, etc. (Groarke 2007). Such an educational endeavour was also fostered by a 1980 California State University Executive Order that required that post-secondary education included formal instruction in critical thinking, in order to help students understand the relation between logic and language and improve their reasoning skills (Groarke 2007).[29] It can be said, thus, that informal logic approaches the study of argumentation, moving from the perspective of formal logic, and going towards the attempt to develop a logic to analyse and improve ordinary language (or "everyday") reasoning. This branch of research derives its normative purpose from formal logic, and is however combined with the attempt of understanding argumentative phenomena in real practices (hence the name *informal* logic).

In relation to the logical aspects of argumentation, it is worth mentioning also an entirely different stream of European contributions to argumentation theory that comes from dialogue logicians and formal dialecticians, such as Lorenzen and his

[27] Contributions bound to this approach can be found in the journal *Informal Logic*, founded in 1978, but also in *Argumentation*, *Philosophy and Rhetoric*, *Argumentation and Advocacy* and *Teaching Philosophy*. It is also worth mentioning the volume devoted to the topic *Reasoning and Argumentation* published by *ProtoSociology* in 1999. Leo Groarke (2007) has written a comprehensive review of studies in informal logic in the Stanford Encyclopaedia of Philosophy.

[28] Concerning this aspect, it is interesting to quote a criticism on 'traditional' logic textbooks included the very well-known work on fallacies written by Hamblin, which can be considered a milestone in the study of manipulation (Hamblin 1970, p. 12): "This is the part of the book [namely, the one devoted to fallacies] in which a writer throws away logic and keeps his reader's attention, if at all, only by retailing the traditional puns, anecdotes, and witless examples of his forbears." Scholars of informal logic extend this criticism to all chapters of logic textbooks.

[29] The original educational goal of this discipline is reflected in a variety of textbooks on informal logic and critical thinking. Here, it is worth mentioning two very recent and comprehensive volumes: *Fundamentals of Critical Argumentation*, by Walton (2006a), and *A practical Study of Argument* by Trudy Govier (2006).

German collaborators, often referred to as the *Erlangen school* (Lorenzen and Lorenz 1978) and the Dutch logicians and philosophers Barth and Krabbe (1982).

Following Groarke (2007), some typical areas of study related to informal logic can be listed, such as the structure of good and bad arguments and argument schemes, including the study of fallacies[30]; the understanding of the context of argumentation, conceived of as *dialogue type* where argumentation is at work (Walton and Krabbe 1995 can be considered a foundational work in this respect), and including the rules of communication that argumentation depends upon; and the study of the rhetorical aspects of discourse, including the role of the *audience* in evaluating argumentation.

Indeed, rhetoric constitutes a further stream of research that has contributed to the developing of argumentation, such as communicative instrumentation and figures of speech. Generally, rhetorical studies point to the effect of argumentative discourse on the addressee (Tindale 2004; Goodnight 1990; Zarefsky 1986, 2007; Zarefsky and Benacka 2008). With regard to the study of discourse effectiveness, argumentation theory crosses the empirical research carried out in the psychological domain of persuasion studies (Petty et al. 1983; Petty and Cacioppo 1986; O'Keefe 2007, 2008a, b).

Considering the modern and contemporary developments of argumentation, a particular attention must be devoted to the Amsterdam school of argumentation, which has originated an articulated and systematic research programme called Pragma-dialectics, which has much contributed to the development of argumentation theory as an autonomous discipline.[31] The pragma-dialectical argumentation theorists are also influenced in their positions by earlier philosophical contributions to the study of argumentation made by the Norwegian philosopher Naess (1966) and the British philosopher Crawshay-Williams (1957).

Within Pragma-dialectics, a model of the argumentative discussion has been elaborated that is mainly founded on the notion of reasonableness in dialogue, already expounded here. Such a philosophical foundation characterizes Pragma-dialectics as a "normative" approach, which aims not only at describing real argumentative practices, but also at confronting them against the ideal model of a *critical discussion*, i.e. of a discussion where both parties (the *protagonist* and the *antagonist* respectively)

[30] The ground-breaking monograph *Fallacies* written by Charles Hamblin (1970) contributed considerably to the development of critical analysis and evaluation of argumentative practices. In relation to this topic, the numerous works by Douglas Walton on formal and informal fallacies also need to be mentioned.

[31] The Amsterdam school has equally become a reference point for the community of argumentation scholars, who are organised in the International Association of the Study of Argumentation (ISSA). Since 1986, the ISSA organizes an international conference on argumentation every 4 years in Amsterdam, which has become a core occasion for dialogue between different scholars. The international journal *Argumentation* is the most important journal for the publication of contributions to argumentation theory.

are committed to solve their *difference of opinion* by means of reasonable argumentation, i.e. by critically testing their arguments (van Eemeren and Grootendorst 2004). In the critical discussion, thus, reasonableness and criticality cooperate. The model of critical discussion foresees four ideal stages, which do not mirror the actual temporal proceeding of the argumentative discussion, but the essential constituents of the reasonable – i.e. *critical* – discussion. In the *confrontation stage* of a critical discussion, the difference of opinion emerges: "it becomes clear that there is a standpoint that is not accepted because it runs up against doubt or contradiction" (van Eemeren and Grootendorst 2004, p. 60). In other words, the protagonist puts forward a standpoint, and the antagonist reacts to it either by casting doubt on it (giving rise, thus, to a *non-mixed* dispute), or by presenting an alternative standpoint (from which a *mixed* dispute originates). In the *opening stage*, the protagonist and the antagonist "try to find out how much relevant common ground they share (as to the discussion format, background knowledge, values, and so on), in order to be able to determine whether their procedural and substantive "zone of agreement" is sufficiently broad to conduct a fruitful discussion" (van Eemeren and Grootendorst 2004). This stage is particularly relevant, because the whole activity of argumentation is based on the confidence in the possibility of finding a reasonable solution by discussing with the counterpart. This attitude of confidence also involves the disposition to find common premises on which both parties agree, and on which they can evaluate their difference of opinion. In the proper *argumentation stage* of a critical discussion,[32] arguments in support to the standpoint(s) are advanced and critically tested (van Eemeren and Grootendorst 2004, pp. 60–61). Finally, in the *concluding stage*, the critical discussion is concluded, "in agreement that the protagonist's standpoint is acceptable and the antagonist's doubt must be retracted, or that the standpoint of the protagonist must be retracted."

Along the four stages of the critical discussion, ten rules must be respected by the arguers, which represent the constitutive rules for maintaining the requested standard of reasonableness. In other words, the rules have to be read as the principles that the arguers have to follow if they want to resolve their difference of opinion in a reasonable fashion.[33] It is worth quoting here the rules, which can be considered as setting the "contract" that arguers have to sign in order to be considered as taking part in argumentation:

[32] The other three stages are certainly not irrelevant for argumentation, not only because they represent as many essential moments of a critical discussion, but also because they frequently require argumentative moves for the fulfilment of their own tasks.

[33] It is interesting to compare the formulation of the ten rules with the definition of "exploratory talk" fostered in the *Thinking Together* program, presented by Mercer in chapter "Developing Argumentation: Lessons Learned in the Primary School" of this volume. Exploratory talk can be said to express, in an explicit fashion, the normative ground rules of the argumentative attitude which is fostered by the program, implemented since the 1990s in UK. The aim of this program to foster primary school pupils' argumentative abilities with the help of their teachers.

Ten rules of critical discussion (van Eemeren and Grootendorst (1992) [34]

1. *The freedom rule*: Parties must not prevent each other from putting forward standpoints or casting doubt on standpoints.
2. *The burden-of-proof rule*: A party who puts forward a standpoint is obliged to defend it if asked to do so.
3. *The standpoint rule*: A party's attack on a standpoint must relate to the standpoint that has indeed been advanced by the other party.
4. *The relevance rule*[35]: A party may defend his/her standpoint only by advancing argumentation related to that standpoint.
5. *The unexpressed premise rule*: A party may not falsely present something as a premise that has been left unexpressed by the other party or deny a premise that he/she him/herself has left implicit.
6. *The starting point rule*[36]: No party may falsely present a premise as an accepted starting point, or deny a premise representing an accepted starting point.
7. *The argumentation scheme rule*: A standpoint may not be regarded as conclusively defended if the defence does not take place by means of an appropriate argumentation scheme that is correctly applied.[37]
8. *The validity rule*: The reasoning in the argumentation must be logically valid or must be capable of being made valid by making explicit one or more unexpressed premises.[38]
9. *The closure rule*: A failed defence of a standpoint must result in the protagonist retracting his/her standpoint, and a successful defence of a standpoint must result in the antagonist retracting his/her doubts.
10. *The usage rule*[39]: Parties must not use any formulations that are insufficiently clear or confusingly ambiguous, and they must interpret the formulations of the other party as carefully and accurately as possible.

[34] This formulation of the ten rules of critical discussion is a more handy and explicit way of presenting the original 15 rules of critical discussion, which are formulated in terms of speech acts (see van Eemeren and Grootendorst 2004, pp. 123–157).

[35] Rules 3 and 4 concern the respect of *relevance*, respectively for the arguments used for attacking the counterparty's standpoints and for the arguments used in support to one's own standpoint.

[36] The starting point rule concerns the correct management of the parties' *common ground*. In argumentative practices, it is essential that the reasoning proceeds on the basis of shared premises which both parties agree upon.

[37] In the following paragraphs, we propose a model of *topics* which helps generating and evaluating possible *loci* (argumentation schemes) in support to one's standpoint.

[38] This rule can be interpreted as an explicit mention of the principle according to which the reasonable attitude requested by argumentation presupposes rationality.

[39] Rule 10 directly recalls the *maxim of clarity* proposed by Grice (1975) as a general component of the principle of cooperation in conversation.

In more recent times, van Eemeren and Houtlosser (2002a) introduced the notion of *strategic manoeuvring*, moving to an integrated model of critical discussion, that allows accounting for the arguers' personal desire to win the cause (*rhetorical aim*), which, in actual argumentative practices, is always coupled with their commitment to maintain a standard of reasonableness (*dialectical aim*).[40] This notion allows reconciling "a long-standing gap between the dialectical and the rhetorical approach to argumentation" (van Eemeren and Houtlosser 2005, p. 27), and takes into account the arguers' personal mobile that moves him to engage in a critical discussion.[41]

Concerning modern studies in argumentation, the contribution of Douglas Walton surely deserves to be brought up. Walton has already been mentioned as a contributor to the development of the informal logic approach; however, his scientific production on argumentation is much wider and articulated. First, Walton has devoted an important series of studies to the typology of *dialogues*, conceived of as the pragmatic context where the argumentative interaction can take place (Walton and Krabbe 1995; Walton 1998). The goal of the dialogue type imposes constraints on the type of moves the speakers are allowed. Therefore, there is a strong connection between the theory of dialogue and the analysis of fallacies and manipulation, to which Walton has devoted an impressive series of studies. More recently, Walton has also focused on the topic of correct argumentation, by identifying a series of *argument schemes*[42] (the most recent results are expounded in Walton et al. 2008).[43]

Recently, studies in argumentation have been increasingly concentrating on the analysis of real argumentative practices in specific institutional settings which constitute social reality. This concern is present in various works. From the theoretical point of view, it is worth mentioning that van Eemeren and Houtlosser have recently introduced the notion of *activity type* (van Eemeren and Houtlosser 2005) for taking into account the institutional constraints on the argumentative practice. Studies on specific communicative practices were however present, also before, in the pragma-dialectical approach. Here, it is worth mentioning, in particular, Agnès van Rees' analysis of *problem solving discussions* (van Rees 2001, 2002, 2003), and Eveline Feteris' research on the process of adjudication and, more in general, on *legal argumentation* (Feteris 1999, 2005). In relation to legal argumentation, we have

[40] See the applications of strategic manoeuvring to the analysis of a Shell advertorial text (van Eemeren and Houtlosser 2002a) and to the interesting case of William the Silent's Apologie, which can be considered a foundational text for the story of the Netherlands (van Eemeren and Houtlosser 1998, 2003).

[41] In this volume, Schwarz notices, drawing on Stein and Miller (1993), that the presence of "a desire to achieve personally meaningful goals" significantly influences, at the level of the children's cognitive acquisitions, their ability to learn argumentation skills.

[42] Among the contemporary studies in argumentation which tackle the topic of argument schemes (*loci*), see also Perelman and Olbrechts-Tyteca 1958; Hastings 1963; Toulmin et al. 1984; Kienpointner 1992; Grennan 1997; Garssen 2001; van Eemeren and Grootendorst 2004; Katzav and Reed 2004; and Braet, 2005.

[43] This research on argument schemes has also been integrated on the account of artificial intelligence and by the application to the domain of reasoning in law (see Walton 2005). The identification of argument schemes is also supported by a software tool for analysing arguments, called Araucaria, developed by Chris Reed and Glenn Rowe at the School of Computing, University of Dundee (see http://www.araucaria.computing.dundee.ac.uk). See also Reed et al. (2007).

already mentioned Walton's approach to legal studies, focused in particular on argument schemes in legal reasoning (Walton 2005).

Marcelo Dascal has devoted a series of studies to the practice of (scientific, cultural, political…) controversy (Dascal 1998, 2003, 2006). Controversies can be defined as interactions of communicative nature characterized by a high level of competition and a low degree of confidence in the possible resolution of the difference of opinion between the disputants. The argumentative discussion has, in this type of practice, social and so to say public implications, which might turn out into a challenge to the protagonists' identity, and, thus, to real conflict (Greco Morasso 2008).

It is also worth mentioning the studies on the conflict resolution practice of mediation, as a particular type of activity in which argumentation plays a significant role. On this point, see, in particular, van Eemeren et al. (1993); the studies by Jacobs and Aakhus (2002a, b; Jacobs 2002; Aakhus 2003), and, more recently, Greco Morasso (2007, 2009).

In religious discourse the role of argumentation should not be underestimated, in particular in the context of multicultural and multi-religious societies. Even though in the different religious traditions an argumentative approach may be more or less allowed or fostered (Zittoun 2007), when religious communities present their views and moral values, the need for a critical argumentative foundation becomes more and more evident.

The process of developing scientific knowledge and the dialogue characterizing scientific communities are also intertwined with argumentative practices on which written argumentative discourse is blended with representational devices (Latour and Woolgar 1979; Latour and Weibel 2002, 2005).

Recent studies highlighted the cognitive and educational advantages of reshaping teaching and learning activities in terms of argumentative interactions (Pontecorvo 1993; Grossen and Perret-Clermont 1994; Nonnon 1996; Mercer 1995, 2000; Schwarz et al. 2000, 2003a, b, 2008; Simon et al. 2006; Michaels et al. Forthcoming). Computer-supported technological devices are now being developed to sustain collaborative decision making, writing and argumentation in learning.[44]

This brief survey of studies in applied argumentation does certainly not comprehend all researches on professional practices and institutional settings where argumentation plays a role. Other important application domains are, for instance, advertising (Adam and Bonhomme 1997; Wüest 2001), media discourse (Burger and Filliettaz 2002; Burger 2005; Burger and Martel 2005; Rocci 2008; Walton 2007; Weger and Aakhus 2003), political discourse (Zarefsky 1986, 1990, 2007; Goodnight

[44] In this relation, European educationalists are also disclosing the relevance of argumentation in substantial projects funded by the EU (LEAD, DUNES, ESCALATE, among others) and in studies such as Nonnon (1996) in France, and Erduran et al.(2004) in the United Kingdom. More recently, the introduction of computer-supported technology in classrooms has opened up important new areas of research concerning mediated collaborative work and learning, adding accounts of the role of technological mediations to the existing literature; the emphasis is usually on group production and learning, but recently specific attention has been paid specifically to argumentation (Andriessen et al. 2003). Another important stream of research in the field of research concerns exploratory talk and guided construction of knowledge as a basis for understanding argumentations (Mercer and Littleton 2007).

1990; Ilie 2003; Cigada 2007, 2008), deliberation practices (Walton 2006b; Aakhus and Vasilyeva 2007), health communication (Goodnight 2006; Brashers et al. 2006; Rubinelli and Schulz 2006; Rubinelli et al. 2006; Bigi, Forthcoming) and therapeutic discourse (Grossen and Salazar Orvig 2006), family contexts (Pontecorvo and Arcidiacono 2007), financial interaction (Mishkin 2004, Healy and Palepu 2001; Palmieri 2008). Concerning argumentation in education, in particular, the studies collected in this volume represent a significant state of the art of this matter.

In relation to the interests of the Lugano group on argumentation, which are strictly bound to the role that argumentation plays in the communicative interactions, the perspective of applied argumentation turns out to be particularly precious, since no argumentative practice is possible outside a specific communication context. In what follows, the Lugano model will be briefly expounded.

8 A Generation-Oriented Model of Argumentation

Above, we have mentioned the manifold aspects that Argumentation theory is in charge of tackling in the current cultural and scientific era. In the following, we illustrate a proposal expounded in the e-course Argumentum,[45] aiming at realizing a theoretical approach to Argumentation theory which focuses on the generation of an argumentative intervention. The complex interplay of contextual conditions, communicative and psychological dynamics, logical structures and rhetorical techniques, through which arguers work out and activate their argumentative strategies, is outlined in an interdisciplinary perspective.

8.1 The Components of the Model

A diagram, which an indeed vague likeness induced us to name "Fishbone," and which plays a relevant role in orienting users' navigation within Argumentum, represents the constitutive components of the model in the framework of their relationships (see Fig. 4).

The first rectangle is mainly devoted to the communicative context of an argumentative intervention; context, in fact, dictates the conditions and suggests the aim of an argumentative intervention; all its relevant factors must be taken into account in order to design a rhetorically and dialectically adequate argumentative intervention.

As the notion of *communication context* is both hugely relevant and considerably complex, it might be useful to briefly outline the results of an analysis developed by Rigotti and Rocci (2006); we start with a scheme representing the articulation of this notion (see Fig. 5).

[45] Argumentum (www.argumentum.ch) is a project financed by the Swiss Virtual Campus to which the universities of Lugano, Neuchâtel and Geneva have been collaborating since September 2004. Greco Morasso (this volume) describes a didactical experience based on this project. See also Tardini (2007) for a description of its technological and pedagogical structure.

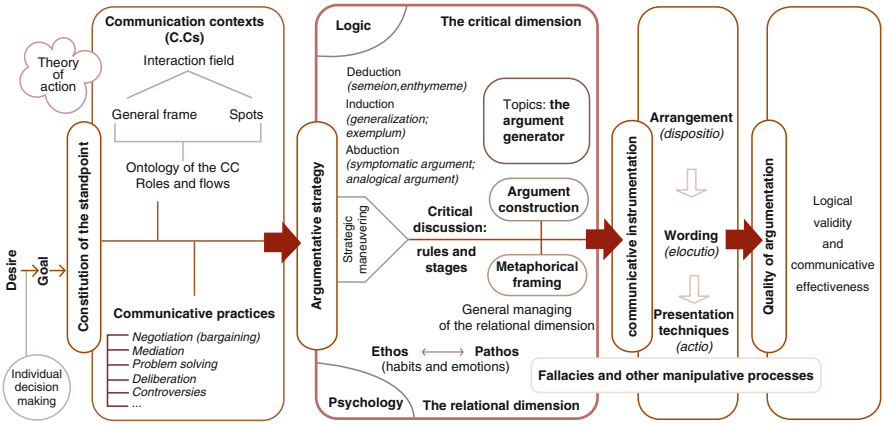

Fig. 4 The "fishbone" model of argumentative intervention

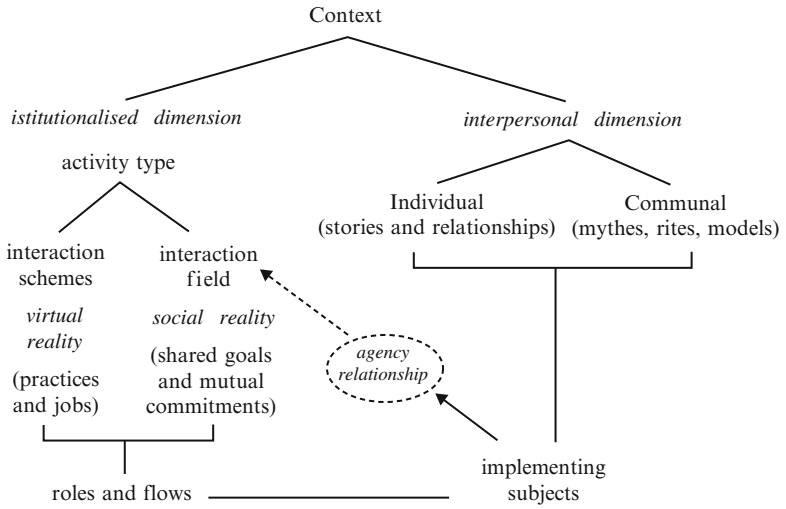

Fig. 5 The communication context

Here, Communication context is presented as consisting of two relevant dimensions, which can be respectively characterized as *institutionalised* and *interpersonal*.

1. The *institutionalised dimension* has been focused on within the pragma-dialectical approach (van Eemeren and Houtlosser 2005), through the notion of *activity type*, introduced by Levinson (1978). The complex notion of *activity type* includes, in turn, two components that deserve to be kept distinct.

   1.1 The first component is represented by the *interaction field*, i.e. by that piece of *social reality* (in Searle's (1996) terms) in which the argumentative

interaction takes place. The interaction field is defined by specific (hierarchically organized) *shared goals*, which all the interagents are expected to share beyond their individual goals, and which define the interagents' mutual commitments. For instance, a business is distinguished from other kinds of institution (hospitals, universities…), because its main shared goal is making a profit (see on this point also Muller-Mirza et al., chapter "Psychosocial Processes in Argumentation" of this volume[46]).

1.2 The shared goal which is pursued by the interaction field is *de iure* the final aim of all the institutional interactions occurring in the interaction field itself. The interaction field operates through a series of *interaction schemes* which aim at the fulfilment of the shared goals. Interaction schemes require corresponding *communicative practices* or, properly, *communicative interaction schemes* (like deliberation, negotiation, consulting, problem-solving, adjudication, mediation…), which, at least in some cases, also constitute proper jobs. For instance, a business needs to make strategic decisions about its financial activities in order to reach its main goal of making profit; often, the process of decision-making is made through the *deliberation* by a group of people. But the communicative practice of deliberation is also applied in other interaction fields (such as a city council, a university department, etc.). The communicative practice is constituted as an interaction scheme aiming at fulfilling the shared goals (the main one and the subordinate ones) defined by the interaction field; the practice involves rules of interaction and specific communicative and non-communicative tools that have been established in the history of the practice itself. As a further and more detailed example of communicative practice, Baker (see chapter "Argumentative Interactions and the Social Construction of Knowledge" of this volume) describes *collaborative problem-solving* processes in the school context, and highlights its implications for students' learning.

The implementation of interaction schemes within interaction fields generates a network of *roles* that are linked to each other through correspondent *communicative flows*.

2. The roles that are thus generated are "embodied" by *implementing subjects* that can be individual or collective. In relation to implementing subjects, the relevance of another component of context arises: the *interpersonal dimension*. This second component has actually to do with the human factor of context. An implementing subject is not to be understood as a simple "filler" of the institutional role, endowed with the required competences: indeed, for each real (individual or collective) implementing subject, the subjective dimension always exceeds the institutional role. The subject maintains his or her own interests and goals,

[46] Within the project Argumentum, this consideration has given rise to the structure of the modules produced by the universities of Neuchâtel and Geneva. Both modules are organized around the metaphor of the "argumentative town," (Argupolis) where each building (school, university, tribunal, family home…) also physically represents a precise interaction field with its institutional constraints and opportunities. See also the website of the doctoral program Argupolis (www.argupolis.net).

which may be aligned with the role itself, or may be conflicting with it. It is, indeed, a typical case of *agency relationship*.[47]

In the interpersonal dimension two types of interpersonal solidarity take place. The first one concerns the relationships between individuals: living and working together within the same interaction field originates various types of stories, in which experiences are shared and relationships established; such stories may also influence the institutional dimension. The second type of solidarity concerns the particular link of individuals "belonging" to the community, which creates myths, rites and models (Cantoni and Di Blas 2006, pp. 233–237); in other words, the proper *culture* of the interaction field.

The relevance of communication context to the argumentation strategy is justified by several facts: first, within context, the issue emerges in relation to which the difference of opinion generating the standpoints arises; second, context is the primary source for defining the strategies in the opening stage; and, finally, context provides arguers with that explicit or implicit *information protocol* from which many proper endoxa are drawn (See the analysis proposed in Greco Morasso 2009).

The second rectangle of the fishbone model is explicitly inspired by strategic manoeuvring, as it is fully devoted to the design of argumentative strategies. Two strictly complementary dimensions are considered: the critical and the relational ones. Each of them offers the possibility of an interdisciplinary enrichment. The critical dimension naturally refers to logic,[48] which is expected to facilitate the assessment of the inferential validity of argumentative procedures. The relational dimension, moving from the Aristotelian notions of *pathos* and *ethos*,[49] largely corresponds to the second

[47] Agency theory, a key instrument in explaining many economic and social phenomena, was defined by Stephen Ross (1973) as follows: "We will say that an agency relationship has arisen between two (or more) parties when one, designated as the agent, acts for, on behalf of, or as representative for the other, designated as the principal, in a particular domain of decision problems." The principal delegates a task, which entails a decision making activity, to the agent, and the agent gets a compensation for it. In such kinds of relationship, a problem arises (the agency problem) because there is no alignment of goals between the two parties, and the agent tends to act, as much as possible, in her own interest. Examples of agency relationship can be found in many situations and in different contexts of interaction (see Eisenhardt 1989; Mann 1997).

[48] An introduction to logic tailored for students in argumentation theory, worked out by Marco Colombetti, is now being published within Argumentum.

[49] The role of emotions in the argumentative strategy has been analyzed in particular by Ch. Plantin. Plantin observes that: "exhibiting the emotional strategy of a discourse can always be suspected of unfair intentions. The antonomy rational/emotional is so deeply grounded that characterizing a discourse as "emotional" practically amounts to implying that it is not rational. Such an interpretation should be strongly rejected" (Plantin 2004, p. 274). In fact, if excluding emotions, argumentation risks becoming "alexithymic," i.e. to become a language where no expression of emotions or sentiments is allowed (Plantin 1998, p. 9), and thus all kind of involvement is mortified. On the contrary, Plantin claims that there are some "reasons of emotions" that cannot be neglected when analyzing argumentative interventions: "On dit, à juste titre, que le discours argumentatif fonde un « devoir croire » (l'horizon s'éclaircit, il fera beau demain); un « devoir faire » (il fait beau, allons à la plage). Nous voudrions montrer qu'on peut de même « argumenter des émotions » (des sentiments, des éprouvés, des affects, des attitudes psychologiques), c'est-à-dire fonder, sinon en raison, du moins par des raisons un « devoir éprouver »" (Plantin 1998, p. 3).

level of strategic manoeuvring (adaptation to audience demand). In particular, it could be profitably connected with those investigations in social psychology that are devoted to persuasive effectiveness of argumentative strategies (Petty et al. 1983; Petty and Cacioppo 1986). The main component of this rectangle clearly coincides with topics, which offers a tool for managing the topical potential, i.e. the set of relevant alternative moves within the argumentation stage. The model of topics worked out in Argumentum will be focused on in what follows.

The third rectangle concerns the communicative instrumentation that "dresses up" the argumentative strategy. This dimension is strictly connected to the presentational devices within strategic manoeuvring and articulates this dimension into the arrangement of the arguments in a rhetorically effective order (*dispositio*), stylistic choices at the linguistic level (wording or *elocutio*), and non-verbal communication, including body-language (*actio*) and other presentational techniques (like graphics, possible audio-visual supports, and so on).

Finally, the fourth rectangle intends to represent the auto-critical reflection which needs to be developed after performing the argumentative intervention within an actual argumentative discussion, in order to improve one's argumentative practice by learning from experience.

The problem of fallacious argumentation strategies of course affects all of the three last rectangles.

We will now specifically focus on the Argumentum Model of Topics (henceforth: AMT), namely the component that represents the kernel of the Fishbone model. Indeed the system of topics plays a crucial role with regard to the three main functions of the model: (a) analysing argumentative interactions by identifying the inferential processes they activate; (b) evaluating the dialectical and rhetorical effectiveness of argumentative discourses; and (c) supporting the planning and construction of argumentative interventions by offering a rich toolkit of alternative instruments.

The model was first proposed in Rigotti and Greco (2006) and then illustrated, refined and expanded, with the help of a certain number of different applications, in Rigotti (2006, 2007, 2009a, b) and Rigotti and Greco Morasso (Forthcoming). Some examples of its possible applications have been provided in Bigi (2007), Greco Morasso (2007), Palmieri (2008) and Christopher Guerra (2008), as well as in Greco Morasso (chapter "The Argumentum Experience" of this volume).

As for the theoretical framing of the AMT model, for the present purposes it is sufficient to say that it has been elaborated by taking into account the contribution of the ancient rhetorical tradition (in particular, *Topics*, *Rhetoric* and *De Sophisticis Elenchiis* by Aristotle, and *Topics* by Cicero), and the late ancient and Medieval elaborations by Boethius (*De topicis differentiis*, Stump 2004), Abelard (see De Rijik 1970), Peter of Spain (*Summulae Logicales,* Bochensky 1947) and Buridan (*Summulae de dialectica* see Klima 2001). But the AMT model is also positioned in the framework of the current research and debate on argumentation, and in particular on *argumentation schemes* (Garssen 2001; Walton et al. 2008). Rigotti (2009a, b) elaborates in more detail on the ancient and Medieval heritage revived and reinterpreted by this model, while Rigotti (2007) and Rigotti and Greco Morasso (Forthcoming) show its added value as for the analysis of the inferential

structure of arguments, in comparison with other modern approaches to the study of argumentation schemes.[50]

This component of Argumentum consists of two main parts, each one of which is, in turn, subdivided into several sections.

The former part is devoted to the theoretical framework and the analytical instruments necessary to face topics. First, a definition of some key notions of topics is proposed and discussed. Second, a relevant section is devoted to the use of various semantic instruments for establishing the ontology of the standpoint in its syntagmatic and paradigmatic dimensions and its modal status (Rigotti and Greco 2006). Finally, the inferential structure of a locus is analyzed by focusing on the maxims arising from different knots of this ontology and on the *endoxa* they evoke.

The latter part outlines the argument generator, which includes a taxonomy of *loci* and the presentation of one or more maxims arising from each *locus*, with their application to specific arguments, by mapping maxims onto the information protocol offered by the context (see Fig. 6).

As mentioned, the model has been more systematically illustrated in other occasions (see, in particular, Rigotti and Greco 2006; Rigotti 2006, 2009a). Here, we will limit ourselves to the presentation of its fundamental traits; in particular, in par. 8.5, an example of argument construction based on the AMT is provided, while the preceding paragraphs are devoted to a general illustration of this model.

8.2 Definition of Some Key Notions

Our model of topics is based on the following key-notions: *topics, locus, endoxon, maxim, argument*. Traditionally, *topics* indicates a systematic method of finding arguments. Aristotle identifies it with "a method according to which we are able to put forward arguments about any standpoint (*problema*) starting from propositions which have already been accepted (*ex endoxon*)" (*Topics*, 100a 1, see Ross 1958). Now, as topics and, more in general, rhetoric were considered in antiquity as "technai," i.e. as arts and not as sciences, their theoretical purpose was not put in the foreground. In order to emphasise the scientific nature of topics, in accordance with its connection with argumentation theory, we focus on its theoretical commitment by adopting the following definition: *Topics is the component of argumentation theory by which ideally all*[51] *(theoretically possible) relevant arguments in*

[50] Here, such theoretical discussion is skipped in favor of an application of the AMT model that is expected to indirectly contribute to show its explicative force.

[51] The claim of generating *all* relevant arguments in relation to a certain standpoint might appear unreasonable. We are not pretending that our model of topics is able to actually *produce* all relevant arguments. As a matter of fact, no model of topics could ever be considered exhaustive in this sense, given that each fragment of reality shows endless aspects that bear endless relations with endless other fragments of reality… Nonetheless, the system of topics generates all relevant arguments as it is expected to assign to each possible argument a precise inferential structure that is related to the ontology of the standpoint.

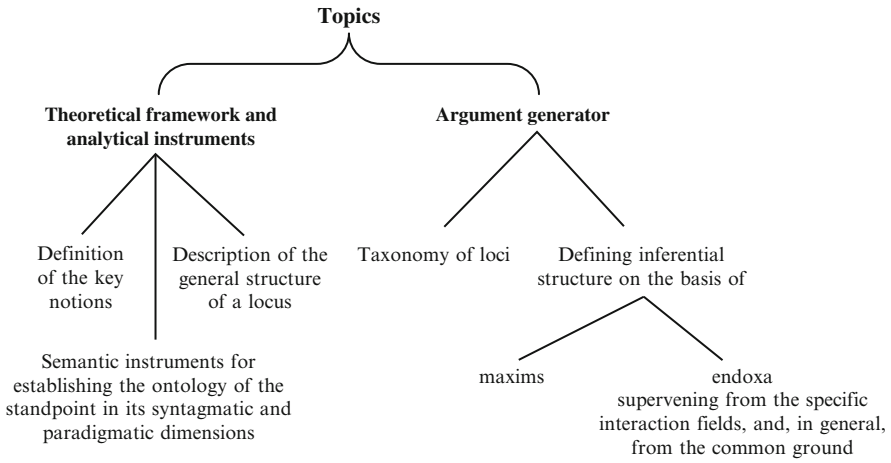

Fig. 6 Map of the main components of the AMT

favour and against any standpoint are generated by specifying their inferential structure through a system of loci (Rigotti and Greco 2006).

Two fundamental notions are focused on by this definition: *standpoint* and *locus*.

A standpoint is a statement (simple or complex) for whose acceptance by the addressee the arguer intends to argue.

Two aspects of the standpoint are particularly relevant in the AMT's perspective.

Firstly, a standpoint is a particular type of statement which (1) has not yet received a shared justification (neither by evidence nor by a previous inference); (2) is bound to a commitment of immediate justification by an inferential procedure (it is destined to figure as a conclusion).

Secondly, a standpoint is always a statement, even though it can be subject to different modalities and thus provide logical equivalencies to other types of utterance (pieces of advice, orders, questions, and so on).

Being the basic constituent of our model, the notion of *locus* plays a fundamental role. *A locus*[52] *is a "sub-generator" of argumentative procedures based on an ontological relation (such as cause-effect, definition to defined, genus to species) which generates one or more maxims, in the form of truth conditions, that allow to bind the truth value of the standpoint to the truth value of propositions accepted by the considered public*.

It is worth noticing that the inferential process cannot be activated if the maxim is not combined (crossed) with propositions that have already been accepted by the considered public. This component of the argumentative procedure was named by Aristotle *endoxon*: "what is already within the shared opinion." It is interesting to directly quote, in this relation, the definition given by Aristotle (*Topics*, 100b. 21, see

[52] It is often the case that the term *argument* is used to indicate both an argument and a locus. Thus, instead of saying "argument belonging to the locus from authority," one can speak of "argument from authority".

Ross 1958): *endoxa* are opinions that are accepted by everyone or by the majority, or by the wise men (all of them or the majority, or by the most notable and illustrious of them)." A modern translation could be: "an endoxon is an opinion that is accepted by the relevant public or by the opinion leaders of the relevant public."

In the above-proposed definition of locus, the notion of *maxim* becomes relevant:

Maxims are implications establishing a connection of the form p→q, that generate inferential processes; each inferential process defines, within the locus, the form of a subclass of arguments that are produced in connection with proper endoxa. All the maxims of the same locus are implications of the ontological relation constituting the locus.

Finally, we arrive at the definition of *argument*: we consider an argument as the actual application of a maxim to one or more proper endoxa, thus deducing the standpoint from the maxim for a certain public that shares the above-mentioned endoxa.[53]

8.3 Instruments of Semantic Analysis

The definition of *locus* brings to light the constitutive connection between the locus and the ontology of the standpoint. Therefore, a rather powerful instrumentation for semantic analysis is needed in order to define the ontology of the standpoint in its strictly internal structure and in its syntagmatic and paradigmatic contexts.

The analysis of the conceptual system, namely the semantic analysis, is therefore preliminary to the study of topics. As remarked in par. 3, semantic analysis helps in

[53] Let us consider an example that could help us recognize the relations between these last key notions of topics. If we consider the *locus from the final cause*, we observe that all the arguments it generates origin from a particular aspect of the standpoint: the final aim of the action referred to by the standpoint. But, depending on the presence or absence of a finality (motive), it is, first of all, possible to state whether the situation the standpoint refers to is an actual action or rather an event, e.g. an involuntary behaviour (*"You've just stepped on my foot!";–"I didn't do it on purpose!"*). However, the same locus can generate other kinds of arguments. Let us suppose that the nature of an action has already been defined and that the arguer's aim is to determine whether this action can be described as a murder or as a case of self-defence. The argumentative process will develop in the following way: if it has been ascertained, from a number of circumstances, that the victim was evidently not capable of causing serious damages to anybody, then the locus from the final cause allows concluding that the hypothesis of murder is true. Both procedures, as different as they may be, are established in relation to the same ontological relation: the finality of the action. It is clear that within the same locus, i.e. by referring to the same moment of the semantic-pragmatic structure (ontology) of the standpoint, different kinds of arguments can be found. Their variety depends on two mutually connected factors: (1) the border which is posed in the standpoint between what is already ascertained and what is still disputed (in the first example, the status of action has not yet been ascertained and is thus being disputed, whereas in the second example it is taken for granted and what is disputed is the quality of the action); (2) the specific maxim. For example, within the locus of the final cause, referring to a different border between the ascertained and the disputed, we have found two different maxims: (1) If a behaviour does not have a final cause, it cannot be defined as an action in a strict sense; (2) If, for an action, the final cause that is pretended is evidently meaningless or incompatible with the actual circumstances, another final cause must be identified.

not being misled by ambiguities.[54] More in detail, the semantic instrumentation performs two main tasks. Firstly, it aims at proposing a tool for semantically and pragmatically analyzing the utterance that constitutes the standpoint; secondly, it has to elicit, from the semantic-pragmatic structure of the standpoint, its inferential implications (see the example provided in Greco Morasso 2006). For the former task, we have exploited our confirmed experience in semantic analysis by introducing some essential moves of Congruity theory – an approach which aims at combining the semantic and the pragmatic levels (Rigotti , 2005a; Rigotti and Rocci 2001; Rocci 2005; Rigotti et al. 2006b). For the latter task, the doctrine of the conceptual system in terms of *categories* (Arist. Categoriae, see Minio-Paluello 1949; Topica I, see Ross 1958) and *predicables* (Arist. Topica I, IV, V, VI, see Ross 1958) elaborated by Aristotle and the Aristotelian tradition has represented a powerful resource.

Besides the analysis of the conceptual system in terms of categories and predicables, two other precious contributions have come to argumentation theory from the Aristotelian tradition and allow considering adequately, beyond the *strict ontology of the standpoint* (i.e. the possible fragment of world directly referred to by the standpoint), the *syntagmatic and paradigmatic context of the standpoint*: the doctrine of causes (Arist. Physica, II, see Ross 1950) and the doctrine of oppositions (semantic paradigms).

8.4 Taxonomy of Loci

In the Medieval literature on topics, loci were distinguished, according to their proximity to the standpoint, into *intrinsic*, *extrinsic* and *middle loci*.

In general, the basic distinction between intrinsic and extrinsic loci can be found in Cicero's *Topica* (Reinhardt 2003): "alii in eo ipso de quo agitur haerent, alii assumuntur extrinsecus." Our taxonomy is however closer to the typology formulated by Themistius and followed by Boethius (*De topicis differentiis*, Stump 2004): (1) loci taken from the factors that are directly established by the standpoint (vel ex ipsis sumantur quae in quaestione sunt constituta), (2) loci that are taken from the outside (vel extrinsecus ducantur), and (3) loci which can be found almost on the borderline between the previous two (vel quasi in confinio horum posita vestigentur).

Moreover, the intrinsic loci do not only include the things which are referred to in the standpoint, but also those that condition the state of affairs denoted by the standpoint, and that either follow it or come together with it. They correspond to all the aspects that constitute the possible fragment of the world expressed in the standpoint or that *coexist* with it. Exploiting the notion of *syntagm*, introduced in modern

[54] The importance of semantic analysis as an essential tool for avoiding ambiguities and possible forms of manipulation has been, by the way, often presupposed in some studies on fallacies and argumentation. Some specific studies are devoted to particular forms of ambiguity, and to ways for dealing with them; in this relation, to quote a very significant example, the works by Agnes van Rees on the possible manipulative uses of *dissociation* (van Rees 2005) are bound to a specific problem related to the definition of the semantics of terms. The problem of *definition* is, in general, tackled in a more detailed fashion by Macagno and Walton (2008).

linguistics to mean the set of relations *in praesentia*, we speak of *syntagmatic loci* to indicate all the classes of arguments that refer to aspects ontologically linked to the standpoint, either directly or indirectly, such as the extensional relations of terms, dependent on the semantic content, on the hierarchical taxonomy of predicates, on the relationship between the whole and its constituent parts; included in this group of loci are also the classes of arguments which move from those pieces of world, traditionally called causes, effects, circumstances and concomitances, that condition the state of affairs the standpoint refers to.

In Themistius' and Boethius' (Stump 2004, pp. 28–29) tradition, the description of the extrinsic loci, on the other hand, is undoubtedly more vague: "Extrinsic loci are not so 'separate' and detached as to prevent the vision, from a certain perspective, of what constitutes the situation concerned by the standpoint" (Non sunt ita separata atque disiuncta, ut non aliquo modo quasi e regione quadam ea quae quaerentur aspiciantur). When considering the loci included within the extrinsic ones (similarity, opposition, major-minor, termination and setting up), it is nonetheless quite clear that they correspond to relations *in absentia* (of alternativeness), defined by modern linguistics as *paradigmatic*. Thus we speak of *paradigmatic loci*, referring to classes formed by arguments that are based on paradigmatic relations, both of opposition (see the notion of semantic paradigm in Rigotti and Greco 2006) and of analogy (similarity).

Regarding the *loci medii* (also indicated as *mixti*), these are characterized by being on the borderline (*in confinio*) between extrinsic and intrinsic ones. The name *complex loci* seems to be more adequate to account both for the frequent contamination they show between paradigmatic and syntagmatic loci, and for the frequent inclusion of extra-discursive elements. A prime example of this should be considered the *locus from authority*, which, pointing to the moral and/or cognitive quality of the "producer" of the message, first of all refers to the syntagmatic *locus from agent* as a subtype of the *locus from efficient cause*; nevertheless, the aspect taken into consideration does not refer to the content of the standpoint but to the communicative situation in which the standpoint is being discussed. Among the complex loci, we also include the locus from promising and warning. *Derivates* and *conjugates* are more rhetorical than dialectical: derivates refer to the so called *etymological figure* ("If he is an entrepreneur, he should stick to managing enterprises and not pretend…") and indeed derive their argumentative power from semantic implications of different nature and different inferential strength (as in our case, it is frequently a matter of the relation between the status of a certain being and its tasks)[55]; conjugates instead draw on the semantic relations implied

[55] A certain likeliness with the *locus from definition* is evident, but an essential difference should not be neglected: the locus from definition necessarily refers to constitutive traits of the concerned entity, while, very often, the locus from derivates refers to aspects of the concerned entity, whose relevance depends on the extent to which their scope covers the whole concerned entity. In our example, we notice that a professional status, like that of an entrepreneur, does not exhaust (is only a part of) the civil status (with related rights and duties) of a citizen. When resting on a proper locus from definition, the arguments of this locus acquire, indeed, a quite different inferential strength: *As they are human beings, they are expected to behave humanly*. Evidently, the specific force of this locus is bound to the wording (is a sort of poetic proof) and is therefore rhetorical in nature, while its inferential strength depends each time on the locus that is exploited.

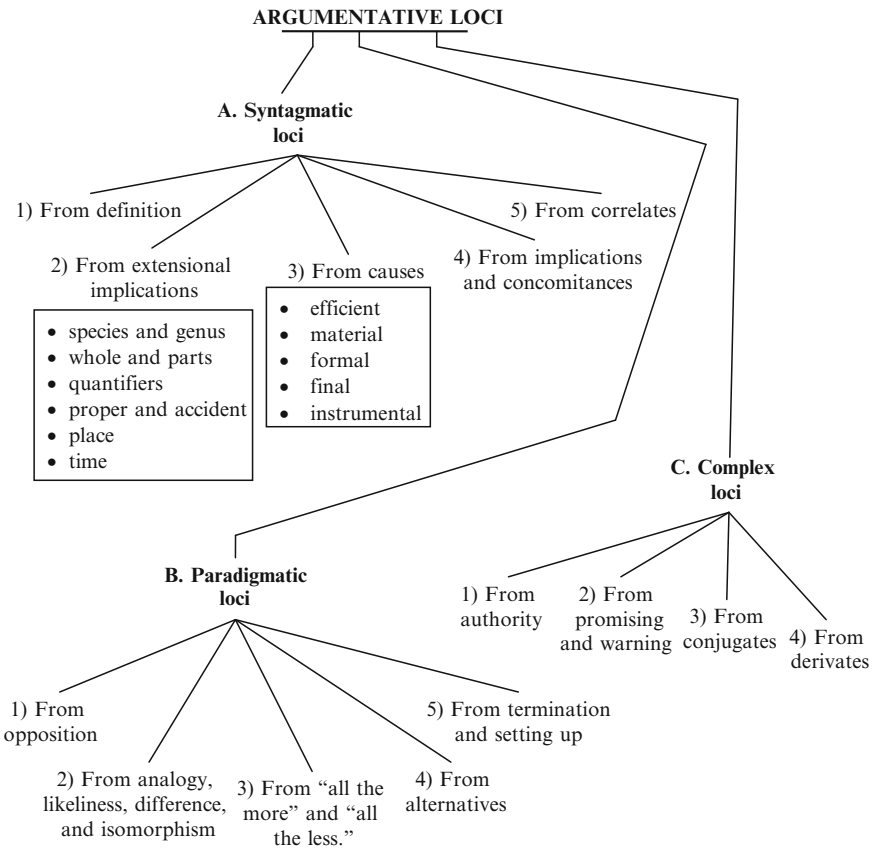

Fig. 7 Taxonomy of loci

by morphological patterns ("Those who fought against us have lost, then those who will fight against us will lose") and activate one or more syntagmatic or paradigmatic loci.

We propose the following diagram to represent the taxonomy of loci, where the three domains of syntagmatic, paradigmatic and complex loci appear with their articulations (see Fig. 7).

8.5 The Structure of an Argument

Here, we will limit ourselves to presenting an example of how the model of topics helps one understand the inferential structure of arguments and evaluate them, also considering their relation to the communicative context of the argumentative

interaction. The example is presented in Christopher Guerra (2008), where a thorough analysis of the debate in question is given.

Between the end of 2004 and the first months of 2005, two academic decisions provoked a vivid debate that strongly involved the Swiss public opinion. The Federal Polytechnic of Zurich decided to close the chair of Italian language and literature consecutively to the retirement of its occupant[56]. This decision was followed, in December 2004, by an analogous one at the University of Neuchâtel, in which, it is worth mentioning, the chair for ancient Greek language and literature was equally suppressed. The decisions made by these two institutions triggered a vivid debate which was hosted by the media in the whole Swiss territory and, in particular, in Ticino. In fact, these were felt as a threat to Italian language and, thus, to Swiss multilingualism; ultimately, they were perceived as a possible menace to the Swiss identity itself[57]. Here, only two arguments, taken from this debate, will be analysed with the model of topics, respectively advanced by Raffaello Ceschi[58] and Piero Martinoli[59]; both of them are arguments against the suppression of these chairs, i.e. they support the standpoint "The chairs for Italian language and literature must be maintained." In order to elicit the sources of the arguments, the analysis will take into accout the perspective of *generation*, considering the choice made by the arguers of the loci and of the relevant endoxa. First, from the point of view of the analysis of the standpoint (Rigotti 2006), it is important to state that the assumed standpoint presents, as a problematic element, i.e. as issue to be discussed, an *evaluative aspect*. The suppression of the chairs is an action that has already been decided; therefore, the arguers' task is not that of discussing its possibility, but that of evaluating its reasonableness and its consequences. Thus, the arguments put forward concentrate on this kind of evaluative task.

Now, in every argumentation, the very possibility of discovering arguments in support to one's standpoint is defined by the confrontation with an *information protocol*, i.e. with a collection of pieces of information, more or less directly related to the standpoint (Rigotti 2006). The information protocol that both arguers, in this case, had at their disposal could be reconstructed as follows:

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[56] This chair was inaugurated in the nineteenth century by the very well-known Italian literate Francesco De Sanctis (from 1856 to 1860).

[57] The survey of the debate on a corpus of articles which appeared in Italian Swiss newspapers between December 31st, 2004 and February 5th, 2005 was conducted during an edition of the Master course in Media Management (*Argomentazione nei media*), held at the faculty of communication sciences, at the University of Lugano (see Rigotti et al. 2006a).

[58] Raffaello Ceschi "*La cultura italiana al Poli.*" The article appeared on a Swiss Italian daily newspaper, *La regione Ticino*, on January 31, 2005; p. 4.

[59] The intervention by Piero Martinoli, at that time Professor at the University of Neuchâtel, appeared on the first page of another Swiss Italian daily newspaper, the *Giornale del Popolo*, on January 20, 2005; it was entitled "In gioco la coesione confederale."

(a) Relevant professional perspectives bound to the study of Italian language and literature
(b) Actual number of students of the chairs
(c) National and international relevance of the chairs
(d) Interest of these chairs for the university context
(e) Relevance of the teaching of Italian language for a significant value of the culture shared by the community
(f) …

All of these pieces of information are taken from the authors' knowledge of the academic and extra-academic (social, cultural…) context. In principle, each of them could be included in one or more possible *loci* for constructing arguments in favour of the standpoint. For instance, (a) could be included in the *locus from the final cause*[60]: the reason not to abolish the Italian chairs is that they represent relevant professional perspectives for students.

Of course, the strength of the arguments, based on the different items taken from the information protocol, can vary from one to another. Therefore, a phase of evaluation, not only of the logical form and efficacy of each single argument, but also of compared evaluation of their relative strength, is always to be foreseen. Not coincidentally, in our case, both arguers choose to rely on an item (e), i.e. to recall the relevance of Italian language to the Swiss culture. But let us first consider the argument proposed by Raffaello Ceschi:

> The Federal State is based on the acknowledgement of the cultures of which it consists, and must ensure equal dignity to each of them, in spite of unequal numbers: these are the conditions which originally justified the Federal treaty drawn up between the Cantons and still justify it today.[61]

This argument rests on the *locus from the whole and the parts*, which is included in the domain of the *syntagmatic loci*. The following "synergic" representation (see Fig. 8) allows distinguishing two parts within the inferential structure of the argument: a topical component, based on the maxim directly engendered by the locus, and a component based on an endoxon, which anchors the argument to the knowledge of

[60] In the second book of his Physics, Aristotle introduces the concept of cause, conceived of as constitutive condition of a state of affairs. The final cause, in particular, is the goal an action aims at, and, thus, the reason for performing that action (see Rigotti and Greco 2006).

[61] The original text in Italian is: "…Lo stato federale si regge sul riconoscimento delle culture che lo compongono, e deve assicurare a esse pari dignità, nonostante le disparità numeriche: questa era stata la condizione che in sostanza aveva giustificato dalle origini e giustifica tuttora il patto federativo stretto tra i cantoni."

the context shared by the arguer and the public of readers of the newspaper (i.e. the decision makers).[62]

The specific standpoint here is that *the Italian culture is essential for the survival of the Swiss Confederation.* The maxim *the whole cannot exist if any of its parts are missing* is directly engendered from the locus from the whole and the parts. In order for this maxim to generate the desired final conclusion, which coincides with the standpoint to be supported, the following minor premise is needed: *The Italian culture is an essential part of the Swiss Confederation*. Such a premise, however, is not self-evident; it needs on itself to be backed by another syllogistic reasoning, in this case anchored to an endoxon, which represents a shared belief for the arguer and his public: *The Swiss Confederation is based on the coexistence of a clearly defined set of different cultures*. This endoxon is very closely bound to the Swiss reality of social and institutional multilingualism, where each language and culture has equal status (Christopher Guerra 2008). The datum constituting the minor

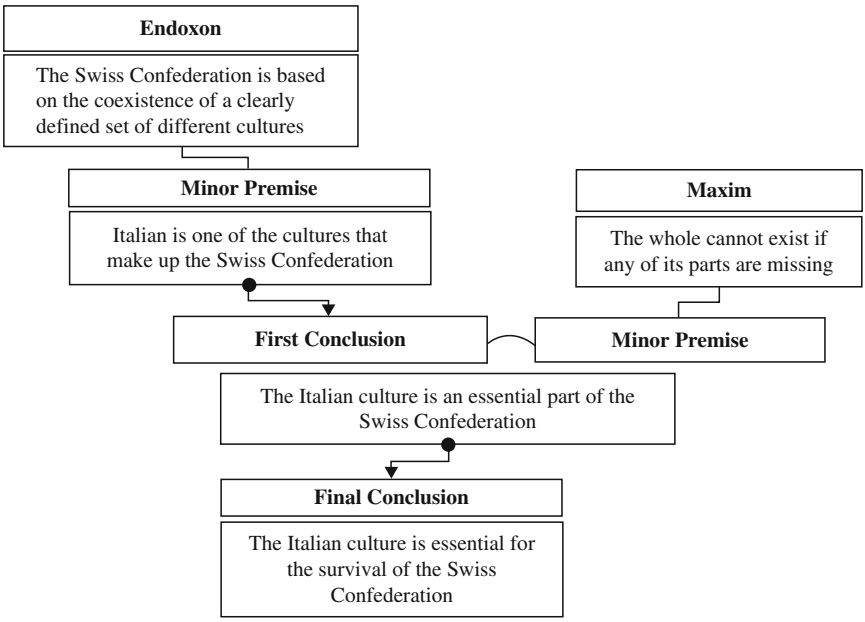

Fig. 8 Synergic representation of Ceschi's argument

[62] For a more detailed analysis of this argument and the following one presented here as examples, and for their critical evaluation of their validity and persuasiveness in the context of the debate on the position of the Italian language in the Swiss multilingual context, we refer to Christopher Guerra (2008).

premise of the endoxical syllogism is that *Italian is one of the cultures that make up Switzerland,* which is quite evident to a Swiss audience. This leads to the conclusion that *the Italian culture is an essential part of the Swiss Confederation*. This conclusion is thus "exploited" by the maxim (as indicated by the small curved arrow in the diagram) to generate the final conclusion, which coincides with the standpoint to be supported.

The two syllogistic reasonings giving rise to the complex inferential structure of actual arguments, whose intersection is represented in the AMT by means of a "*Y*-like structure," have distinct and complementary functions: the maxim is responsible for the inferential mechanism and defines the law, while the endoxon links the argument to a shared opinion in the community. We could even say that the topical component ensures the inferential force, while the endoxical component provides the persuasive effectiveness. In other words, topics guarantees the inferential consistency of the procedure, but, if this procedure is not combined with an endoxon, it remains a mere logical mechanism with no hold whatsoever on the public. Considering our example, what engenders the strength of the argument is exactly its grounding in a shared value concerning Swiss culture and federal political structure, represented, in Ceschi's discourse, by the keywords *Federal State* and *Federal Treaty*.[63] From the point of view of the analysis of context, this endoxon is closely related to the interpersonal dimension of context, in particular to its communal dimension: the myth of the Federal treaty of 1291 is evoked as a foundational experience of the country, and the will to acknowledge one's another culture is recalled as fundamental for the Swiss identity itself.

Let us see how this argumentation is brought forward in the intervention by Piero Martinoli:

> There is, however, an essential argument in favour of the maintenance of the above mentioned Italian department. This argument resides in the very nature of our country: the existence of Switzerland is in fact based solely on the political will to live together in a multicultural structure.[64]

Martinoli first assumes the same argumentation as Ceschi; for reasons of space, this part of the argument has not been represented in the diagram in Fig. 9 (on the left), since it is identical with the one in Fig. 8; it gives rise to the first conclusion A (*The Italian culture is essential for the survival of the Swiss Confederation*, see Fig. 8). However, the argumentation is carried further by means of the *locus from instrumental cause*, also combined with another reasoning stemming from an endoxon, which is represented on the right (endoxon B). The dynamics of crossing and combining between the syllogisms is the same explained above; in this case, however, the argumentation makes use of two distinct endoxa. The first one, analogous

[63] In relation to the functioning of keywords in argumentative discourse, see Bigi (2007).

[64] The original text in Italian is: "…Esiste tuttavia un argomento essenziale che gioca a favore del mantenimento del detto istituto di italiano. Questo argomento risiede nella natura stessa del nostro Paese: l'esistenza della Svizzera poggia infatti soltanto sulla volontà politica di vivere insieme in una struttura multiculturale."

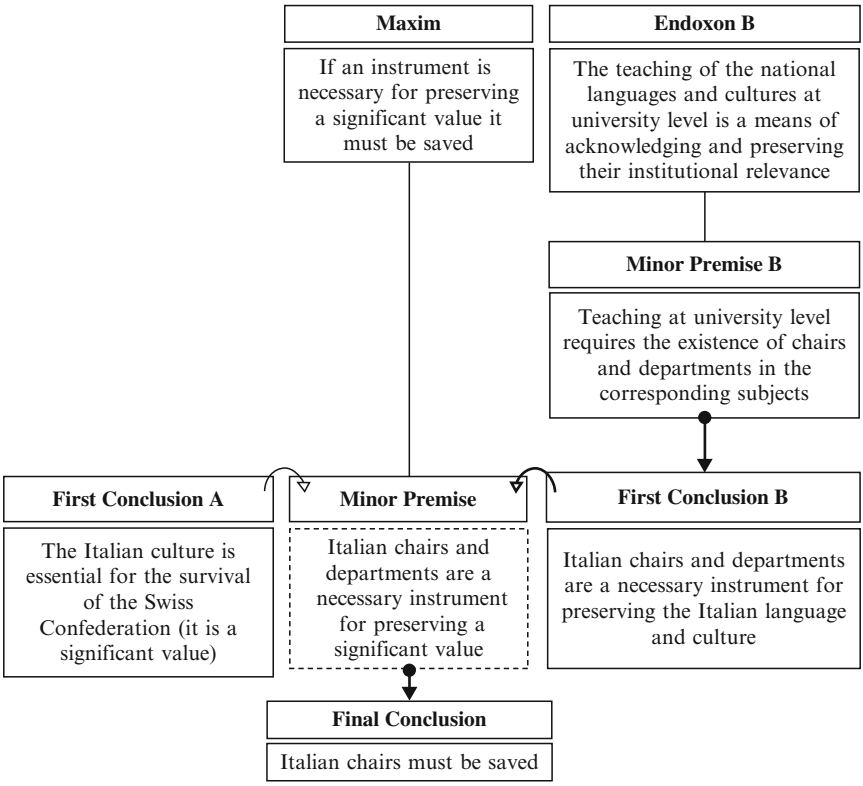

Fig. 9 Synergic representation of Martinoli's argument

to the one presented by Ceschi, is explicitly mentioned by Martinoli: "the existence of Switzerland is in fact based solely on the political will to live together in a multicultural structure[65]". The second one concerns the relation between the teaching of languages at university level and the cultural relevance of the language itself. The combination of the conclusion reached by Ceschi's reasoning (First Conclusion A) with the conclusion obtained from this second line of reasoning (First Conclusion B) gives rise to the minor premise *Italian chairs and departments are a necessary instrument for preserving a significant value*. Such premise, associated with the maxim of the locus from instrumental cause, brings to the conclusion that Italian chairs must be saved. Italian chairs, thus, prove to be an instrument necessary for maintaining a significant cultural value in Switzerland.

[65] Very significantly, Martinoli makes a Swiss shared and almost unquestionable premise explicit. This provides a very solid foundation of his argument in the readers' common ground.

9 Fallacies and Other Manipulative Processes

Traditionally, in argumentation studies, an important chapter is devoted to the analysis of fallacies and of manipulative processes. The function of this study, understood as awareness of argumentative validity and resistance to manipulation by others, was clearly indicated by Aristotle in his Rhetoric.[66]

In the pragma-dialectical approach, fallacies are organically studied as violations of reasonableness, and thus, as violations of the ten rules of critical discussion. Indeed, manipulative processes can be largely interpreted as violations of these rules (van Eemeren and Grootendorst 1992). In this way, pragma-dialectics offers a comprehensive grid representing an ideal model of a reasonable discussion, against which all actual argumentative moves can be tested and evaluated.

However, identifying the violation of a specific rule does not keep one from analysing the specific inferential mistakes at work in a given manipulative process. For instance, all fallacies and manipulations based on the wrong application of an argument scheme (or locus), in support of a certain standpoint, constitute a violation of rule 7 (the *argument scheme rule*). The *argumentum ad verecundiam* (manipulative use of the argument from authority), the fallacy *secundum quid et simpliciter* (or *hasty generalization*), or the *post hoc ergo propter hoc*,[67] are all violations of rule 7; but they work on a very different basis, i.e. they "exploit" different forms of inferential mistakes, more or less definable in terms of formal logic, and that however deserve to be distinguished in order to have a precise account of their manipulative force, and of how they can be avoided or corrected.

Douglas Walton has been already mentioned for his numerous studies of fallacious arguments, which are correlated by an impressive volume of empirical analyses and examples. In Walton's perspective (Walton and Krabbe 1995; Walton 1995), a move can be considered as fallacious or sound only by evaluating its *pragmatic context*, namely the type of dialogue in which it occurs. This perspective has the unquestionable advantage of highlighting how some argument schemes (the *locus from authority* is a typical example of this) can have correct interpretations but also incorrect uses, according to the context where they are introduced. Some dialogue types, indeed, do not allow the use of this kind of argumentation. However, the theoretical problem remains open of defining under which conditions a certain move becomes a fallacy in a given context. Moreover, some procedures traditionally identified as fallacies constitute incorrect inferences; they can never be considered sound moves, even though they might turn out

[66] Aristotle observed: "Further, one should be able to argue persuasively on either side of a question, just as in the use of syllogisms, not that we may actually do both (for one should not persuade what is debased) but in order that it may not escape our notice what the real state of the case is and that we ourselves may be able to refute if another person uses speech unjustly" (see Ross 1959).

[67] See below for the analysis of these manipulative processes.

to be persuasive in some circumstances, if the audience is not perfectly aware of their inferential weakness.

The perspective of communication studies has brought to a wider consideration of the social, political and cultural context in which manipulative processes can be framed. In particular, in 2002, an international conference was devoted to the study of the very peculiar context of totalitarian regimes of the twentieth century in Europe (de Saussure and Schulz 2005). Within this study of a complex social system based on manipulated consent, specific manipulative processes have been identified, beside fallacies, which operate at a less local and more strategic level (Rigotti 2005b).

In the context of argumentation for education, the awareness of manipulative processes becomes particularly strategic; it turns out to constitute an instrument to distinguish actual cognitive acquisitions from mistakes that block knowledge construction, and to develop students' critical attitude towards processes of decision-making in society. For this reason, drawing on Rigotti (2005b), we will briefly expound here different types of manipulative processes.

Before, however, we will start proposing a tentative definition of manipulation:

> A message is manipulative if it twists the vision of the world (physical as well as social – or human – actual as well as virtual) in the mind of the addressee, so that he/she is prevented from having a healthy attitude towards the decision (i.e. an attitude responding to his/her very interest), and pursues the manipulator's goal in the illusion of pursuing her/his own goal.

For example, the manipulator, consciously or unconsciously, tries to induce the victim to comply by presenting a positive virtual state of affairs, depending on an insincere promise, conditioned by the compliance itself. Here it is the vision of the social world – a promise is indeed a social fact – and of the connected future state of affairs which is distorted.[68]

It is relevant for the domain of teaching and learning that the dynamics of manipulation be very close to the dynamics of human error. More precisely, manipulation involves an error on the part of the manipulated person. In several languages, the reflexive form of the verb that means "to deceive" is used in the meaning "to make a mistake," according to a rather common decausative word formation pattern: see Latin *fallor*, French *se tromper*, Italian *ingannarsi*. We can now interpret the verb *to manipulate* as "to induce into error," in other words to foster somebody's errors while blinding her/him by concentrating his/her attention only on some positive, but very partial, aspects of the situation that is under judgment in the decision making process. Furthermore, "to induce into error" has, like many other causative verbs, two possible interpretations:

[68] The fundamental aspect that our definition fails to consider is precisely *how* manipulation can succeed in twisting the addressee's world without being discovered. In fact, in order to succeed, a lie has to seem true, an insincere promise must seem authentic, a fallacy must look like a sound argument, a secondary aspect has to appear essential and a deviant or reductive reading of a key-word must look straightforward and appropriate. In short: what is negative has to be somehow disguised as something positive.

1. "to act intentionally in order to induce somebody in error";
2. "to behave unwillingly in such a way that somebody is induced in error."

The situation described in (ii) occurs if our candidate makes his promise sincerely and *is not aware* at all that the promised measure shall at the end damage the electors.

In our opinion the most interesting case of manipulation – and at the same time the more likely to succeed – occurs when an already manipulated person aims at convincing another. In fact, in this case, the manipulated person does not pursue the goal of the manipulated manipulator but the goal of the original manipulator. Anecdotal evidence and the personal testimony of people who survived totalitarian regimes suggest that the effect of a manipulative device is heavily strengthened if it is applied by somebody who has himself been manipulated.[69]

Now, we can present some manipulative processes; we will start from the simpler and more basic deceptive processes, concerning truth values of propositions, sincerity commitments and inferential processes, going on to the misuse of the cognitive and relational components of common ground and ending with some "deeper" and more complex manipulations.

Falsity, which violates the presumption of authority, refers to statements and directly twists the vision of reality in the manipulated, while *insincerity* is related, in particular, to commissive speech acts like promises. Falsity assumes the form of *disinformation* if the manipulator controls the whole (or, at least, a large part of the) communication system and can therefore avoid the risk of being contradicted by possible competitors.[70]

When manipulation intervenes in the inferential processes of elaborating knowledge and making decisions, within the logical and rhetorical tradition, this type of manipulation is called a *fallacy*. This is undoubtedly the first form of manipulation that has become subject to scientific analysis (Aristotelis *De sophisticis*[71] *elenchis*,

[69] Manipulation perpetrated by such individuals may be of a mixed type: partially unintentional – because they have been manipulated – and partially intentional (as they might think that a little bit of manipulation can help in pursuing the "Good Cause"). In principle, between these two extremes, various intermediate degrees of *fausse conscience* can be envisaged. Such a picture of the manipulator's mind would also lead to hypothesize the possibility of *auto-manipulation*, where there is no manipulator whose goals are pursued.

[70] Here, one could not help also thinking of the attention devoted to the educational system (programs, textbooks…) as a system of propaganda and disinformation by totalitarian regimes. In every case, this manipulative form can succeed if legitimated by a wide consistency with the whole communicative behaviour of the manipulator: in his *Institutionis oratoriae libri duodecim* (1. IV, 2, 91–92), Quintilian (see Winterbottom 1970) mentions, in this connection, a subtle proverb: "Uerumque est illud quod uulgo dicitur, mendacem memorem esse oportere" (*What the common people say is true: it is convenient, for the liar, to have a good memory*).

[71] As the ancient sophists were believed to systematically apply manipulative distortions to inferential processes, the term *sophism* is used as a synonym of *fallacy*.

Ross 1958). Aristotle has listed 13 types of fallacies, which are discussed in a detailed way in the well-known work by Hamblin (1970). Six of them are connected to different linguistic phenomena – like ambiguity and other types of semantic vagueness –, that take place in every particular historical language and can cause logical inconsistencies within inferential processes (equivocation, amphiboly, combination of words, division of words, accent, and word forms). The language independent fallacies – that is to say, those that do not depend on the *semiotic* function of language – are seven (accident, secundum quid, ignoratio elenchi, to state the consequent, petitio principii, non-cause as cause and many questions).[72] These fallacies present, undoubtedly, a greater degree of complexity; some of them are particular applications to inferential processes of more general manipulative devices.

In the tradition of studies in argumentation and fallacies, the medieval logicians deserve a particular mention whilst, among the modern philosophers, the name of John Locke is bound to the so called *ad fallacies*.[73]

The last logical fallacy in Aristotle's list (the so-called "many questions" fallacy) is properly a particular way of *violating presuppositions*. This type of manipulation was identified by Gottlob Frege (1892), who remarked the manipulative nature of

[72] The fallacy concerning accident refers to the incorrect inference "deducing" the identity of two terms that receive the same attribute: *Socrates is an animal; the donkey is an animal, so Socrates is a donkey*.The fallacy named *secundum quid et simpliciter* takes place when a property inhering to one part or aspect is generalised to the whole entity: *John is good at swimming, so John is good*.*Ignoratio elenchi* could be translated into "incorrect proof of contradiction": *You said that John was a bachelor and that John married, so you said that John was married and unmarried*. The fallacy *secundum consequens* infers the premise from the consequent. *If a man who has fever is hot, a man who is hot must have a fever*; *Since after the rain the ground is wet, in consequence, we suppose that if the ground is wet, it has been raining*.The not-cause-as-cause fallacy (*non causa ut causa*) takes place when a false cause is indicated to explain an undesired consequence;Petitio principii (begging the question) intervenes when the consequent occurs covertly among the premises: *The party we vote for defends our interests because it is the people's party*.Finally the fallacy named "many questions" refers to questions (see also below) where apparently the questioned statement is one, but other statements deserving to be questioned too are implicitly conveyed: *Why did Ivan betray the party?* – where the fact that Ivan betrayed the party is not already established and therefore cannot be taken for granted.

[73] Locke (1975) has distinguished four main arguments, three of which are misleading, while one is correct and relevant: *ad verecundiam*, *ad hominem*, *ad ignorantiam*, *ad iudicium:* the first dissuades from refusing an opinion not to be arrogant towards an authoritative source; the second opposes an argument by focusing not on the argumentative force of the discourse, but on the quality or the behaviour of the arguer; the third induces to adhere by simply showing that the other is not able to propose an acceptable opinion; finally, the fourth is based on the force of the argument itself. In the Western tradition before and after Locke, other fallacies were singled out. The following are, in our opinion, particularly noteworthy: *ad consequentiam:* "this is false, because if it was true, terrible consequences would follow"; *ad populum*: "This newspaper is read by 100,000 readers every day, therefore it's a good newspaper"; *ad baculum*: "I am your main advertiser, but you keep your freedom of the press"; *post hoc ergo propter hoc*: "After the conversation with you he died. Therefore you caused his death."

the noun phrase *Der Wille des Volkes*, depending on an undue usage of denotative expressions.[74] A fallacy we have already mentioned under the name of "many questions" is based on the same manipulative device, which has a far wider application. This device, called *presuppositional accommodation*, is grounded in the introduction of new information into discourse structures requiring true and shared information (Greco 2003). The possible manipulative effects of this device are manifold. First, the critical control by the addressee over presupposed information is weaker than the one that is exerted over asserted information. Second, the addressee is led to believe that he is ignorant of something he should already know and hurries, ashamed to adhere. And, finally, as the common ground on which every human group (nation, race, political party, social class, etc.) is founded consists in presuppositions (in terms of knowledge, beliefs, values, etc.), the refusal of any presupposition is felt – and can easily be cast up to – as a betrayal of one's own group; in this sense, presuppositions work like tests of loyalty towards the group.

Manipulations very often consist in misuses of basically positive human exigencies and tendencies. This is very clearly the case when we have to do with manipulation exploiting the human need of establishing a general comprehensive view of reality: in the cognitive dimension, as well as in the ethic one, human beings feel an irresistible tendency *to look for principles having general validity*,[75] and each particular datum is assumed as a sign of total truth. And, under certain conditions, this is not only perfectly correct, but it represents an authentic accelerator of scientific progress; its possible defect arises from undue simplifications. An aspect of this undue application of our universalising instinct is referred to by the fallacy of *hasty generalization*. We can directly ascribe to this form of manipulation the rather common practice of constructing those seemingly harmless ethnical stereotypes which go a long way in creating the type of ideologically polluted terrain where many ethnic conflicts arise. The risk of manipulative generalisation surfaces in interpersonal relationships as well, when a certain property is transferred from a particular behaviour to the characterization of the entire person.

An *improper interpretation of the logical properties of semantic paradigms* could be listed among the logical fallacies. A semantic paradigm is a set of alternative (mutually exclusive) predicates. Accordingly, the colors constitute a paradigm, because the inherence of a particular color to a certain substance excludes the inherence of the other colors to the same substance, at the same time, and under the same respect. If a predicate of a paradigm is affirmed, all other predicates are excluded (implicitly negated); if, instead, a predicate is negated, the disjunction of all other

[74] For a more detailed account on the treatment of noun phrases in their manipulative exploitation, see Cigada (1999).

[75] A possible danger of manipulation related to the universalizing instinct, which consists in the manipulative exploitation of *agenda setting* power of the media, the control of which is an important component of political and economic power. Another particular instance of this "totality temptation" that it constitutes an enormous source of manipulative power could be termed "the cake temptation." This is not, by the way, a sin of gluttony but the tendency to think that the resources we have in front of us make up the totality of possibly available resources.

predicates is implicitly affirmed.[76] Now, if a semantic paradigm consists of two predicates only, the negation of the former becomes the affirmation of the latter: it is the case of the *contradictory* relation. Instead, if a paradigm consists of more than two predicates, the negation of one of them does not necessarily correspond to the affirmation of any other predicate in particular: we only affirm that it is the case for one of the others.

Our manipulative process arises in relation to those paradigms that present a scalar structure, where there is a graduation between one extreme and the other, with the presence of intermediate states: [*high…low*]; [*white…black*]; [*strong…weak*]; [*good…bad*]; [*friend…enemy*]. Here, the negation of one extreme does not coincide with the affirmation of the other: they cannot be both true, but they can be both false, one of the intermediate predicates being true. Thus, if somebody is not my friend, he/she is not necessarily my enemy and not to hate does not necessarily mean to love.

This important logical difference singled out within the Aristotelian tradition between twofold and manifold[77] oppositions has been often neglected by linguists, in particular in lexicology and lexicography, where couples of different types like dead – alive and friend – enemy are often considered indistinctly antonymic. But this distinction is, more importantly, often overlooked by the speakers, who are tempted to consider, in any case, the negation of one extreme as entailing the affirmation of the other.

Perhaps, *distorting relevance and interest* is the most radical form of deception. This type of manipulative device is based on a meta-communicative dimension: every communicative act moves from the presumption that what is said will interest the subjects involved in communication (Cigada 2006). Interest is indeed a keyword of our definition of manipulative messages. Manipulation intervenes when a message seems interesting, but is not: a false interest is constructed replacing the "true" one. The question that, of course, arises, is how the notion of "true" interest could be defined. A reasonable answer could be that true interest has to do with the existential relevance of the considered topics. But interest is clearly related to some rather "mysterious" dimensions of the human being such as desires and needs, from which any communicative and non-communicative human action takes its origin

[76] It has to be noticed, however, that the actual *relevant paradigm* with respect to which negation operates is *pragmatically* restricted by the actual contextual condition in which the speech act is performed and does not coincide with the virtual lexical paradigm that can be reconstructed from the organisation of long term memory. For example, when I say *This animal cannot be a mink*, my utterance can be understood as implying that the animal can be a ferret, or some other sort of small furry carnivore, but certainly not as implying that it can be an elephant, a whale or a seagull. Note also that the actual, pragmatically restricted paradigm of negation coincides with the *rhematic paradigm* made of the set of alternatives to the focus of the utterance. On the interaction between paradigm, focus and negation see Gatti (2004).

[77] Peter of Spain (see Bochensky 1947, pp. 53–54) speaks of *contraria immediata* and *contraria mediata* respectively.

(Rigotti 2003). But, here, we clearly feel that we are dealing with hugely complex dynamics of human attitude and behaviour, including the deepest levels of cultural belonging, that we could dare to tackle only with the help of an interdisciplinary approach (including insights from philosophy, ethics, psychology, anthropology, sociology, cognitive sciences, and so on).

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Psychosocial Processes in Argumentation

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Abstract This chapter examines argumentation as a psychosocial practice, embedded in institutional, historical, and cultural contexts. Even though they are in reality interwoven, several dimensions (cognitive, interactive, and cultural) will be distinguished. At the cognitive and individual level, the questions comprise the following ones: what are the cognitive prerequisites for engaging into an argumentative interaction? How is the development of argumentative skills taking place in children? But focusing only on the individual level would not take into consideration other dimensions that are important such as the relational and dialogical aspects of argumentation, the status of the partners and characteristic of the "audience." The specific demands of the cultural context in which argumentation takes place are also examined.

Keywords Social interaction, Argumentation, Cognition, Emotion, Dialogue, Learning, Mediation, Context, Meaning, Culture, Developmental psychology, Social psychology, Cultural psychology

1 Introduction: A Psychosocial Approach to Argumentation

In daily life, everyone has to face situations of uncertainty in which decisions have to be taken. In such contexts reasoning is not based on demonstrations, proofs, deductions, etc. Trying to take the best decision, carry out the right action or find a solution to a problem involves processes related to argumentation, such as formulating a position, or producing justifications and refutations. Argumentation – whether with another person, an audience or with oneself – is a discursive practice which forms part of everyday experience: "To argue is a form of discursive move

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in which we do not limit ourselves to expressing or communicating ideas, opinions, proposals, wishes, projects, etc., but we want to justify them, prove them by reasoning. In other words, we commit ourselves to maintaining a critical attitude towards ourselves and the others" (Rigotti and Greco 2005).

Argumentation is a complex subject which has been studied for a very long time by researchers from many disciplines such as philosophy, logic, linguistics, argumentation theory and others. The ubiquity of argumentation and its importance in both thinking and learning, have made it a subject of research within the field of psychology. Areas that have been studied within this field include the skills required for arguing, and how they develop; whether people can learn to argue, and if so, how; whether argumentation has a role in cognitive development; whether adults and children, girls, and boys argue in the same way; whether people argue in the same way with a peer as they do with someone with a different hierarchical status; whether people can argue about any subject; or whether culturally shared values and rules affect argumentation.

Linguists, philosophers of language, psycholinguists, theorizers of argumentation have tried to model this particular type of communication, notably by examining the rules of argumentative discourse and how it is linguistically performed. Their attention in usually focused on the specific, normative properties of argumentation. Our focus in this chapter is different. We are interested in understanding how children and adult develop argumentative abilities, why and with whom. Sophisticated argumentations are rare in everyday or professional life – or even do not occur at all. Our psychological approach invites us to consider individuals when they think, feel, recall, project themselves and act in social situations involving confrontations and justifications of their points of view. So we will be examining argumentation from the particular perspective of social and cultural psychology, and in so doing we will consider argumentation as a practice that is situated in and performed in certain everyday activities by individuals.

Argumentation is a very suitable subject for examination from a psychosocial perspective. It involves an individual (the proposer), an interlocutor (or opponent) and an object (subject of the discussion) about which there is a divergence of points of view. To the three sides of this "psychosocial triangle" we will add a fourth: the mediation tools. For indeed in any communication situation it is important to consider the tools (technical and symbolic) by means of which the actors conduct the interactions.

Argumentation involves cognitive, interactive, and dialogical processes of meaning-making. It does not take place in a social vacuum, but in an institutional and cultural context. So dimensions that have to be taken into account include the individuals with their own cognitive and communicational capacities, the interlocutors with their status and intentions, the topic under discussion, the mediation tools used, and the sociocultural context. We will try to describe how these different and interdependent dimensions work in everyday practices, by focusing on:

- The intrapersonal dimension of the argumentation. What are the thinking tools which are required at the individual level in order to enter into this cognitively and emotionally complex practice? We will try to understand the cognitive

prerequisites which enable an individual to take into consideration the dialogical dimension of the argumentation, we will examine the affective aspects of it, and the individual's relationship with the subject of discussion and with the mediation tools.

- The dialogical and interpersonal dimension. If we take into consideration only the individuals involved in the argumentation, we cannot understand the dialogical complexity of the activity. So we have to consider the interaction between the individual and the interlocutor and study how argumentation, as a particular type of dialogue, contributes to the entry of individuals into a field of specific activities, in a culture and in learning. This will also leads us to a closer study of the characteristics of the interlocutor. The dynamics of the interaction and argumentation are affected by whether the argumentation takes place with a peer, an adult or a superior in the hierarchy.
- The content (topic) around which the argumentation is taking place is undoubtedly more than just the pretext for the argumentation. We will study how its specific properties may constrain or enhance the argumentative processes involved.
- Mediation tools are also an important dimension as their form, the uses they crystallize and the operations that they make possible are all inherent to argumentation.
- The sociocultural dimension. Argumentative dynamics occur in specific sociocultural contexts, which orient, constrain, and contribute to the form that they will take. In this light, argumentation is always "situated." So we will consider how in a given place and at a specific time, argumentation practices take place within other activities and how cultural usage and traditions contribute to the forms which the argumentation takes.

2 Intrapersonal Dimension of Argumentation

Although argumentation is clearly understood here in its dimension of interaction, it also involves skills that the individual must be able to actualize to engage in argumentation.

2.1 The Cognitive Prerequisites Needed to Enter into Argumentation

Some authors see traces of the beginning of argumentation in very small children, while others emphasize the complexity of argumentative discourse. Such discourse does involve different cognitive and linguistic operations, processes such as supporting, planning, coherence, and continuity of subject; so it is thought not to be really mastered under the age of 16 or 17 (Dorval and Eckerman 1984; Dorval and Gundy 1990; O'Keefe and Benoist 1982).

Very early, at about 2 or 3 years old, children show themselves to be capable of argumentation in the context of their daily life, in the sense of trying to convince someone else while taking their interlocutor's interests into account (promises, repetition of the same argument; insisting, etc.). Their discourse bears traces of the operations of justification and/or negotiation, but these operations are still very undeveloped. It is only older children who use organized argumentative discourse, involving specific, articulated operations, consisting of arguments and counter-arguments (Golder 1996).

At the psychological level, argumentation involves specific processes such as:

- *The ability to decentrate*. The individual must be capable of decentration. This process is described by Piaget as the ability to consider the point of view of another person rather than just the child's own point of view as the centre of any representation of the world. The child cannot acquire the faculty of arguing until he or she has emerged from egocentrism, as "so long as the child supposes that every one necessarily thinks like himself, he will not spontaneously seek to convince others, nor to accept common truths, nor, above all, to prove or test his opinions" (Piaget 2007, p. 33). According to Piaget, the child only develops its argumentative ability at about 7 of age, at same time as decentration which is when the child becomes aware of the distinction between the self and the world. Argumentation requires individuals to distance themselves from their own discourse and envisage it as one among other possibilities. So children could not argue in a developed manner until they had reached the threshold of the stage of formal operations. Only children of 12–13 years would be capable of simultaneously defending their point of view and taking into account that of their opponent. In another research field, studies have been carried out in contexts more meaningful for children and have shown that they acquire at an earlier stage, at between 3 and 5 years of age, the decentration which allows them to take account of another person's point of view (Astington 1994). In this paradigm, it is the acquisition of a theory of mind that takes the place of decentration and permits the child to take another person's position into account (i.e., the ability of attributing mental states to the other person and taking them into account in order to predict and interpret their behavior). So a theory of mind makes it possible to develop argumentation abilities at an earlier age than that given by Piaget.
- Relating one's point of view to that of others: psychologists observe the ability to relate another person's argument to their own only relatively late in development. Younger children make their contributions in turn, in a sort of "collective monologue" that Piaget describes as the expression of the egocentrism of the young child. Argumentation requires an individual to take into account not only the interlocutors in an argumentative discourse, but also their beliefs and arguments, which is particularly difficult for a child. In effect, it means using "acceptable" arguments, i.e., those based on common values or on collective standards (Miller 1987).
- Providing justification and evidence. It seems that at first the child believes all hypotheses and does not feel any need at all for evidence. In particular, Piaget

> explains this by referring both to the fact that the child is not aware of his or her own train of thought, and also to the fact that the child only reasons about particular cases and is not capable of generalizing. Piaget distinguishes the appearance of logical justification or evidence (at the age of about 7) from justification or causal explanation. From Piaget's point of view, it is the time when the child experiences "the shock" of "our thought coming into contact with that of others, which produces doubt and the desire to prove (…). The social need to share the thought of others and to communicate our own with success is at the root of our need for verification. Proof is the outcome of argument (…). Argument is, therefore, the backbone of verification. Logical reasoning is an argument which we have with ourselves, and which reproduces internally the features of a real argument" (Piaget 1969, p. 204). Systematic justification is only seen at about 13–14 years of age (Golder and Coirier 1994).

However, in studying the competences and processes involved in argumentation, several issues encourage us to examine more than individual, intramental skills. A distinction needs to be made between oral and written argumentation. We also need to acknowledge the importance of the affective dimension, and the role played by the content.

2.2 Oral and Written Argumentation

Psycholinguists try to trace the acquisition of linguistic tools in argumentation, such as connectors (temporal, logical, of concession, etc.) and certain adverbs (hardly, only, nearly, etc.), as a function of the child's development (Moeschler 1989). Other researchers observe argumentation more in the linking together of propositions in dialogue rather than in the use of certain connectors or adverbs (François 2005).

Argumentation seems to be more difficult to master when a written text has to be produced. From the point of view of development, children first meet situations which require oral communication before they find themselves in situations which involve the written word. Children learn oral argumentation within a family situation (Dunn and Munn 1987; Pontecorvo and Arcidiacono 2007). They argue in order to achieve personally significant aims such as possession of objects (Hay and Ross 1982). Within the family, parent–child conversations involving conflict have been studied. These studies show that by 2 years of age, children are highly familiar with conflict interchanges, and by the age of 4, they have long been witnesses of and participants in family conflicts (Stein and Albro 2001). They become increasingly skilled, particularly in acquiring more language and cognitive skills and new social knowledge about rules and rights. François (2005) showed that while playing, children manage to justify their point of view and to oppose adversaries' propositions from the age of 4–5 years. 3 years seems to be the key age for producing justifications. Before this age, children use bodily persuasive strategies (aggressive gestures, crying) or verbal strategies (intimidation, threats, blackmail) to convince

other people, rather than argumentative strategies. Stein and Miller (1993) suggested to children aged 7–14 years that they should resolve dilemmas in areas with which they were familiar. The results show that children know how to adopt a clear position and defend it from the age of 7. They identify the factors involved in the conflict but do not really offer any response to their opponent. At about 11, they produce both justifications explicitly defending their point of view, and statements referring to their adversary's point of view.

The problems facing children regarding written argumentation clearly arise from the characteristics of literacy itself; the writer has to assume all responsibility examining and comparing ideas, within the same text (Perelman and Olbrecht-Tyteca 1969). They have to consider the diversity of opinions on the same subject and select the most relevant. They have to anticipate objections and use coherent linguistic methods to connect the elements together. This diaphonic or even polyphonic dimension of argumentative texts is mastered relatively late in development. In an argumentative dialogue, the presence of two individuals face to face seems to act as a support for the child in understanding the other person's point of view and adapting to it. In written argumentation, more effort is involved in identifying the purpose of the discourse (Dolz 1996).

Some psychologists can see a fairly strict chronological order in the mastering of written argumentation: at around 10–12 years, children are capable of backing up an opinion; around 13–14 years, they begin to modulate their text and take a certain distance with the opinions expressed; at 16 years, they master modulation and consideration of counter-argumentation.[1]

However, contrary to this vision of entry into written argumentation centred on individual competences, other researchers have drawn attention to the importance of the practice and teaching of argumentation. Argumentation has only recently been taught in the primary school, in certain countries. In addition, textbooks are rarely written in dialogue form and they very rarely give alternative arguments when explaining a subject, which may also account for the fact that written argumentation skills are mastered late.

This debate about the skills and processes required is important as the conclusions reached will have repercussions, particularly on the types of educational actions envisaged: should the teaching of argumentation in school wait until the skills related to the child's cognitive development have been acquired? Can this development be accelerated by creating stimulating situations? Can argumentation be taught through specific activities from the first years at school (Brassart 1990; Dolz and Schneuwly 1998)? [see on this subject the chapters in this book by Mercer and by Schwarz].

[1] With regard to the operations of support or backing up, Golder and Coirier (1994) propose five levels of structural organisation: absence of explicit position taking, adoption of a position not backed up, adoption of a position backed up by one argument only, adoption of a position backed up by two arguments, adoption of a position supported by two arguments connected to each other (Dolz 1996, p. 230)

2.3 Affective Dimension

The question of emotion, identity, and feelings should not be overlooked in argumentative situations (Plantin 2004). When individuals enter into argumentation, they undertake both a commitment and a risk: commitment, because they consider that an issue is sufficiently important to be introduced into the discussion, and risk, because by advancing an argument, they will have to have it examined and they may face attack by the other person, and they also risk loss of face in the sense described by Goffman (1967). According to Stein and Miller (1993), knowledge of the function, form, and content of the argument "emerge out of a desire to ensure that personally meaningful goals are attained" (p. 101). These authors believe there are four components underlying the development of argumentation (1) a desire to achieve objectives which have meaning for the individual; (2) awareness of the positive and negative consequences of the actions associated with achieving these objectives; (3) awareness of the obstacles hindering the achieving of these objectives, and (4) beliefs concerning the consequences of not achieving the objectives. More generally, Stein and Albro (2001) demonstrate the importance of the personal and social aims of the interlocutors, who fear all along the dispute that it might disrupt the friendship of the relationship. In the field of education, Van der Puil et al. (2004) examine the fact that organized sequences of argumentation during software-mediated learning activities are often followed by time spent repairing the relationship, as if argumentation itself has a negative effect on the relationship between the participants. The emotional dimension is salient again when the participants in an argumentative discourse are faced with contributions that they judge to be unfair. In relation to this, Mischo and colleagues (Mischo 2003; Christmann et al. 2000) show that in such a situation the participants tend to express themselves either by emotional reactions or verbal confrontation.

2.4 Meaningful Objects of Argumentation: Individuals' Relationship with the Content

Too often, researchers regard the content, the subject being discussed in the argumentation, as a pretext for the observation of argumentation skills and their development. However, it is by no means certain that argumentation skills belong to an individual, independently of the content. Voss and Van Dyke (2001) have clearly demonstrated the importance of the subject's relationship with the content in explaining contradictory results between different studies, some of which show that young children are already capable of developing argumentation skills while others observe that these skills have not been acquired by children of the same age: "This apparent disagreement can be resolved by noting the roles of two factors, the tasks and two types of knowledge, of subject matter and of argument-related verbal structures or schema. Young children have experience in conflict situations,

and they become personally engaged in them. They have encountered peer and parent–child interpersonal conflict. When they enter into argumentation, their knowledge and experience in social relationships is activated with their related argument structures, even though in many cases the children probably could not verbalize the nature of such structures. However, what could happen if such a child were asked as an individual why people return to prison? (…). Whether or not a person is able to perform reasonably in an argumentative situation depends on context, which includes the argument's contents" (2001, pp.102–103).

In relation to school, Douaire (2004) also observes that students who had to engage in argumentation during geography lessons had difficulty decentering from their perspectives especially if they were very concerned with the issue. We know how important it is to be familiar with the topic under discussion and interested in it; these aspects affect the development of argumentative strategies. The nature of the subject matter refers back to the individuals' previous cognitive and affective experience.

Some researchers have also found that it is important for the individual to feel that the subject under discussion is "discussable." For example, Golder (1996) observed that certain subjects become "discussable" as a function of a child's age. However, it is also true that the cultural context plays an important role in establishing what is discussable; in some historical and cultural configurations God, His nature, His intentions, the form and place of the Earth within the Universe, the evolution of Humanity, and many other subjects, may be regarded either as a subject for debate or a taboo subject. So before argumentation can take place, the partners have to consider the subject to be discussable; but discussability is perceived differently according to the social or cultural group to which individuals belong.

So in our perspective it is important to see that argumentation cannot be reduced to its developmental and intrapersonal factors: "Whether or not a person is able to perform reasonably in an argumentative situation depends on context, which includes the argument's contents" (Voss and Van Dyke 2001, pp.102–103).

3 Dialogic and Interpersonal Dimension of Argumentation

The presence of another person is not only a characteristic of argumentation as a special form of communication, it is also key to the processes of thought and learning. Identifying the dialogic dimension of argumentation makes it possible to demonstrate that argumentation always involves an interaction, a type of dialogue (even one in which one person argues with themselves) in which argumentation emerges as a response to doubts or divergences on the part of an audience: arguing involves presenting different views on a single subject. So by its essence argumentation is a relationship with an "other," who may or may not be physically present, but whose contradictory or sceptical voice contributes to the emergence of argumentation (Van Eemeren and Grootendorst 2004). By addressing their discourse, the speaker anticipates their interlocutor's response in a process which Bakhtin calls "responsive understanding" (Bakhtin 1981). In this light, all interventions take

their meaning from what precedes them and what follows them in a chain of discourse; argumentation is therefore the product not of an isolated thought but of cooperation by the participants.

3.1 Dialogue and Thought

Emphasizing the dialogic dimension of argumentation leads us to consider the role of verbal interaction, and in particular of dialogue, in the construction of thought. A sociohistorical perspective in psychology draws attention to the fact that development and learning are "co-constructed" in social interactions. In situations where children relate to other people, they are led to modify or construct their representations and understanding of their environment and of themselves. In this sense, development takes place while moving backwards and forwards between the intrapersonal equilibrium of understandings of the world and the interpersonal level; the knowledge and tools developed at this level are then internalized by the child, who appropriates them as personal thinking tools.

In Vygotsky's theory, often referred to in research into the role of social interaction in learning, language (and oral language in particular) is conceived as having two principal functions: as a "communication tool," it is used to share and develop the knowledge which makes social life possible, while as a "psychological tool," language is transformed into a tool for reflecting on one's own activity, so making it possible to reason, plan, organize thought and verify one's own actions: "Children solve practical tasks with the help of their speech, as well as with their eyes and hands" (Vygotsky 1978, p. 26). But these two functions are inevitably interdependent; children learn to talk in the concrete practices of their life, they learn language by using it in activities in the community into which they were born. Bruner (1990) in particular, and other scholars (Mercer 2000; Mercer and Littleton 2007), have shown how the development of young children is constructed through and by their dialogues with the people around them.

The work of Pontecorvo and her team is interesting in this light. Based mainly on cultural psychology, the team considers that psychological processes (memory, sense of personal and social identity, etc.) can be studied through the manner in which the culture allows for them, organizes and speaks of them. So they study the phenomenon of socialization, which is understood as a reciprocal exchange of adaptation and knowledge between society and its new members, taking a particular interest in language which is considered not only as the instrument, but also the aim and object of socialization. Pontecorvo and her team use analysis of the everyday activities of children in the context of the family and school to see how what Bruner calls "the mind in the culture" is constructed. From a detailed analysis of verbal interactions, the authors show that family conversations are one of the important places in which the social and relational function of language develop. The ability to argue is constructed interdependently in the cognitive, language-related, and social domains. So the child's experiences in conversation play a very important part in building comprehension of the structure of conversation and of argumentation (Pontecorvo and Arcidiacono 2007).

Ordinary conversation, particularly dialogue, is the matrix for our reasoning and our learning, and the foundation for the possibility of entering into dialogue: "conversation is the natural arena for exercising intelligibility of cognition and actions" (Trognon 1997, p. 253). Conversation brings out a particular, pragmatic, form of rationality which uses all the social assumptions which govern human entry into the world of language.

On this subject, developmental psychologists have shown not only how young children are induced to enter into argumentative types of dialogue in their everyday activities with their parents or peers, as we saw earlier, but also how argumentation itself may be a factor in learning (argumentation as tool for constructing new knowledge, new relationships with others and with oneself).

3.2 Social Interaction, Argumentation, and Development

For understanding argumentation in a learning situation, we were interested in studies which examined the effects of confrontation and of a shared goal beyond that confrontation. In particular, studies of sociocognitive conflicts (Darmon et al. 2008; Perret-Clermont 1996; Perret-Clermont and Schubauer-Leoni 1981) demonstrated the importance of confrontation of points of view within social interactions. However, this confrontation is only a source of learning under certain conditions: the child must be ready from a developmental point of view for this destabilizing sociocognitive encounter (Perret-Clermont 1980), and the search for a common solution to the conflict must be of a cognitive nature, and not of a social or affective nature, such as subordinating oneself or trying to please by blind acquiescence (Buchs et al. 2004).

Other research studies leading on from these earlier ones have focused more on understanding the role played by argumentation in learning. They examine how argumentation develops in social situations involving the processes by which people co-develop new knowledge (Baker 1999, and chapter in this book): "The appearance of the new at the intra-psychological level is viewed here as the outcome of a dialogical process of negotiation in the course of which culturally developed ways of acting, speaking, and thinking become part of the learner's internal functioning. Discourse plays a crucial role in such a process as it brings people into a form of social (inter)action that makes it possible for them to negotiate their views on a topic and transform them" (Leitão 2001, p.4). [Schwarz in this work has reviewed the literature on this subject].

3.3 The Status of the Interlocutor in the Interactions

Argumentation practices cannot be understood without also considering the question of the opponent's identity and status. Aristotle himself emphasized the importance of a good knowledge of the intended audience of a discourse, to better convince

them. Some modern researchers have shown that the characteristics of an interlocutor affect the capacity of the young child to consider opposing points of view. Golder shows that the familiarity of the audience is one of the determining factors in argumentative forms: "Working out the positions of the interlocutor, and so anticipating their objections, is closely linked to the level of familiarity of the relationship between the speaker and that interlocutor" (Golder 1996, p.141). Based on her study, she established that between the ages of 5 and 14 children argue in a more diversified and developed way against an adult than against a peer, and against someone they do not know rather than one who is familiar to them. So children are better at negotiating their point of view when they have to convince (a) an adult close to them rather than a peer of their own age; (b) an adult they do not know well rather than an adult close to them; (c) an adult who argues their point of view rather than an adult who does not intervene in the discourse; (d) a peer who is a friend rather than a peer who is hostile to them (Coirier et al. 1990).

In terms of comparison of identities, it is also important to consider the dimension of the interlocutor's expertise. Grossen et al. (1997) showed that in a situation where they feel that their expertise is equal to that of their interlocutor: "The induction of a social comparison leading the novices to perceive themselves as being as able as their partner to perform the task had a positive effect on their performance in session 4 (post-test)" (p. 184). By demonstrating that identities can have a modulating effect, these results could also be adapted to interpersonal argumentative dynamics. The question of the type and gender of the interlocutor may also affect the way in which the proposer enters into the argumentative situation (Psaltis and Duveen 2006; Voss and Van Dyke 2001).

Specific characteristics are concealed in an argumentative situation between a child and an adult compared with an interaction between children: a dialogue between adult and child is a discourse of dominance, while discourse between child and child is one of cooperation or conflict (François 2005). Between peers, the way discourse is linked together is as statement–statement, while an adult introduces a question–response structure; the relationship between children is therefore more equal but also more diversified, and freer; a child demonstrates more self-continuity in argumentation with another child than with an adult. In addition, when argumentation takes place between peers it is experienced more as play, so permitting creativity. Finally, one of the specific characteristics of argumentation between peers, and of dialogue between children in general, is the variety of discursive forms; this is due to the trial and error inherent to learning in children, and to the lesser importance accorded to social prohibitions. Fasulo and Pontecorvo (1999) showed that without a teacher's intervention, learners in school can converse more freely, which enriches their mastery of language. In such a situation children do not feel that they are being judged by the teacher according to the rightness or wrongness of what they say, which allows them to express themselves freely.

Hofer (1999) studying interactions between mothers and their adolescent daughters shows how adolescence is a period of many changes and is marked by certain paradoxes in the relationship with parents, characterized by a desire for independence and a still strong attachment. In parent–child interactions, Hofer observes that parents

try to convince by explanation, while adolescents demonstrate their own individuality by rejection, criticism, and counter-argument. In an analysis of argumentation, it was found that daughters and mothers dominated different aspects of the dispute. The mothers regulated the discourse, while the daughters were more active in generating arguments and counter-arguments.

3.4 Psychosocial Processes

In an argumentative situation, individuals are involved in a communication situation. Each individual is also a member of social groups, depositaries of representations and values which are shared to a greater or lesser extent by other people. But above all, each individual is regarded by the others as a member of a group; they represent a majority in power or a minority without the right to speak.

Social psychology has developed many concepts which can help us to understand how argumentation can sometimes be difficult to distinguish from persuasion or from influence. When evaluating the responses we give to the questioning we meet everyday for which there are no objective responses, we generally refer to someone else. We thus perform a social comparison (Festinger 1954). Social comparison is a way of evaluating perceptions, emotions, sentiments, thoughts, and actions which consist in relating to others. For a person who is questioning the value of a point of view social comparison performs two functions: it is a source of information, and it increases psychological comfort. The individuals will have more self-confidence if the response they have chosen is the subject of consensus in the group to which they refer (Trognon and Bromberg 2006).

It is important to consider the effects of conformity with the group (Asch 1956; Milgram 1974) in understanding the psychosocial processes which may inhibit their engaging in argumentation. For example, some authors have identified two major processes to explain the phenomenon of conformity to the group; the first is “normative influence” (people adopt the group’s norms in order to obtain rewards; this type of influence most affects positions taken publicly), and the second is “information influence”: people compare their response with that of others when they are not sure it is correct (personal opinions are more affected by this type of influence). But if the processes of conformity can prevent argumentation from developing, it may be interesting to study “conversion” (changing a private opinion). According to Moscovici and his co-workers (Moscovici 1976) influence exerted by a minority is more likely to lead to conversion than conformity. When people are confronted with the position of a minority, they engage more readily in creative thinking (Mugny 1982; Nemeth 1986).

In educational situations, the role played by the image of the other person in regulating the dynamics of the argumentation is also important. In particular the role of the teacher (and their representation of the learning processes) may profoundly modify the forms that communication takes, and so modify the dynamics of the

argumentation. Studies of "communities of learning and practice" (Tusting and Barton 2006) demonstrate the mediation function of the design of the teaching on the forms of learners' participation, and therefore on the possibility of using arguments. One important feature of many innovative educational studies is to question a reliance on "top-down," teacher–student communication in favor of learners' collaborative communication as they share and construct knowledge. Arguing becomes a crucial part of class activity (Schwarz's and Schwarz and Andriessen chapters in this book).

4 The Object of the Argumentative Discourse

We saw earlier how important it is to consider the relationship between the individual and the topic under discussion, insofar as past experiences in terms of knowledge and of familiarity may have an important role in implementing argumentative strategies. The subject itself may also be regarded as imposing a certain degree of constraint on argumentative practices; a mathematical problem, a historical or a physical problem are not discussed in the same way. They have different relationships with concrete facts, and the epistemological obstacles and the discursive traditions for each of these disciplines are different (Brna et al. 2002; Douaire 2004) (see Schwarz's chapter in this work).

Different rules guide the actors towards how to argue on different matters and these activities in turn construct the social reality. For instance Amsterdam and Bruner (2000) analyze the argumentative process in the making of legal decisions and the reality that these decisions create. Di Donato (2008) describes the argumentative practices of clients, lawyers, and judges in the "making" of a legal case. Zittoun (2007) describes the specific tradition of argumentation when reading the Tora.

5 Mediation Tools

Human artefacts are not only used to facilitate processes which would exist without them; they also completely transform them. The specific nature of mediation tools contributes to the expression and form that the argumentation will take. Earlier we referred to the role played by mastery of certain tools such as written or spoken language, and to technical knowledge for the use of technologies to facilitate argumentation. But the characteristics of the tool have a mediating role not only in the way in which an individual implements argumentative practices, but also in their entry into a certain culture.

The use of certain tools is effectively an invitation for an individual to enter a culture. For example, by learning to write, a child no longer lives in the spontaneity and immediateness of the spoken word, but begins to reflect on the discourse

produced and becomes capable of going back over its own written product (Olson and Torrance 1996). So the child appropriates an instrument which will allow it to view its own activity and its knowledge from a distance and gradually, by learning to use it, the child will better control its discourse. So written argumentation means entering into a complex activity; it means simultaneously developing certain internal cognitive capacities, and also becoming an actor in a milieu where the linguistic activities of those making statements are structured and organized in writing. Learning to write an argumentative text is not simply a matter of transposing an oral debate into a literate context, but it also means, for example, becoming capable of holding oral discourses whose organization and structure are the product of the controlled work of writing, and carried out by means of the written word. Appropriating writing means structuring one's thoughts and actions using methods developed by a culture of writing. Very often, psychology studies of written argumentation fail to consider the contexts in which texts were produced, but focus instead on intellectual and individual activity. However, it is during teaching and learning interactions that pupils acquire these capacities and access the culture of writing.

In the field of computer-mediated learning, many studies start from the Vygotskian premise that manipulation of external graphical representations facilitates the resolution of cognitive tasks and has consequences on development. The results show that visual representations and structured dialogues can facilitate learning, under certain conditions (Andriessen 2006; Andriessen et al. 2003; Muller Mirza et al. 2007; see also Andriessen's chapter, in this book). Muller Mirza and Perret-Clermont (2008) observe that introducing software designed to support and facilitate argumentation into the classroom has consequences on the whole educational activity.

6 Argumentation as a Socially and Culturally Situated Activity

6.1 Institutions

An inventory of the different contexts in which argumentation takes place raises new questions, such as what it is that distinguishes argumentation in one context compared with another; whether arguing in a courtroom or at home is the same type of communication; what it is that distinguishes them, and what their common points are. The distinction between different contexts makes it possible to show that the institution in which argumentation takes place exerts a constraining effect of greater or lesser degree, in particular in relation to certain historical and social processes which define the roles, rules, and norms of use for the different actors involved. It is therefore essential to consider the institutional context in which an argumentative discourse takes place.

The courtroom is often cited as the place where rhetoric originated, and is an institutionalized setting for argumentation; it has a body of specialist professionals whose task is to provide reasons for judging an individual to be innocent or guilty, and whose roles, tools, and manner of speaking have been defined socially and historically, and need to be specially learned. In this situation, the available "elements of evidence" and the situation (both physical and emotional) in which the event in question took place, the selection of articles of law used to determine punishment, and other elements, are subject to interpretation and consequently to argumentation between the different parties (Amsterdam and Bruner 2000). The two sides set out their opposing positions and each tries to convince the other that their reasoning and perception of the facts are right, while following special rules to do this, within a very specific framework. While argumentation certainly takes place in the courtroom, there are specific norms governing its use by the different protagonists, which give it a recognizable character.

The institutional dimension is also important to researchers studying argumentation in school. The school defines units of knowledge to be taught and learned, and the methods to be used. For learners, learning in school involves participating in an activity which is both cognitive and social, which requires an understanding of the routines, implicit rules and timings which are the foundations for communication between teacher and learners (Grossen 2000; Mehan 1979; Mercer 2000). So teaching and learning are activities which should be seen as situated in institutional and cultural contexts (Lave 1988; Lave and Wenger 1991).

It is therefore important to study argumentative practices by studying the educational objectives and programs: What are the place and educational goals of argumentation in academic programs? At what age should argumentation be taught? What practices are suggested to the teachers? Are they efficient? Certain studies have also demonstrated the importance of the subject chosen in an argumentative discussion (Dolz and Schneuwly 1998). Learners may feel that certain subjects belong to their personal or family life, in which case they would not feel they are allowed to discuss them in a school setting. From the learner's point of view, evaluation is a key issue: if I get involved in discussion in the classroom, will my skills or the opinions I express be judged?

6.2 Cultural Dimensions of Argumentation

In general, representations and the way they are put into words are rooted in the previous and collective experiences of the individual and of the group. People have learned how to find their place, adopt a script, allow themselves to act, take the floor and make claims in front of another person; they have learned their expected roles, rights and duties, and to recognize whether or not subjects are suitable for discussion. The culture offers matrices for thought, symbolic resources for interpreting events (Bruner 1990, 1996).

In argumentative situations, individuals take from their previous experiences references to beliefs and norms that they have shared in interactions with other people, roles they have tried out, subjects for discussion, discursive forms, etc… It is therefore important to ask when and how individuals and groups learn to recognize the value of argumentative communication.

6.2.1 Is Argumentation Universal?

In a way which today could be seen as somewhat provocative, some authors have asked whether all cultures allow their members to develop what they call "basic rationality," the foundational logic of argumentation. For instance, in this field, Miller (1987) studied complex discussions about territorial litigation between Trobrianders. He asks whether certain forms of ritual communication could to some extent prevent the development of collective argumentation. The observations made around the Malagasy form of oratory known as "kabary" (Bloch 1971; Muller Mirza 2005) could be an example of this. Kabary is a discourse where generally the only people who speak are the elders, or people acknowledged as having power. Before speaking, the community's leaders announce the seriousness of the subject they are about to address, according to an unvarying order of precedence which reproduces the hierarchical order and is reflected even in the physical arrangement of the individuals who are present: "From that point, less powerful individuals know that they have no chance of being heard" (Ottino 1998, p. 587). Authority is therefore crystallized by physical and symbolic elements which make its effect natural: "The order in which things are arranged is not seen as the result of the actions of anybody in particular, but of a state which has always existed and therefore of the same kind as the order of nature" (Bloch 1975, p. 17).

In order to determine the role of the sociocultural context in reasoning, during the 1930s Luria (1974/1976) carried out a series of studies in Central Asia, as part of a collaboration with Lev Vygotsky. Independently of the criticism addressed to Luria, the results demonstrate differences in the way in which individuals approach and resolve problems, particularly with regard to their academic level. In general, individuals who have not received any schooling show themselves to be incapable of categorizing objects (or refuse to do so) in a way considered by individuals who have received even basic schooling, to be "correct." Rather than using "theoretical" or abstract reasoning (these are Luria's terms) to resolve syllogisms, for example, subjects who had not been to school use "practical" reasoning, or reasoning "related to a concrete situation."

Luria concluded that this was a lack of aptitude for abstract logical reasoning, but in fact it is more a case of peasants refusing to play the game of logic (Muller Mirza 2005). This reticence goes back to different cultural values – you don't express what you don't know – and to a vision of the world in which it is important to know who is allowed to say what. When attention is focused on the relationships between the object and its context, some authors call this way of thinking holistic

or dialectic thought: "Holistic thought is based more on concrete knowledge than on abstract logic. It is also qualified as dialectic, i.e., that when opposing points of view are put forward, the individual (…) will maintain multiple perspectives and look for a 'middle way'" (Norenzayan 2007). This means that when two opposing points of view meet, the individual will not exclude one of them but will try to find a "middle way." They will look for harmony, as both types of proposition contain elements of truth. Based on different experiences, Nisbett and his colleagues found that people from Asian countries (notably China and Japan) have a tendency to avoid social conflict and reduce contradiction by changing their point of view (Peng and Nisbett 1999). The authors define "dialectic thought" according to three principles: the principle of change (reality is a process which is always in motion, dynamic, and changing); the principle of contradiction (since change is constant, contradiction is constant too and if there are two contradictions, they are connected and mutually control each other); finally, the principle of relationship and holism (nothing is isolated and independent, but everything is connected; if you want to know an object, it has to be seen in relation to its environment). Conversely, analytical thought, which is felt to be more highly valued and developed in Western countries, extracts the object from its context by concentrating on its characteristics in order to assign it to categories according to rules, and tries to resolve contradictions. This reasoning which decontextualizes the object leads to a search for the true and the false from two opposing points of view. The authors state that Westerners rely more heavily on formal logic which separates the structure of the argumentation from its content. Analytical thought is based on three principles: pursuing a single truth; building counter-argumentation; and finally, giving preference to content.

To explain the differences observed, the researchers refer to familiar values of the people studied and shared within their group, and the way in which speech is used and valued within everyday activities. Among certain social or cultural groups, the child gradually becomes familiar, in the different contexts of its life, with the scripts of communication involving values and categories of people with whom an argued discussion is possible. For example it is interesting to observe the adolescents who when faced with a Piagetian task of conservation, will not let themselves contradict an adult's false assertions; they focus on the relationship rather than on the task to be resolved. Bernstein's (1972) studies demonstrate the importance of argumentation in the processes of socializing young children, as arguing involves making explicit the rules, social positions, codes, and reasons for authority behavior, particularly in asymmetrical relationships between children and parents. In certain social environments it seems that children are more exposed to articulated argumentation, while in others, authority is presented in the form of behavior or the taking of a position without words to support it. This type of relationship with authority could prevent the child from developing behaviors of curiosity, exploration, speaking out, and particularly at school, when the teacher encourages a child to construct a position and then support it (Robinson 1982). We suggested earlier that in certain cultural configurations, certain topics are not considered equally suitable as subjects

for possible discussion. For argumentation to take place, the partners have to perceive the subject as "discussable"; but discussability is perceived in different ways, depending on the social and cultural group to which individuals belong.

6.2.2 Implications for School

In the context of school, even when argumentation is considered to be an effective learning tool, actually holding debates to encourage argumentation may in some situations lead to problems. For example, Sekiguchi (2002) shows that young Japanese have difficulty in entering into an argumentation situation in a maths class as they are afraid that they may to some extent damage social harmony, which is an important cultural value. In traditional Japanese culture, the aim of public communication is to create harmony ("wa") among the participants. So people have a tendency to avoid expressing disagreement in public; expressing direct opposition is regarded as very impolite. Cooperation is highly valued, rather than competition. Because people try to avoid direct confrontation, they openly rehearse their opinions in advance, so that they can abandon them or change them easily if other people indicate their opposition. In Japanese classes, teachers often organize exchanges of opinion in the whole class or in small groups. These exchanges are called "hanashi-ai," and the teachers have an important role in managing them, for example by seeking to use conflict setting children against each other as good opportunities to deepen understanding of the phenomenon in question for the whole group; the conflict is shared between members of the class, it becomes "our" problem. Although hanashi-ai can agree on the fact that a solution is better, more correct, effective, elegant etc., competition is generally discouraged; there are no losers and no winners. The teaching of Demonstration ("shoumei") in maths takes place in the context of a "collective model" of Japanese communication. Such demonstration should separate the stated assertion from accepted premises, so reconciling the idea of "following the social obligations of the community" with the process of stating the proof. This model seems more suitable to the style of communication practised in Japan than Toulmin's model (which involves affirmation, foundation, guarantee, and qualifier), used in class in certain Western countries and sometimes metaphorically associated with war: although there is no physical battle, there is a verbal battle, and the structure of argumentation – attack, defence, counter-attack, etc. – takes this into account (Lakoff and Johnson 1980).

For the last few years, researchers in psychology, sociolinguistics, and education have expressed their doubts about a model which they felt was culturally Eurocentred; in their eyes, it put too much emphasis on deductive and inductive forms of justification. They have asked whether in other cultures exist different models which would not necessarily require individuals to take an opposing view, or to be contentious or aggressive when justifying their point of view. Some studies in the field of learning English or French as a second language suggested the difference, at the level of writing, between the argumentative structure adopted by native speakers and the members of other cultures and languages (Disson 2002; Takagaki 2000).

So there are many strategies for justification (deductive, inductive, abductive, narrative, epideictic, etc.), which are used in different ways by members of different cultures when they need to justify and persuade. In particular, some studies have demonstrated the positive value accorded to indirect styles of justification (e.g., justification by deduction, for example) by members of Asian cultures. However, Warnick and Manusov (2000) highlight the fact that the majority of these studies deal with written argumentation (or reports of oral interactions) and question the relevance of the results in relation to oral situations of justification. In research carried out in the United States with students from different cultural backgrounds, they demonstrated the use of different types of justification. Their conclusions open up interesting perspectives in education, emphasizing that in teaching, it is important to consider alternatives to the forms of argumentation which are valued in European cultures. However, we should note that these studies have underestimated major theoretical and methodological problems, such as the definition of the term "culture" (considered as a product, when it is in fact a dynamic process, continually reconstructed, negotiated, and transformed in everyday interactions); they also use very gross categories that are too general and ignore the diversity that exists within this geographical grouping, etc.

7 Conclusion

Argumentation is a cognitive activity which involves the skills of logic and reasoning. Dialogue is a major part of argumentation, which means that it involves all dimensions of an individual – cognitive, communication, affective, etc. This is what makes it valuable in educational situations. It is also what makes it a particularly sensitive and difficult activity, which only seems to arise in certain contexts. Arguing is a highly complex activity which is simultaneously cognitive and social.

In this chapter we have looked at the psychological and psychosocial dimensions of argumentation, and we have demonstrated the importance of the processes of constructing meaning. Arguing is not a trivial activity. It requires the use of language and other cognitive tools, and the ability to recognize another person's position. The ability to develop complex argumentation, i.e., to justify and negotiate, develops gradually in children. However, a narrow focus on the abilities of the individual, seen independently of a situation in which the child has recourse to thought and speech, is inadequate. To sum up briefly: it matters who you are arguing with, it matters what you are arguing about, it matters what context you are arguing in, and it matters why you are arguing.

It Matters Who You Are Arguing with

The question of the "other" is key to argumentation. It lies at the heart of the definition of the activity of arguing; people argue when they have to oppose another form of

thought. The central nature of argumentation means that both the dynamics of interaction and group dynamics are involved in argumentation. The interlocutor's opposition leads the individual to look for proof or evidence, and so to develop a new form of understanding of the subject under discussion. But argumentation is affected by the identity and status of the person who is being argued with. There are issues of asymmetrical relationships and management of status and of power, both between children and adults, and also between peers. The risk of losing or of endangering the relationship is felt by the protagonists in a particular way in an argumentation. Processes of social comparison and conforming to the group are also involved in an argumentative interaction.

It Matters What You Are Arguing About

The form and style of the argumentation differ according to the subjects being discussed; people do not argue in the same way about political or ethical issues, historical events, or biology. Argumentation is affected by its subject, because of the way it has been "built" and because of the representations that it conveys. Every topic has its own social representations, shared to a greater or lesser degree, and brings out emotions and motivations inherent to the activity and which can be contrasted. The issue of the social and cultural legitimacy of the topic of the argument is important.

It Matters What Context You Are Arguing in

The situation dimension of argumentation is illustrated by a courtroom, which has been historically and culturally constituted as the location par excellence of argumentative discourse; in court, speakers use coded discourse, and the rules regarding participants, manner and timing of arguments have been defined beforehand. Other places probably lend themselves less well to argumentation, for reasons related to the hierarchies of social relationships and to issues arising from practices; for example, the care situation and the relationship between patient and caregiver.

It is in the family, another important social institution, that the child becomes familiar with argumentation by participating in an increasingly central manner in discussions. This is where the child learns, more or less, according to family traditions, to develop their position and have it listened to and to listen to other people's positions, either with brothers and sisters or with parents. Within the institution of school, the place and role of argumentation are incorporated within the curriculum, which itself bears traces of historical, economic, and political issues. Argumentation has for a long time been an educational subject in courses in rhetoric, and today it has a place in activities involving debate around current issues or accepted knowledge. However, the learners, as actors in this specific institutional situation, may not consider themselves authorized to participate in building knowledge.

Individuals are also members of larger groups which have developed traditions concerning the division of roles and status, who may take the floor and when, and for what purpose. So the cultural dimension runs through the activity of arguing, and structures it. In certain situations, arguing is regarded as endangering a certain harmony in relationships, if it is not given the boundaries of precise rules. Among the Baoulé of the Ivory Coast, for example, when it is felt that a confrontation is about to start, one of the protagonists recalls a proverb saying that it is not the individuals who enter into conflict, but ideas. In other cultural and spiritual traditions, for example in Judaism, argumentation based on specific techniques and frameworks is regarded as a condition which maintains and renews one's knowledge of oneself and of the world.

It Matters Why You Are Arguing

Sometimes individuals argue, but what is important is not so much the acceptability or rationality of the argument as the sense attributed to the global situation in which the argumentation is taking place; the individuals may wonder whether their opponent will continue to speak to them, if they confront them or whether, if they enter into a debate, their teacher will judge them by what they say, or by their personal opinions; whether, if they put forward hypotheses which they try to support, this will have an impact on the real world; they may wonder whether their representation of what reality is will be overturned.

The personal, social, and cultural implications are very important in this particular activity of thinking which makes it possible to explore the sometimes hard to identify borders between searching for rationality and searching for meaning.

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Argumentation and Learning

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Abstract This chapter provides multiple perspectives on the intricate relations between argumentation and learning. Different approaches to learning impinge on the way argumentation is conceived of: as a powerful vehicle for reaching shared understanding, as a set of skills pertaining to critical reasoning, or as a tool for social positioning. Each perspective has harvested empirical studies that have stressed the importance of argumentation in learning. Methodological tools that fit the respective perspectives are reviewed. In spite of the pluralistic stance adopted, this chapter attempts to draw connections between the findings obtained in the different perspectives. In a separate part, it considers the specific role of argumentation in learning processes and outcomes for four subjects areas: in mathematics, studies are presented that show deep gaps between argumentation and proof. In science, experimental studies are reviewed to examine whether and how argumentation promotes conceptual change. In history, the chapter considers the role of argumentation in challenging narratives and in claiming a position. At last, we describe the new wave that characterizes civic education programs towards the instillation of argumentative practices in democratic citizenship.

Keywords Critical reasoning, Shared Understanding, Learning from interaction, Emergent Learning

1 General Introduction

Writing an essay on argumentation and learning is not only difficult because of the complexity of the processes involved but also because the terms "argumentation" and "learning" cannot be combined without reflecting on their very nature separately. The term "learning" is highly loaded, it means very different things for psychologists

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belonging to different traditions. Socio-cultural psychologists view learning as a process that emerges during interactions. Emergent learning is often conferred to a community that develops new practices that yield new outcomes (understandings, know–hows, etc.). Emergent learning is basically visible as it deploys in interactions among people, in the use of tools, etc. For others learning is a psychological change in the individual which is observed indirectly between successive activities. Researchers that study emergent learning focus on a large context – a community with a common motive in which individuals interact and use tools and technologies, while researchers that study learning as a psychological change focus on individuals. This choice is not indispensable and we will see later on that it is a fact problematic. Since in this chapter learning is considered in a context for which the process (argumentation) and the object (argument) are two sides of the same coin, scrutiny over community in context and over individuals are both relevant. From a theoretical point of view, though, the two views of learning have been considered as incompatible (for example the controversy about "situated learning" in Greeno 1997). Our approach on this controversy will be ecumenical for a simple practical reason: we wished to review research on argumentation and learning and since it is partitioned among the two camps, we were obliged to report on their findings. In several places of this chapter we try to conciliate between them, especially when they seemed to lead to contradictory conclusions. However, an overarching theoretical effort is still to be done. Within the more modest limits of this chapter, since we used the same term, learning, with two different theoretical meanings, we distinguished between the meanings intended by qualifying the first as *emergent learning* and by using the plain term "learning" to refer to a psychological change in the individual.

2 Learning to Argue and Arguing to Learn

The relations between argumentation and learning are complex. This complexity depends in the first place on the multiple facets of argumentation. In the chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource," Rigotti and Greco (this volume) described many of these facets. They raised the term "reason" with its ambiguous meaning as well as the term ratio to characterize a way to think, a relationship between reason and language. In contrast, argumentation was also presented as a tool to achieve goals, arguing in order to understand, clarify a doubt, decide, solve a conflict, amplify knowledge, etc. The relationships between learning and argumentation are then at least twofold. It may consist of learning to reason, to explain or to challenge. On the other hand, it may consist of learning to achieve a specific goal through argumentation. In their book, *Arguing to Learn*, Andriessen et al. (2003) make this distinction clear: "Learning to argue" involves the acquisition of general skills such as justifying, challenging, counterchallenging, or conceding. In contrast "Arguing to learn" often fits a specific goal fulfilled through argumentation, and in an educational framework, the (implicit) goal is to understand or to construct specific knowledge. Do we mean to focus on how people learn to argue, or rather on how people learn through argumentation? They presented the two

directions as alternatives. Are these two directions exclusive, though? When one counterchallenges her peer in a discussion, such a move reveals a skill, counterchallenging, and its "content," the reason invoked to justify an argument previously raised, and by such strengthens argument. Learning to argue and arguing to learn are then not independent. Rather, they are intertwined and often seem inseparable when we observe discussions in classrooms. However, this distinction is helpful to identify the aims of researchers in the studies undertaken so far on learning and argumentation. We organize then this chapter along with this distinction for the sake of clarity of presentation. In some cases, the researchers themselves were explicit about the inseparability of argumentation as a tool and its object in learning processes. This happened with several psychologists with a socio-cultural tradition according to which the context of action is apprehended in a broad sense.

3 Learning to Argue

Developmental psychologists have studied the ability of children in natural settings such as disputes or negotiations. In these contexts, children know how to argue very early. Three-year-old children know a lot about the form, content, and function of arguments in verbal interactions, and by the age of five are skillful negotiators with their parents, siblings, and peers (Eisenberg and Garvey 1981; Maynard 1985; Stein and Trabasso 1985). These findings conflict with very broadly cited studies by Kuhn (1991, 1996) and Nickerson (1986). In her 1991 study, Kuhn interviewed four age intervals to sample: teens, 20s, 40s, and 60s about urban social problems (e.g., "what causes prisoners to return to crime after they're released?"). The interview consisted of eliciting and probing the subject's reasoning about these problems. Subjects were elicited and probed to express their causal theories, to justify them by providing supporting evidence, to generate opposing theory, to evaluate presented evidence, and to answer epistemological questions regarding certainty and influence of the evidence on their own thinking. This study and other studies by Kuhn and by Nickerson showed that people tend to provide theories with a single cause or with multiple parallel causes. Concerning evidence, people had difficulties differentiating between theory and true evidence to often express "pseudoevidence." From a developmental perspective, teens and elderly persons have more difficulties to evaluate evidence, and their judgment is biased by their own standpoint. Also, all age interval samples – even adults, have difficulties in elaborating opposing theories. People at their 20s are the most skillful in this respect. Also there is a clear advantage to more educated persons. The superiority of educated persons was the most pronounced for epistemology. Another interesting finding is that the mastery of skills is quite stable over the social problems that were checked. Such stability confers to the "argumentive skills" (according to Kuhn's terminology) a status of "general skills" that develop in the life span. In summary, Kuhn's studies (1991, 2001) showed that in the sixth- to the ninth-grade period, argument skills grew in children. After that, educational level made the difference, with college-educated people performing better than ninth graders, but with people without

a college education performing at a level between sixth and ninth graders. Kuhn (2001) identified developmental differences according to a three stage development of epistemological understanding: *absolutist*, in which knowledge consists of facts, *multiplist* or *relativist*, in which knowledge is regarded as an opinion, and *evaluativist*, in which claims and support are acknowledged. The influence of Kuhn's studies on research in learning to argue has been substantial since learning can be measured by the increase in argumentive skills scores and since the tools proposed are relatively simple to use (Zohar and Nemet 2002).

Stein and Miller (1993) provide theory and findings that help overcoming the contradictions between the natural propensity children have in engaging in argumentation and biases in argumentive skills. According to Stein and Miller, although argumentation skills emerge very early in development, knowledge about the function, form, and content of argument "emerges out of a desire to ensure that personally meaningful goals are attained" (p. 101). Stein and Miller introduce emotion in argument contexts to assume that four components underlie the development of an argument (1) the desire to achieve personally meaningful goals, (2) knowledge about the positive and the negative consequences of actions, associated with the attainment of these goals, (3) knowledge about obstacles that stand in the path of goal attainment and (4) beliefs about consequences of not attaining these goals. In that way, understanding the nature of personal goals allows predicting the thinking, reasoning, and actions carried out during attempts to resolve conflicts. When children recognize that they have conflicting views, both willingly engage in an argument and both aim at settling it (by wining or by reaching an agreement).

The contradiction between the developmental studies undertaken by Kuhn and by Stein and Miller can also be settled through a different but complementary argument. This argument belongs to the methodological realm. In checking learning to argue, those scientists evaluated argumentative skills. In the two kinds of studies, the methodological tools were of very different nature. For Kuhn (and Nickerson) these were structured interviews or questionnaires administered at different ages (for developmental studies) or before and after an educational treatment. In these questionnaires or interviews, students are typically asked about social issues in order to check whether their ability to give reasons, to produce evidence that corroborates them, to imagine challenges and to rebut them, etc. increases (Kuhn 1991). Similar tools similar are used to measure the success of educational programs to check the acquisition of skills. For example, Zohar and Nemet (2002) used such questionnaires in similar scientific issues to show that during a program on genetics and ethics in which a teacher scaffolded argumentative skills through explicit prompts, the learned argumentative skills could be applied in near transfer and far transfer tasks. On the other hand Stein and Miller directly observed children when settling disputes or negotiating a decision. The ability to challenge or to counterchallenge was observed in situ, not like for Kuhn in interviews in which an experimenter asked questions such as "Could you imagine how you could answer to somebody who does not agree with you? Give reasons" It is then clear from a theoretical point of view that the implementation of argumentation skills is highly sensible to context. A reasonable interpretation of educational studies that evidence

"the acquisition of some argumentative skills" is that intensive programs in which students receive argumentative prompts turn to normative the enactment of argumentative practices in the specific context in which these practices developed.

The suggestion that argumentative skills can be differently enacted through manipulations that modify the goals of subjects has been confirmed in a recent study by Glassner and Schwarz (2005). Glassner and Schwarz investigated what they called the antilogos ability, an argumentative skill that consists of critically evaluating whether information presented actually supports a given claim. The antilogos ability was tested for different variables: age group (Grades 8 and 10), direction of information (one text was presented as supporting a claim and the other was presented as opposing the same claim), whether or not a personal argument is constructed before critical evaluation, and whether or not a worked-out example is provided before critical evaluation. The study indicated that (a) antilogos develops during adolescence; (b) it differs for different directions of information; (c) the combination of expressing personal argument before critical evaluation and being provided a worked-out example improves antilogos performance in Grade 8 students; (d) personal standpoint can be neutralized during critical evaluation. This study indicates both a developmental trend and the fact that context can considerably modify the manifestations of this skill.

3.1 Implications of Research on Learning to Argue on Education

The research we overviewed has very important educational implications, on the role of school to foster argumentative skills. School should be sensitive to providing adequate contexts for argumentation. In general, the effort of the educator should be put on (1) designing situations in which the personal goals of the students (implied by the design) will help them engage in situations with educational value, (2) help students in identifying the goals of all participants. Another insight is that the explicit teaching of argumentative skills is often valueless: since students acquire basic argumentative skills very early, what is more needed is to contextualize these skills in educational settings. Schwarz and Glassner (2003) have described the asymmetry between everyday life and scientific argumentation through personifying everyday argumentation by a blind person and scientific argumentation by a paralytic person: The blind – the everyday arguer, can operate argumentative moves (can walk) but the result of the negotiations is often unclear – he/she does not know exactly where to go. The paralytic – the scientific arguer, receives principles, laws, theories; he/she can see them, but is not able to move on with them, to use them in further activities. This is then the job of the educator to design activities, and to provide tools with which the natural propensity to engage in argumentation could be capitalized for scientific issues.

This kind of result puts to the fore the importance of education and suggests that when Kuhn showed that "argumentative skills" are more elaborated among persons that learned at university, this does not necessarily mean that these "skills" characterize

people who (will) go to the university but simply that students can learn to use argumentative skills naturally deployed in everyday discussions, in formal settings (such as interviews) and when they are invited to discuss scientific issues.

Educational programs generally do not put to the foreground of their rationales the fostering of argumentation. Rather, many educational programs are dedicated to promote "critical thinking" but their implementation heavily depends on the instilment of argumentative practices. Still, the variety of these programs is immense. Since, as we pointed out, argumentative practices are highly sensible to the goals of the participants (and of course, among them the teacher), it is important to identify the ideologies that underlie educational programs fostering critical thinking and argumentation. For example, in Perkins' Point Zero program, the learning to argue is realized through explicit coaching that express an ideology that considers education to think as the acquisition of thinking skills similarly to an apprentice that acquires craft in a workshop. And indeed, students are coached to express argumentative skills which are generally considered as meta-cognitive skills in a cognitive apprenticeship setting. One of the most celebrated programs dedicated to critical thinking is Lipman's "Philosophy for children" (P4C) (Lipman 1991) in which students are presented issues with a (folk) philosophical character and that are relevant to society. According to his ideology, critical thinking concerns understanding and not skills. The understanding is realized through dialogues among students, and dialogues between students and the teacher. Mercer's "Thinking Together" program (Dawes et al. 2000) concerns another ideology, the fact that education to thinking should focus on fostering dispositions rather than skills or understanding. Concerning argumentation, students are invited to comply with ground rules about what they call "exploratory talk" (and which could be called also critical reasoning). These rules are well known by students but they must enact them during classroom discussions. The role of the teacher is to sustain collective talk according to such ground rules. These three programs for fostering critical reasoning are quite archetypical. They differ strongly according to their ideologies and such ideologies induce different kinds of argumentation. Although we favor plurality (we are more sympathetic to an understanding-dialogic ideology, though) it is imperious to evaluate the programs that foster "learning to argue" with tools that fit their underlying methodology. For example, while P4C is clearly a program whose ideology concerns understanding, its impact has been measured by using tools pertaining to the acquisition of skills ideology. This is probably for this reason that, although the P4C program seems a sophisticated and extremely well-designed program, its evaluation shows mixed results: the tools for evaluating the P4C program are generally tools that fit a "skill acquisition methodology."

4 Arguing to Learn

In comparison with "Learning to argue" the volume of research and of educational initiatives that focus on argumentation as a tool for learning specific content is much more voluminous. In the two last decades, theoretical, empirical, and design efforts have been invested in this direction. We review first the theoretical

work that has been done. This review is important since it impinges on empirical studies as well as the setting of learning activities. We then review empirical studies that have general implications on the relationships between argumentative activity and learning. Such studies have given birth to tools and strategies that may afford productive argumentation. In the last subsection we review research on argumentation and learning in specific domains, mathematics, science, history, and civic education.

4.1 Theoretical Underpinnings: Why Argumentative Activities Can Lead to Learning

The various definitions of argumentation point at social as well as cognitive aspects (e.g., as defined by van Eemeren and colleagues – see chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource"). We will see that from a theoretical point of view, each of these aspects should lead to learning.

According to the cognitive aspect, argument generation, whether in solitary or group format, causes a person to ponder the explanations behind solutions or perspectives, and requires him/her to express them in verbal, explicit communication. Such an act taken in isolation is also a self-explanation whose generation would be expected to lead to the "self-explanation effect" (Chi 2000, Chi et al.1989, Chi et al. 1994, Neuman and Schwarz 1998, 2000): the act of epistemic examination of one's personal theories and the reasons behind them is considered to improve understanding and knowledge construction processes (Baker 1999, Chi et al. 1989, Kuhn 1991). However, argument generation in an argumentative activity conveys more than an explicit verbal articulation of theories and their reasons per se. The verbal articulation is directed to another person, and may further encourage clarification of contradictions and faults in one's understanding, especially when communications are aimed at convincing others. In fact, research on accountability effects has shown that even the mere anticipation of an unknown audience that might require explanations or justifications has been found to improve a person's quality of thinking (see for example Tetlock 1992). Thus, this type of nondialectical or one-sided argumentation alone is expected to yield cognitive gains.

In addition, dialectical argumentation requires, by definition, the examination and coordination of different perspectives. Participants are forced to acquire new information about the topic under consideration, since they are exposed to a multiplicity of ideas and encouraged to explore the validity of each of these ideas. This means that they have to consider objections to their personal theories and assumptions, to attempt to understand alternative positions and to formulate objections and/or counter-objections (Stein and Miller 1991). Thus, the mere effect of exposure to and creation of more relevant information in argumentative contexts would alone be expected to lead to better learning results. In addition to such cumulative effects, however, the dialectical dimension of argumentative interaction is thought to have

considerable qualitative advantages. First of all, when engaged in exploring the reasons why a certain theory is faulty, it not only allows one to propose convincing arguments to refute that position in a discussion, but it also deepens his/her understanding of the correct concept in the process (see also Kuhn 1992). Secondly, argumentation's unique structure of linking premises, conclusions, conditions, rebuttals, and so forth is also thought to considerably improve and extend the organization of knowledge, which leads to better recall and understanding on subsequent test occasions (Means and Voss 1996). This claim is further supported by current theoretical models that regard human thinking and the organization of knowledge presentations as mainly argumentative in nature (see e.g., Antaki 1994, Billig 1996). Accordingly, dialectical argumentation may be conceptualized as a tool, whose particular form provides a supporting and organizing structure to examine, evaluate, and elaborate on different ideas and to reach a solution.

Argumentative formats of reasoning are, furthermore, likely to significantly reduce some of the extensive cognitive load that is involved in learning, especially in tasks that involve cognitive conflict techniques. The individual cognitive load may be reduced by collaborating with other persons, through the combination of individual resources and the distribution of task-related cognitive demands among the participants. The dialectical dimension of argumentation, however, may provide an additional advantage to mere peer cooperation: Instead of having to represent the different views in one's mind and to elaborate, evaluate, and integrate them, an argumentative group discussion enables the objectification of perspectives and their representation by actual persons defending them (Baker 2003). Such an effect would be expected to significantly reduce the cognitive load.

So far, we mainly considered the cognitive aspect of argumentation and how this aspect may facilitate learning. We considered the individual at the center, the peers helping in elaboration of knowledge. The social aspect of argumentation was considered through the individual. A first very general potentiality of the social role of argumentation in learning concerns the fact that argumentative activities include practices for which participants feel highly engaged and motivated. They are committed to convince, or to understand, and to present personal views. Several researchers (e.g., Rogoff 1990, 1998) have regarded argumentative discussions as settings through which shared understanding emerges, testimony to the fact that the active engagement to share ideas takes place. Miller (1987) explained why argumentation achieves shared understanding and learning. In a theoretical analysis, Miller explained that three cooperation principles of argumentation provide the coordination that leads participants toward a set of collectively valid statements: generalizability, objectivity, and consistency. A statement is justifiable (generalizable) if it has been immediately accepted by the participants or if it can be traced back to other statements that have been immediately accepted. The status of statement may change for the collective according to the principle of objectivity: if a statement cannot be denied, it becomes collectively valid. Consistency, the third principle, precludes the acceptance of contradictions in the realm of the collectively valid. This interesting analysis is theoretical, though. It adds to the Vygotskian general idea of internalization (Vygotsky 1981):

"The higher functions of child thought first appear in the collective life of children in the form of argumentation and only then develop into reflection for the individual child" (p. 157). It also adds to a contemporary formulation of Vygotskian ideas, the idea of *participatory appropriation* (Rogoff 1993): "the process by which individuals transform their understanding of and responsibility for activities through their own participation… participation is itself the process of appropriation" (pp. 150–151). However, such ideas do not rely on fine-grained studies that scrutinize relations between social and cognitive aspects in argumentative activities. They are not specific enough. We will see later on in this chapter how Cobb and his colleagues, who adopted this socio-cultural stance, successfully described how collective argumentation led to autonomy of individuals and in participation of the emergence of new mathematical practices. Cobb and colleagues propose the term "taken-as-shared'" understanding instead of "shared understanding" to preserve a psychological aspect in his analytical method to analyze classroom activities. However, in the teacher-led discussions that took place in classrooms according to a careful design, talk was always argumentative.

We claim that it is imperious to be sensible to different types and patterns of engagement, and fine-tuned coding systems for identifying claims, counterarguments, evidence, conditions, justifications, etc in order to analyze learning processes stemming through shared thinking. As Teasley (1995) mentioned: "(…) simply having a partner and talking a lot will not improve learning. What seemed to be crucial to learning [in this task] is that children produced the types of verbalization that supported reasoning about theories and evidence" (p. 219). We argue, therefore, that it is imperative to distinguish between different types of discourse and to identify different argumentative interactions, to test their relations to learning. Theoretical considerations and empirical studies on this issue are still in an embryonic stage. Some speculations on the recurrence of argumentative formats similar to Bruner's formats for language acquisition (Bruner 1982) and on the formation of corresponding "topoi" – general understandings deriving from the regularities in meaning emerging from the participation to these formats have been raised by Krummheuer (1995). However, these are only speculations so far.

Several teams have entered a more modest path, but also more realistic for now, the characterization of talk or dialogues according to holistic features, and the empirical study of correlations between the engagement in such dialogues and subsequent learning. Mercer, and Wegerif (Mercer 1995, Wegerif et al. 1999) distinguished between cumulative, disputational, and exploratory talk, the latter being responsible for (emergent) learning and change. Asterhan and Schwarz (2007) discerned between two-sided argumentative dialogue, one sided argumentative dialogues and nonargumentative dialogues to correlate them to subsequent learning gains. Although this approach – the analysis of different types of talk, has constituted a decisive step for the empirical study of arguing to learn, it has not led so far to a real breakthrough in the understanding of learning mechanisms emerging from recurring argumentative formats.

5 General Review on Research on Arguing to Learn

Research on arguing to learn can be classified according to the methodological paradigms used to observe it. The first method is indirect. It concerns observing students in subsequent activities in which observation is more convenient – generally in tasks given to individuals. We show then that in order to be effective in studying arguing to learn directly, one should first discern between types of talk. We then report on studies that describe emerging learning in argumentative talk. We conclude by suggesting that the two methodological paradigms should be merged although such an effort did not succeed so far.

5.1 Studies of Learning in Activities Following Argumentative Interactions

Among the theoretical reasons for learning outcomes in and from argumentative activities, the Vygotskian idea of internalization of social interactions is the most popular. It is then natural to trace learning in activities after argumentative interaction. The types of activities that have been used for this purpose are diverse: from simple expression of attitudes/opinions (e.g., after a discussion), to structured interviews or argumentative writing of essays. The timing of these activities is also diverse: from immediate tests to tests after several weeks. In most of those studies the aftermath activity involves individuals; the research question concerns "effects of interaction on individuals." The argumentative writing of essays is problematic since the biases and weaknesses in content and structure of written arguments may be attributed more to the difficulty to engage in the argumentative writing process itself than to shortcomings in the participation of students to a previous argumentative activity. Also, gains from argumentative interactions may stem from the writing process itself that demands to a very rich cognitive activity. In spite of these caveats, written arguments are nevertheless used to measures gains from previous argumentative activities (Kuhn et al. 1997, Schwarz et al. 2003, Sandoval 2003). This kind of methodology is justifiable though, if the researcher keeps in mind that the written argument is the product of two activities, the argumentative interaction, and the writing process.

Several methods have been developed to analyze argumentative texts. The most obvious analysis concerns change of standpoint or of attitude. For many contents (e.g., in social issues) change in standpoint does not occur as a result of argumentative activity and learning should be identified in more subtle features of the written text. The second most common method is structural: it consists of identifying Toulmin components in the written text: What students cite as evidence to support their claims, or how do students make warrants rhetorically and how do they refer to data within explanations (Sandoval and Millwood 2005). Another method concerns an evaluation of the form of the written text (also called the argumentative

level of the text). Mani-Ikan (2005) integrates ideas by Means and Voss (1996) and Kuhn (2001) to propose five levels:

Level 1. Unwarranted: unsupported claim/s.
Level 2. One sided: an argument containing claims and reasons for only one point of view.
Level 3. Multiplist: an argument containing claims and reasons for opposing points of view or stand, without deciding between them.
Level 4. Decided: an argument containing claims and reasons for opposing points of view, and a declared but arbitrary choice between them.
Level 5. Evaluativist: an argument containing claims and reasons for opposing points of view, and a choice between them, based on evaluation and confutation of the stand not taken.

Obviously, the level depends on the issue at stake and one may write a high-level argument for one issue and a low-level argument for another one.

There are nonstructural changes that concern less holistic characteristics of written arguments, for example certainty. Other changes are characteristic of specific contents: for example, it is valuable to observe change in empathy, agency, and plot scheme in history. To observe changes one has first to establish typical arguments.

These methodological precisions and caveats being made, we can exemplify now in two research papers, methods for studying learning through comparison of texts written before after argumentative activities. Kuhn et al. (1997) investigated the effects of dyadic interaction on argumentive reasoning. They showed that if adolescents or adults were prompted to find consensus or to understand differences of opinions in successive interactions, argumentive reasoning progressed. The progresses were measured in written essays 6 weeks after interaction through identification of number of arguments, their quality (nonfunctional to functional), whether evidence was used, and holistic evaluation of structure of arguments (from one-sided to two-sided arguments). Kuhn et al. study showed interesting results: first the fact that the arguments in the final texts were more two-sided. Also, although opinions did not change, they turned to be more moderated among adolescents than among adults. Also, among subjects that changed from a one-sided to a two sided argument, the adolescents used meta-cognitive statements while the adults did not. The theoretical interpretation of this study is problematic, though: the written text of the individual is understood to represent the argumentative reasoning of the student on the issue. Another thorny issue concerns the nature of the activity designated as "dyadic interaction." Kuhn and colleagues recognized that in most of the dialogues, no conflict model dominated and that peers agreed in the course of their discussion. The term "effect of dyadic interaction" is then quite fuzzy. The types of processes during interaction are diverse, and some of them only were really argumentative. In spite of its problems, this study is valuable if instead of dealing with effects of dyadic interaction on argumentive reasoning, one interprets it as the study of argumentative characteristics of texts after dyadic interaction. This interpretation is adopted by Schwarz and colleagues (Schwarz et al. 2003) to show how triadic interactions improved the quality of argumentative texts written by Grade 5 students invited to write arguments on

the issue of experiments on animals. The experiment comprised multiple stages in which students wrote arguments individually or collaboratively. At one of the stages, triads were presented short texts representing arguments pro or con the issue. Schwarz and colleagues showed that collective essays were of the highest argumentative quality and that the Grade 5 students did not use texts in their essays. In contrast with Kuhn and colleagues, Schwarz and colleagues concluded that knowledge about experiments on animals was co-constructed in argumentative activities (and not that argumentive reasoning increased). To illustrate their conclusion, Schwarz and colleagues analyzed some protocols to show the argumentative processes that led to changes in written texts. Like in the Kuhn et al. study, the processes showed more socialization than adversarial dialogues. In summary, the "effect" in both studies did not measure a correlation between a type of dialogue and quality of individual text writing but between a very general set of conditions – dyadic interaction, and instructions to seek consensus or understand disagreements, and individual text writing. The set of conditions can be called an argumentative design, as it is hypothesized to provide constraints and affordances for argumentative activity although actual argumentative processes are not guarantied.

Chapter "Argumentative Design" in the present book is dedicated to argumentative design. In that chapter, it is stressed that without a meticulous planning concerning tools, initial knowledge of the discussants, their social arrangement etc, talk is generally nonargumentative; argumentative talk emerges generally when structured by the teacher and/or by representational tools. The scarcity of productive argumentation raises an important issue from a research point of view: the measure of impact of argumentation on learning through analysis of a product after "argumentation" instigated through argumentative design is quite problematic. It is always necessary for the researcher to ascertain that argumentative talk really deployed during interaction as a result of the argumentative design.

5.2 Differentiating Types of Talk: A First Step in the Identification of Learning in Argumentation

We stressed that talk is far from being always argumentative. More than that, cognitive (internal) conflicts or (external) disagreements do not automatically trigger argumentative processes. For example, de Vries et al. (2002) have showed that argumentative talk is not common in learning scientific knowledge even in those conditions. However, these conditions facilitate their emergence. For example, in a pre-post design experimental study on conceptual change in inheritance issues, Williams and Tolmie (2000) found that children with dissimilar ideas were able to take more advantage from group discussions, than were those assigned to groups with partners who had similar initial ideas. Dialogue analyses of on-task group behavior, furthermore, showed that the two conditions differed not only in amount of intra-personal conflict, but also in the extent that collaborators engaged in negotiation and joint construction of ideas (see also Tessler and Nelson 1994, Kruger 1993).

However, the talk that developed uncovered shared thinking that was not necessarily argumentative. In other words, teachers or researchers cannot dictate the kind of talk that develops among peers, even through well-designed situations. The study of learning outcomes of argumentation by analyzing products of activities following argumentation is then overall problematic. The study of emerging learning in argumentative activities, which is a priori more complex, is then perhaps more promising, since it is conditioned by a prior identification of argumentative talk.

The widely cited study conducted by Lauren Resnick and colleagues (Resnick et al. 1993) is an excellent example of the intricate relations between these fields of research: Triads engaged in collaborative argumentation on nuclear power and gradually co-elaborated complex arguments. Learning here emerged in the interaction between interlocutors through the expression of argumentative moves (see also Leitão 2000; Pontecorvo and Girardet 1993). In this influential study, Resnick ostensibly did not discuss problems of emergent learning in the course of the discussion or of "learning gains" after discussion. The study brought to the foreground the deployment of reasoning in conversation and focused on the argument that was developed by the group. By concentrating on the development of collective arguments during conversation, however, she delimitated another domain to be studied by her followers: learning from conversation. What can be said on further activities at the individual level following collaborative reasoning activities?

5.3 Emergent Learning in Argumentative Talk

The study of emergent learning in argumentative talk has been especially done in the framework of collaborative problem solving activity. Such a framework is very far from "natural settings" as it demands careful design. A first approach to the study of emergent learning in argumentation has been proposed by Cobb and colleagues (Cobb et al. 2001) in mathematics classrooms. This approach, called "the analytic method," fits teacher-led discussions in elementary school mathematics classrooms. Each of the activities is carefully designed according to expected "learning trajectories" that concern "taken-as-shared" understandings of the group. Between activities, design is reassessed against data collected through triangulation methods. Emergent learning is first observed through emergent practices and the establishment of new socio-mathematical norms, then through the arguments raised and accepted by the group and by individuals. This sociocultural perspective is important for all scientists interested in observing learning in a rich context. However, when the focus is on argumentation, the relevance of this study is limited: For Cobb and colleagues, argumentation is part of the design: the teacher is committed to invite all children to participate, to explain or justify, to listen to and to attempt to understand others' explanations, to indicate when they considered solutions as invalid, etc. Talk was then considered to be argumentative overall inasmuch as the teacher was committed to instill these practices, although only in some of the protocols presented, students autono-

mously challenged and counterchallenged each other's solutions: Instead of characterizing any talk aimed at attaining shared understanding as argumentative, one should have a more precise scrutiny over the kinds of argumentative talk that govern classroom discourse.

When one discerns different kinds of talk, argumentative talk is not common, and the study of emergent learning begins by the identification of segments of argumentative talk. Baker (2003) has provided a detailed account of the emergence of learning in the framework of collaborative problem solving. Argumentative talk is triggered by the awareness of some diversity in the epistemic status of solutions: participants consider different solutions to the problem or have different beliefs about the solution (even they propose the same one). This diversity leads to an interlocutory problem in which participants try to transform the epistemic statuses of the solutions. According to Baker, this transformation proceeds through two complementary processes, argumentation, and negotiation of meaning. Argumentation functions in two ways. Dialectically, it enables linking different sources of knowledge through moves that strengthen or weaken epistemic statuses: we recognize here the construction of arguments and counter-arguments. Dialogically, argumentation induces roles (proponents, opponents) that bring forward theses. The role players interact according to ground rules of interaction that are partly logical and partly pragmatic and cooperative. The ground rules lead participants to agree on the outcomes to be retained. Negotiation of meaning is the process completing argumentation through which collaborative learning is realized. This is an interactive means to interpret preceding dialogues. Negotiation of meaning occurs in or near to argumentative talk in two ways: dissociating concepts and combination (or compromise, see also Perelman and Olbrechts-Tyteca 1958). It appears that dissociation and combination lead people to drop beliefs that are not well articulated and to accept beliefs whose definitions are more elaborated. Baker claims that such processes influence the epistemic statutes of solutions.

Schwarz, Perret-Clermont, Trognon, and Marro approach (Schwarz et al. 2008) to emergent learning is compatible with the approach proposed by Baker. Their method of analysis is inspired by the *Interlocutory Logic* developed by Trognon (1999) to trace learning in interaction: they identify the interlocutory force of all utterances and their propositional contents. The interlocutory forces include illocutory goals (e.g., Assertive, Directive, Declarative, or Questioning) in the speech acts expressed by the interlocutors and their intersubjective interpretation in the context of the activity (e.g., (request for) explanation, elaboration, or clarification, objection, agreement, challenge, etc.). The propositional contents concerned inferences or what the scientists called knowledge construction or transformation. Such methodological tools could yield fine grained descriptions of emergent learning. Schwarz and colleagues showed that emergent learning during interaction cannot be seen as monolithic; they identified what they called *unguided emergent construction in interaction*, and *guided emergent construction in interaction*. The researchers showed that what emerges in interaction uncovers only one aspect of learning. The interlocutory approach concerns then interactional visible learning processes. Other learning processes cannot be discerned during argumentative interaction but by comparing the argumentative

interaction with other successive activities. In observing how students who interacted in the emergent construction of a new strategy solved similar tasks individually in successive activities, Schwarz and colleagues identified such as *continuing construction from interaction,* and *retrieved construction from interaction* and traced how these processes succeed or fail in yielding immediate or delayed learning. Such a study suggests the complexity of learning processes, visible and invisible, involved in collective argumentation.

5.4 The Need for Studies Integrating Emerging Learning with Learning After Interaction

The study by Schwarz and colleagues not only bridges between two kinds of methods for observing learning but between theoretical tenets. Researchers that study emergent learning in argumentative activities see learning as a highly contextual process emerging from specific social interaction and mediated by special tools; they do not ponder whether the learning as a characteristic of an interaction is foreseen to be capitalized on in later activities. On the other hand, researchers that check products (such as written essays) before and after argumentative activities often suppose that the products represent argumentative reasoning on the issue learned. Two implicit hypotheses underlie this supposition (1) argumentative reasoning about a specific issue is in some way quite stable during a certain period; (2) this reasoning can be measured through an interview or the writing of a composition in which students are invited to react in rubrics that correspond to predefined argumentative categories. We contend that for both camps, there is a need to consider both foci. That is, socio-cultural psychologists should consider how constructs elaborated in collective argumentation activity are capitalized on in successive activities. Also, psychologists adopting a skill acquisition approach should consider and understand the apparent inconsistencies when those skills deploy in social interactions. In their analytic method, Cobb and colleagues (Cobb et al. 2001) apprehend learning in successive activities by observing whether understandings negotiated in specific activities are taken as shared in subsequent ones. But as mentioned before, the argumentative features of talk are unspecified and the role of argumentation in emergent learning in successive activities is thus difficult to observe.

An attempt to trace learning in successive activities, one of them being argumentative, has been recently done by Asterhan and Schwarz (2007): In a pretest-intervention-posttest study, students were asked to solve individually problems on evolutionary theory, then to collaboratively solve similar problems in dyads, and then to solve similar problems individually at two different period of time. Asterhan and Schwarz identified characteristics of dialogue during dyadic interaction and studied relationships between these characteristics and the change in the mental models that appeared between the pre-test and the post-test in individuals. Among the characteristics of the dialogue that predicts conceptual learning, the fact that the dialogue

is dialectical – in which different arguments are expressed. Another characteristic concerns the fact that arguments are distributed among discussants and the fact that, in spite of the dialectical character of the dialogue, discussants co-construct the solution.

6 Argumentation and Learning in Specific Domains

The findings we brought so far are quite general. However, in several domains, argumentation has been identified with the very language people should use while reasoning. For example, Driver, Newton and Osborne (2000) have claimed that argumentation is the language of Science. Similar claims have been raised in Mathematics and in History first for professional mathematicians and historians, then for students in schools. However, the characteristics of argumentation in which people engage in different domains are quite different. This is because, argumentation, and especially collective argumentation bears domain norms according to which people reason. We describe here theoretical developments and empirical data on learning processes in argumentative activities and subsequent learning gains in four domains, mathematics, science, history, and civic education. The panorama that will stem from research reviews in these domains concerning argumentation and learning will not show a uniform picture, but will uncover potentialities and difficulties that are to some extent domain specific. A caveat before delving into the four reviews: In light of the arousal concerning the role of argumentation in specific domains, a systematic review would have overtaken reasonable limits for the length of the chapter. We preferred then to pick up representative studies rather than being exhaustive.

6.1 Argumentation and Learning in Mathematics

6.1.1 Argumentation as a Basic Form of Mathematical Professional Activity

Among all types of scientific activities (in a Vygotskian sense), mathematics has been perhaps the most discussed from an argumentative perspective. In fact, this is not very surprising. In the first chapter of this book, Rigotti and Greco compared demonstration and argumentation through examples in mathematics. And indeed, we all know the terms “demonstration” and “proof” from our experience as pupils attending lessons in mathematics, especially in geometry. Generally mathematics educators contrast between proof and argumentation like Rigotti and Greco: the role of proofs is not to convince but to provide a way to communicate mathematical ideas. Often in mathematical proofs, one single solution is acceptable, and is practically irrefutable. In second half of the twentieth century, mathematicians showed that their professional activity is far from being purely logical but is largely

dialectical: in *How to solve it*, Pólyà (1945), showed that mathematical activity is based on heuristics – general strategies for problem solving that may or may not help in specific cases; in *Mathematics and plausible reasoning* (Pólyà 1954), he models mathematical activity under uncertainty. In his influential book *Proofs and refutations*, Lakatos (1976) built on Pólyà's ideas to show that the development of mathematics does not consist (as conventional philosophy of mathematics tells us it does) in the steady accumulation of eternal truths. Mathematics develops, according to Lakatos, in a much more dramatic and exciting way – by a process of conjecture, followed by attempts to "prove" the conjecture (i.e., to reduce it to other conjectures) followed by criticism via attempts to produce counter-examples both to the conjectured theorem and to the various steps in the proof.

6.1.2 Formal Proofs and Argumentation in Mathematics and in Mathematics Education

The approaches adopted by Polya and Lakatos to mathematical activity contrast formal proofs as they are recorded in books or journals from the dialectic processes that lead to their elaboration. For mathematicians, it is a way for establishing the validity of ideas in the scientific community. The anecdote about the famous mathematician Paul Deligne who presented the formal proof of a new theorem in a conference in research in mathematics and who asked the audience "Is there somebody that can help me understand now why the theorem is true?". For the mathematician, though, creating mathematics and the inscription of proofs are two distinct but related activities: the mathematician poses problems, analyzes examples, raises conjectures, generates counterexamples and revises conjectures. The elaboration of a proof results from a refinement and validation of ideas that answer the question they posed.

Since mathematical results are presented formally by mathematicians in the form of theorems and proofs, this rigorous practice is mistakenly seen by many as the core of mathematical practice. As stated by Hanna (1989) it was assumed for years that "learning mathematics must involve training in the ability to create this form" (pp. 22–23). Elaborating formal proofs has been a central goal in mathematics education. However, if for mathematicians the creation of mathematics and the inscription of proofs are two related activities, for children they are not. In fact, several leading mathematics educators have stressed the psychological gap that set apart arguing and proving. For example Duval (1993), has shown that although students in schools are accustomed to give reasons and to provide proofs, such actions are generally not relevant (pertinent in his own terms) to them: The explications they give do not convince them of the validity of their arguments. In the same vein, Fischbein and Kedem (1982) asked junior-high school students who demonstrated a geometrical proof correctly whether they are confident of its truth. The students often took the figures they used to demonstrate the proof in order to measure distances with their rulers. Elaborating a proof, then, did not have any role in conviction. In other words, there is a huge gap between arguing and proving in mathematics,

especially for young students (similar results in Schoenfeld 1986). Therefore, differently from professional mathematicians, for children, proofs are not products of argumentation; rather the elaboration of proofs and argumentation are two unrelated activities.

6.1.3 Suitability of the Toulmin Scheme for Mathematical Activity in Professionals and Students

As shown by Rigotti and Greco in chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource," Toulmin (1958) elaborated a scheme of argumentation in the fifties to distinguish scientific reasoning from formal logic. Several researchers in mathematics education have recently adopted this model to describe mathematical activity, and such an adoption is an important step from a psychological point of view (Aberdein 2006; Hoyles and Kücheman 2002). However, with the Toulmin scheme mathematical activity departs from formal logic but is still a branch of informal logic. In a recent study in which the Toulmin scheme was adopted a priori to describe mathematical activity, Inglis et al. (2007) asked talented post-graduates in mathematics on conjectures in number theory. The researchers showed that, in contrast with the inscription of formal proofs, subjects used modal qualifiers that express doubt, reasonableness or high certainty; they also used inductive warrant-type arguments in addition to their deductive warrant type arguments. Also in contrast with the other researchers in mathematics education who used the Toulmin scheme to describe argumentation Inglis and colleagues (Inglis et al. 2007) included modal qualifiers and rebuttals in what they called a genuine model of mathematics activity. Even in this interesting study, the mapping of the Toulmin scheme upon protocols looks quite imposed rather than adapted to describe reasoning processes in solvers.

The Toulmin scheme seems then too structural to grasp the dynamic, dialectical nature of mathematical activity. This is not surprising: the impressive developments in Argumentative Theory shown by Rigotti and Greco in this work show that this model is gradually abandoned to the advantage of other models.

In mathematics education (as well as in science education) the Toulmin scheme is still in use in spite of the methodological and ontological problems we pointed out. And we think that such an adoption may be good if the Toulmin scheme is used as a tool for educational purposes rather than as a model to describe mathematical activity. Its simplicity can help educators bridging between arguing and proving in classroom activities. When used by the teacher as a cognitive tool, proving and arguing seem in the same spectrum rather than being incommensurable activities. However, so far, in most of the current studies in mathematics classrooms, researchers have neglected the activity of proving to the benefit of the activity of arguing. We present in the next section such studies in which activity in mathematics classrooms is described in argumentative terms, including with the Toulmin scheme.

6.1.4 Collective Argumentation in Mathematics Classrooms

Instead of bringing students to reconstruct normative proofs through deductive steps, researchers recognized that the ultimate goal is not necessarily to prove or to demonstrate but to co-construct reasonable arguments in teacher-led discussions. Krummheuer (1995) began studying argumentation for its own sake in mathematics classes, argumentation being defined as "interactions in the observed classroom that have to do with the intentional explication of the reasoning of a solution or after it" (p. 231). Such a focus necessitates the term *collective argumentation* (also Miller 1987). Also, the definition goes astray from the definitions given in chapter "Argumentation as an object of interest and as a social and cultural resource." The retractions, modifications, hesitations, or replacements that occur in classroom discussions cannot be mapped onto any a formal model such as the van Eemeren pragmatic-dialectic model. Kummheuer uses the Toulmin scheme of argumentation as a tool for modeling the explications given during classroom activities. According to Krummheuer, this model "helps to reconstruct the informal logic of an argumentation and the kind of accountability developed for the resolution of a quarrel." Judiciously, Krummheuer notices that "this scheme is not to be understood as a method for identifying the different components of that model in concrete interaction – this needs to be done by a related analysis of interaction. The scheme merely points out the different roles that utterances play in an interaction when reconstructed from a perspective of the emergence of a substantial argument" (p. 240). Krummheuer clearly states here that he does not model argumentation but emerging arguments in classroom interactions. The validity of the structure of such an emerging argument is often problematic since it is reconstructed by the researcher without taking into consideration the concrete interactions into which it deploys.

The role of the Toulmin scheme turned to ancillary in the description of emergent processes by researchers such as Cobb, Yackel, and colleagues (Yackel and Cobb 1996, Cobb et al. 2001). In such studies researchers focus on activities in elementary school in which teachers adopted an inquiry approach. The teachers led discussions to pose problems, then organized students in small groups, then instigated whole-class discussions. The approach to instructional strategies concern both fostering active individual construction and acculturation into the mathematical practices of wider society. The general definition of argumentation given by Krummheuer is taken for granted. Argumentation is the interactive process through which understandings are taken-as-shared and lead to intersubjectivity. These understandings are accompanied by the constitution of socio-mathematical norms that govern the elaboration of beliefs and values. For example, Yackel and Cobb (1996) showed how teachers led discussions in which norms about what are different solutions or sophisticated ones are. In these discussions, students tried to explain to others what seemed not clear for them. By such, the elaboration of socio-mathematical norms in argumentation provided opportunities for learning. Interestingly and almost paradoxically, the concern to be comprehensible by others and to be accepted by them leads to autonomy in active discussants.

Later work by this team of researchers was more specific about the competencies the teacher should deploy to orchestrate the elaboration of desirable socio-mathematical norms and about the role of the design of activities to trigger learning opportunities. Yackel (2002) showed that the teacher needs mathematical knowledge as well as psychological knowledge about the competencies of the students that participate in the discussion. Cobb and colleagues (Cobb et al. 2001) used the term "learning trajectory" to designate the hypotheses designers and researchers have concerning how children would participate in a series of activities. One of the most specific processes that accompany collective argumentation in mathematics concerns the transformation of the object of discussion from material objects to mathematical ones, a component of the process of mathematization (Gravemeijer 1994).

As mentioned above, the direction led by researchers such as Cobb, Yackel, and Krummheuer is based on a very loose definition of argumentation, "the intentional explication of the reasoning of a solution or after it" as stated by Krummheuer. Is it possible to refine the general approach to argumentation adopted, and by such to turn to relevant the models of argumentation proposed in chapter "Argumentation as an object of interest and as a social and cultural resource"? Since "argumentation" is not a condition discussants fulfill or not according to demands, one might wonder about the relevance of ideal models. However, we already mentioned the role of teachers in instilling ground rules (Mercer et al. 1999) or in instigating argumentative moves. These moves or ground rules partly convey models of argumentation. More generally, argumentation theory is relevant to classroom discussion in the design of the environment in which discussions take place. The most immediate design principles concern scripts suggested to students (and to teachers) in discussions such as: "to (help to) accommodate divergent views," "to (help to) give reasons pro and con a certain claim and to give reasons for the decision," "to (help to) convince each other and to reach consensus," etc. Of course, as shown by Atzmon et al. (2006), the interactions that take place as a result of the same scripts for the same activities with different students and/or teachers can be very different from an argumentative point of view. The study of argumentation and learning in mathematics needs then to be more specified to lead to useful distinctions.

One of the main specifications has been the situatedness of argumentation in a field of experience. For example, Duval (1991) listed among others (a) the existence of a "reference corpus" consisting of true statements and reliable arguments – true or reliable because they are institutionalized or can be checked/measured, (b) the existence of doubtful statements. Such specificities have been taken into consideration as part of a design process to lead to learning through participation in argumentation. Douek (1999) used such ideas to describe how fourth grade students learned about inclination and angles through activities on sunshadows in which the students capitalized on real experiences they undertook, and drew then used graphs in discussions in which different arguments were brought forward. In several studies, the design of the tasks possibly leading to argumentation and learning turned to conditions. Such an approach inevitably discerned between types of argumentation and comparison between learning gains for students participating in the different

types of argumentation. Schwarz and his colleagues attempted to design situations in which the design concerned the choice of students engaging in small group interaction according to characteristics of their initial cognitions (something similar to Duval's existence of doubtful statements), affordances and constraints of the task, and tools for checking hypotheses (similar to Duval's existence of a "reference corpus"). Concerning initial cognitions, it seems that diversity (in solutions, in mental models, etc.) is preferable. Designing tasks for affording certain cognitive actions, and prohibiting or constraining others is difficult. It demands an epistemological analysis of possible tasks to foresee such affordances and constraints (Schwarz et al. 2000, for learning decimal fractions in dyadic interaction; Schwarz and Linchevski 2007 for learning proportional reasoning in dyadic interactions). However, the types of argumentation in which students engage are diverse. Schwarz and Linchevski (2007) showed that many students engaged in one-sided noncritical argumentation, and that conceptual learning (of proportional reasoning) occurred when students engaged in two-sided dialectical argumentation. The use of technological tools is often necessary to design particularly complex situations. For example, Hadas et al. (2002) designed situations with Dynamic Geometry tools to encourage students to engage in deductive reasoning in geometry in dyadic interaction (without teacher). Also, Hershkowitz and Schwarz (1999) designed an activity to encourage hypothesizing in algebra through the use of graphical calculators in small groups of students. The immediate feedback of technological tools (as well as tools for checking hypotheses in general) proved to be crucial for learning. In all those examples, students engaged in remarkably rich and productive interactions. After many of these activities, a teacher undertook a reflective activity in which dialectical activities were recapitulated to lead to further learning. In summary, although the design of tasks leading to argumentation in mathematics should be meticulous to be productive, this design is possible and is the object of intense efforts in mathematics education.

6.2 Argumentation and Learning in Science Education

Science in schools is commonly considered from a "positivist perspective" as a subject in which there are clear "right answers" and where data lead unequivocally and incontestably to agreed conclusions. This attitude towards science has been rooted in a philosophical-empiricist approach according to which science was considered to be based on empirical processes, where claims to truth are grounded in observation, and where conclusions are unproblematic deductions from such observations. Current research into the activities of scientists, however, points to a different picture: Practices such as assessing alternatives, weighing evidence, interpreting texts, and evaluating the potential viability of scientific claims are all seen as essential components in constructing scientific arguments (Latour and Woolgar 1986). In making scientific claims, theories are open to challenge and progress is made through dispute, conflict, and paradigm change. Science is now viewed as a social process of knowledge construction that involves conjecture, rhetoric,

and argument (Taylor 1996). This perspective recognizes that observations are theory-laden (Hanson 1958, Kuhn 1962) and that, therefore, it is not possible to ground claims for truth in observation alone. Claims are seen to be grounded through the generation of arguments that relates the imaginative conjectures of scientists to the evidence available (evidence which itself needs to be open to scrutiny in terms of the way it is framed conceptually and the trust that can be placed in it from the point of view of reliability and validity).

Establishing a knowledge claim in science involves then first the process of establishing what counts as data, through conducting and checking observations and experiments. Then deductions are made from the conjectured theory through reasoning and calculation. The extent to which the data agree or disagree with the prediction then needs to be examined. Rather than a single theory or conjecture to be checked, it is often the case in science that there are two (or more) competing theories. Then the key activity of scientists is evaluating which of these alternatives does, or does not fit with available evidence, and hence, which presents the most convincing explanation for particular phenomena in the world. As Siegel (1989) argued, the central project of science is the search for reliable knowledge, albeit within a limited domain. To achieve this, scientists hold a central core commitment to evidence as the ultimate arbiter between competing theories. Such a commitment, which is basic to science, should therefore be a feature that science education should seek to illuminate strongly.

In addition to the argumentative nature of epistemological aspects of science, over the last few decades there has been an increasing awareness of the social processes that are also involved in the production of scientific knowledge as public knowledge (much more than mathematical knowledge). Science is a social practice and scientific knowledge the product of a community. Of course, this social process involves first the inner circle of other scientists through critical peer review in scientific journals, revision or rejection, and acceptance. However, in presenting and evaluating arguments, scientists are influenced by factors beyond those internal to science, factors such as scientists' social commitments, values, and by the wider culture of ideas and technological capabilities in society at the time (Woolgar 1988).

These different circles of social interaction in which scientists are involved are well illustrated through the exemplary controversy and argument that surrounded the process of establishing whether BSE ("mad cow" disease) can be transmitted to humans. The first level is within the mind of the individual scientist when struggling to design an experiment or to interpret data; second, within research groups where alternative directions for research program are considered in light of the group's theoretical commitments and empirical base; third, within the scientific community at large, through interactions between competing positions at conferences or through journals; and fourth, in the public domain where scientists in a contested field expose their competing theories through the media. Through this discussion of science as the production of socially constructed knowledge, discursive practices play a central role in establishing knowledge claims. Observation and experiment are not the bedrock on which science is built, but rather they are the handmaidens to the rational activity of generating arguments in support of knowledge claims.

But it is on the basis of the strength of the arguments (and their supporting data) that scientists judge competing knowledge claims and work out whether to accept or reject them.

In light of the studies that uncovered what the work of professional scientists consists of, and in light of the societal needs concerning the use scientific knowledge in adulthood, educators have recently expressed the importance of developing scientific literacy (Millar and Osborne 1998, Norris and Phillips 2003). The publication of the American Association for the Advancement of Science volume on enquiry (Minstrell and Van Zee 2000) and other official publications point to a commitment that science should be concerned with more than knowledge of scientific facts. Rather, it should be dedicated to critical reasoning and argumentation (Driver et al. 2000). Science education requires a focus on how evidence is used to construct explanations: beliefs in scientific ideas and theories should be grounded on the examination of data and the generation of warrants; one should understand the criteria used in science to evaluate evidence (Osborne et al. 2004). Comprehending scientific arguments is a crucial part of *scientific literacy* (Osborne et al. 2004). In the same vein, inferring meaning from science texts requires the ability to recognize the standard genres of science, and to evaluate claims and evidence advanced in scientific arguments.

Declaring the necessity to develop scientific literacy, to a large extent enculturation to scientific argumentation and inquiry, is important but faces many difficulties in the science classroom. We review here some of these difficulties. We begin by listing some of the difficulties students have in engaging in argumentation. We then turn to what we think is the main obstacle to enculturation to scientific argumentation-literacy, the current teacher-led classroom talk.

6.2.1 Students' Difficulties in Constructing Arguments and in Engaging in Argumentation

The weaknesses reported at the beginning of this chapter in presenting arguments "for and against" about social issues, are more accentuated in science. Drawing on a wide literature relating to science education, Zeidler (1997) identified the following five reasons for fallacious argumentation – essentially the common errors in students' arguments in science and the reasons for them:

1. Problems with validity – students fall into the trap of affirming the consequent and are more likely to affirm a claim if they believe the premises to be true rather than false, despite warrants contrary to their beliefs.
2. A naive conception of argument structure – students tend to have a confirmation bias and select evidence accordingly with little attention paid to disconfirming data.
3. The effects of core beliefs on argumentation – arguments that are consistent with students' beliefs are more convincing than those that are counter to their beliefs. This weakness compromises students' ability to evaluate counterevidence and criticism.
4. Inadequate sampling of evidence – students are not sure what constitutes convincing evidence and tend to jump to conclusions before enough data are

available; their lack of functional understanding of probabilistic information and statistics is also a barrier here.
5. Altering the representation of argument and evidence – students do not necessarily consider only the evidence that is presented to them, but make additional assertions about the context of the problem, or even introduce inferences that go beyond the boundaries of the evidence presented and that introduce bias in the outcome.

And indeed, these considerations have been largely confirmed in an important study by Chinn and Brewer (1998) in which they showed that students have a set of eight responses to anomalous data choosing either: to ignore the data; to reject it outright; to exclude the data by declaring it to be irrelevant to their field of study; to hold the data in abeyance by deciding that there is insufficient data to determine the outcome or too many uncertainties associated with it; to reinterpret the data by arguing that the causal explanation is significantly different from that proffered by the scientist; to modify their theories peripherally by arguing that its effects are minor rather than major; and, finally, to express uncertainty about the data itself. In only 8 of the 168 cases in their study did students modify their views as a consequence of evidence contradictory to their previously held beliefs. Both Zeidler (1997) and Chinn and Brewer (1998) reminded us, in their concluding discussions, that scientific thinking is complex and messy and that the reasoning of scientists themselves is often subject to the same kinds of problems listed above. Inducting students into the norms of scientific argument is therefore an idealistic activity; norms may be accepted by the community of scientists but can be overlooked in practice. Yet, making students aware of both how they, and scientists, respond to contradictory claims will provide important insight into the social processes internal to scientific argument.

6.2.2 Difficulties to Sustain Argumentative Talk in Science Classrooms and Programs to Support It

A second obstacle to the enculturation to scientific argumentation concerns talk in classroom. As shown by several scientists that analyzed the language used in science classrooms (Lemke 1990, Mortimer and Scott 2003), their implicit beliefs about science are reflected in their interactions with students in classroom discussions. Teachers commonly share the belief that science is constituted of a body of unequivocal and uncontested knowledge. As a consequence, interactions uncover control over turns, questions that invite short answers that are correct or not. In contrast, apprehending science as not being about absolute and certain knowledge induces more deliberative and dialogic talk in the classroom (Mortimer and Scott 2003). Adopting a new talk, more dialectical and dialogical, in the classroom is then not a matter of adopting a new vocabulary but assimilating new goals, and new epistemic beliefs. The study of talk in science classrooms has then naturally turned to a central issue in two directions. First, researchers are interested in descriptions in order to (a) define the argumentative features of classroom scientific talk, and (b) uncover

teachers' and students' beliefs about science. The descriptions are done in natural settings in the sense that the researcher–observer is not interested to engage in interventions of any kind. The second direction concerns quasiexperimental studies in which the teacher opts for a pedagogy that is expected to lead to scientific gains through argumentation. In particular we will review the role and conduct of argument in addressing two emphases in science teaching: developing conceptual understanding and developing investigational capability. We report first on difficulties then, describe representative initiatives to overcome them.

6.2.3 Difficulties to Promote Conceptual Learning Through Argumentation in Classrooms

Several studies have shown difficulties the difficulties science teachers have in promoting conceptual learning in classroom discussions. The huge problem to be overcome in these studies is methodological: how to trace the existence or the absence of conceptual learning in classroom discussions. Like in mathematics, some researchers used the Toulmin's model to describe emerging arguments collectively elaborated. For example, Jimenez-Aleixandre and colleagues (Jimenez-Aleixandre et al. 2000) studied the discussions of groups of students about a genetics problem set in a practical "real life" context. With the Toulmin model, they represented arguments as group productions of which they could identify interesting features (e.g., the arguments were very limited in complexity, often warrants were not made explicit, and conceptual confusion affected the quality of the arguments). Jimenez-Alexandre and colleagues also identified aspects of the arguments that could not be represented using Toulmin's scheme; for example, epistemic operations (e.g., causal relations, explanation procedures, analogies, predictions) and the influence of school culture on the arguments produced. What the study did achieve was to make explicit the difficulties students encounter in marshaling evidence, drawing on their conceptual understanding of the topic, and composing arguments in support of scientific knowledge claims. Other studies used theoretical schemes to identify features of the discourse. Some, such as the schemes evolved by Pontecorvo (1987) and Alexopoulou and Driver (1997), are analytical and illustrate the different types of argumentative moves used by students in discussing conceptual problems in science.

6.2.4 Difficulties in Developing Investigational Capability Through Argumentation

The process of inquiry is central in scientific activity in which execution and interpretation of experiments should be used to dialectically construct ideas about scientific processes and then to construct models or theories based on those ideas. A number of studies have focused on student argumentation while students solve scientific problems within a conceptual area that requires engagement in laboratory investigations

over extended periods of time. For example, Richmond and Shriley (1996) studied the discussions of six groups of four students during the planning, execution, and interpretation of student-designed experiments in a grade 10 science class over a 3-month period. The course was designed around a case study of the nineteenth century cholera epidemic in London, and introduced students to the nature of scientific detective work as well as to basic concepts of cell biology. The goal of this study was to report on how students construct arguments for collecting and using data in a scientifically acceptable form, including their ability to identify a problem, construct a testable hypothesis, design an experiment, collect data, and recognize the implications of the results. The investigators analyzed students' understanding and participation on two dimensions, a conceptual dimension and a social dimension. They considered the interplay between these dimensions in interpreting students' ability to construct arguments as the program of work proceeded. They noted that, at the beginning, students were not able to construct arguments relating to procedural aspects of carrying out their investigations. They had difficulty differentiating between a problem and a hypothesis, understanding the value of controls, and distinguishing between their results and what the observations meant (conclusions). They noted also that, early on in the study, students concentrated on procedural issues with little concern for understanding the conceptual basis of the problem at hand. In general, as a result of the extended program, the investigators reported that levels of student engagement with the problems rose and arguments became more sophisticated. They also noted how the progress of the groups was a product of cognitive and social factors and depended to a great extent on the style of the group leader. This finding serves to emphasize of the importance of social context and the need to develop an understanding of the social rules necessary for "successful" discourse. Druker et al. (1996) also provided an analysis of science students' arguments in the context of solving practical performance tasks. The tasks used in their study involved electrical "mystery boxes." Students cooperated in pairs to work out, through empirical tests, what the electrical components in a set of boxes might be. The students' actions and discussion were documented and analyzed using Toulmin's argument framework and as a result a range of types of errors in students' arguments were identified.

The overall picture of the study of classroom talk is that high quality argumentation in school classroom (e.g., the use of valid argument) does not come naturally and is acquired through practice. The implication for science education is that argumentation is a form of discourse that needs to be explicitly taught (Hogan and Maglienti 2001; Kuhn 2001, Simon et al. 2006, Zohar and Nemet 2002). The issue is then to find ways in which teachers can appropriate the discourse of argumentation and whether changes occur in the nature of teachers' classroom interactions.

6.2.5 Intervention Studies to Improve the Quality of Argumentation in Science Classrooms

Intuitively, instilling the discourse of argumentation in science classes may seem a quite simple matter limited to the enactment of certain teacher actions. For example teachers may think of presenting different points of view on the same issue by posing

tasks within an oppositional framework (e.g., debates or arguments for or against in a discussion group). Boulter and Gilbert (1995), however, argued that this oppositional structure, and the polarized language that ensues, can be a problem. Furthermore, they suggested that "an inclusive rather than oppositional language has more connection with personal experience." In fact, this example suggests that instilling the discourse of argumentation in science classes is not simply a matter of learning to apply a list of recipes for teaching action.

In some studies, researchers proposed to the teacher to impose rules of scientific discourse and inquiry. For example, Herrenkohl and Guerra (1995) examined an intervention study designed to improve the quality of argumentation employed by students when engaged in investigations. Two classes of fourth grade students from one school were involved in the study that was conducted over a period of 12 teaching days while the students were engaged with a hands-on, inquiry based curriculum unit on "structure and balance." The purpose of the intervention was to engage students in "performances of understanding" in science. To promote this, in the case of both classes, the "rules" of scientific discourse and inquiry were made explicit to the children. Three discourse practices were focused on: monitoring comprehension; coordinating theories (and predictions) with evidence; and challenging others' perspectives and claims. In one of the classes the teacher explained these practices and reminded the children about them each day. The teacher did the same in the second class, but in addition, the children were assigned sociocognitive roles designed to help them monitor each others' reports as they conducted their work. The roles were: checking reports for statements of predictions and theory; checking reports for a clear summary of results; and checking that theory is supported by evidence in reports and, if not, generating alternative accounts. Children took turns in practicing these roles. The oral reports given to the class by the children were recorded and the discourse moves were analyzed. There was clear evidence that, in the class in which the children were assigned roles, the reports from the children included a larger number of the target discourse moves than for the other class. Thus, these findings suggest that, not only is it important to inform students of the norms of scientific argument, but, if students are to assimilate these norms, they also need the experience of rehearsing them for themselves.

Studies like those by Herrenkohl and Guerra show that instilling scientific rules of discourse is possible, but these studies centered on the learners only. They conceal the huge effort needed from teachers to orchestrate collective argumentation in class discussions. Several in-service teachers programs have been implemented for this purpose. For example Simon et al. (2006) have trained 12 teachers in a 1-year long program to teach argumentation. The researchers used the Toulmin model of argumentation not only as a tool for analyzing lessons but as a tool for training the teachers to engage in argumentation in their classes: it appears that the simplicity of this tool that makes salient argumentative components (claims, data, warrants, backing, rebuttal, etc.) helps teachers appropriating argumentative norms in discussions. The program not only enables teachers to use the language of argumentation but to get immersed in inquiry, questioning, experimentation and to engage in concrete teaching tasks in which they capitalize on their experience with students. Learning to teach argumentation is a very long lasting process which took, in the

case of Simon and her colleagues one full year. The good news are that the program was successful not only concerning the quality of arguments co-constructed in classes but concerning the quality of argumentation as it appeared in moves such as justifying with evidence, or counter-arguing: The teachers in the second year of their teaching were better than in the first year according to both argument structure and argumentation.

6.2.6 Environments for Promoting Argumentation

In addition to in-service teachers programs, researchers and designers have developed several technology-based environments for sustaining argumentation in science. The reason for these huge development efforts in Science education is the recognition of the complexity of processes involved in instilling a new scientific literacy that integrates investigational and argumentative practices. In chapter "Argumentative Design," some of these environments are described, some of the ones that focus on the argumentative part of scientific activity (e.g., the Belvedere system). Several researchers have proposed environments that integrate facilities for inquiry as well as for argumentation. As announced at the beginning of this section, our review is far from exhaustive and is rather representative.

As an example among many other environments for promoting argumentation in science, a group of researchers participated in the EC-funded ESCALATE project (http://escalate.org.il/engsite/home/default.asp) in which cases integrating argumentation and enquiry-based strategies were integrated in two distinct environments. For argumentation, students used Digalo, a graphical tool with which the argumentative moves of synchronous discussions are gradually represented and can be reflected on. e-discussions with Digalo occurred in small groups of 2–5 students; in some groups, the teacher intervened (the teacher could not intervene in more than two groups in a classroom e-discussion). For the enhancing of enquiry, "Microworlds" were designed and tailored for specific uses, and allowed students to change, for example, the initial conditions of a physical phenomenon, isolate a specific factor and see how it influences a certain physical procedure, etc. In that sense, students experimented to define the physical laws that dominate phenomena. They could use trial and error methods to examine "what will happen if…"situations, and they can transform the environment "so that … will happen," etc. In this way students could test their hypotheses and discuss the most viable. The description of the implementation of the different cases in five different countries pointed at several generalizable phenomena (1) The very nonconformist kind of environments and pedagogical approach demand to negotiate with teachers, principals, educators the kinds of cases to be implemented; the negotiations were far from being trivial processes; the kinds of solutions for implementation highly depended on the microculture of the class, and the institutions. (2) The teachers participated in several workshops or meetings in they were immersed in the new literacy of science. (3) After the negotiations, the implementation of the cases led to important conceptual gains. (4) In spite of the preparation of the teachers, they had often very hard time to intervene, especially in small group e-discussions.

This short review points at the potential of environments and the capability of teachers to lead a reform in science education based on a new literacy. However, this potential demands huge investments in teacher training, in design and in software development.

6.3 Learning History Through Argumentative Activities

While in Science and in Mathematics, educators have difficult time to design argumentative activities in which students engage in productive discussions, the situation in history should have been much easier: among school activities, discussions on historical issues can be the closest to discussions in natural settings. This is only a potentiality, though. The juxtaposition of history education and argumentation reflects a deep change in history education in which many educators hesitate to engage: the initial goal of history education (in the nineteenth century) was to instill authoritatively collective memory and social identity (Ferro 1984; Funkenstein 1989). The introduction of argumentative activities in history classrooms gives legitimacy to critical analysis of official narratives and to the acquisition of alternative perspectives. From a psychological point of view, some educators) have suggested that an argumentative approach risks having an unsettling effect eroding students' values and identity (Naveh and Yogev 2002). Proponents of the reform have suggested that encounter with diverse historical sources and group discussions transform the collective memory narrative from a self evident truth into a freely taken personal perspective. As Baker (2003) claims, argumentative activity turns accounts into stands held by protagonists in historical action and participants in historiographical debate. Societal and ideological changes concerning autonomy and authority in modern society have led educationalists to favor a critical approach in history education (Nash and Dunn 1995). They developed new kinds of activities such as evaluation of historical sources, discussion of multiple texts, or argumentative writing (Hynd 1999). By doing so, they bring the historian's craft to the school, a craft in which most of the practices are argumentative (Wineburg 1994).

Empirical findings on the effects of this reform on historical reasoning are still rare but encouraging. For example, Perfetti et al. (1994) showed that historical problem solving argumentative activity may influence narrative, attitudinal, and argumentative characteristics of student's writing: in a well designed experiment based on the critical reading of conflicting sources, they showed that opinions turned to more two sided. They also pointed to relations between changes in empathy and in argumentative level of text writing and the use of information from historical sources – a clear indicator of historical learning.

Goldberg et al. (2008) undertook another study based on argumentative activities. They obtained similar results concerning the improvement of argumentative writing. A major difference between the two studies is that in the Perfetti et al. study, the issue was quite neutral (the history of Panama) while Goldberg and his colleagues designed a study in which the researchers focused on the effect of the vitality of historical

issues in collective memory on students' history learning processes and products. Forty 12th grade students of different ethnic background participated in two historical problem-solving learning tasks. The historical issues were found to differ in their vitality in collective memory as signified by students' consensus, certainty, and reference to the present. These differences defined vitality as expressed in living and dormant collective memories. Findings showed effects of vitality on narrative and argumentative change, and on the relation of historical source evaluation with narrative change. An interaction was found between issue vitality and ethnicity in the source evaluation: more vital collective memory narratives were more resistant to change and more prone to ethnic identity bias. In the case of living collective memory, two groups representing two different narratives were involved in argumentative activities. Goldberg and his colleagues showed that when the debate is in the context of inter-group relations it heightens awareness of in-group membership, "making social categories salient." Thus, on the one hand the preconceived collective narrative of the past is more open to change, and on the other hand it arouses social identity motivating its change. Argumentative strategies and historical sources serve as resources for social identity needs.

The fact argumentative improvement relates both to stability and change of attitude shows that historical argumentative activity does not simply free learners from the influences of their subjective preconceptions into the realm of unbiased critical thinking. The motor and motivator of argumentative change is still the individual's fundamental attitudes and needs, often stemming from social identity. Argumentative activity and the critical encounter with diverse historical sources somewhat loosens the hold of collective memory and widens the scope of narrative choices for the individual.

6.4 Argumentation and Learning in Civic Education

Although we showed that argumentative practices are inherent in mathematicians', scientists', or historians' crafts, and should be adopted in schools, the connections between civic education and argumentation seem to be even more natural. First, democratic citizenship, is in itself of argumentative nature: political engagement – the willingness and the capability of citizens to participate effectively in self-rule, and an understanding and commitment to the fundamental processes in democracy, demand from the citizen to know to express opinions (e.g., in petitions), to participate to debates, to bargain, or to make compromises. Second, in civic education – the domain aimed at educating to democratic citizenship, argumentation seems a priori a powerful tool for learning to be a democratic citizen. However, we will see that systematic research on learning processes in civic education has not been initiated yet. Rather, studies report on the success of civic education programs by measuring relevant skills before and after the implementation of the program.

But what are these skills? The National Standards for Civics and Government and the Civics Framework for the 1998 National Assessment of Educational progress

(NAEP) recognize the centrality of critical thinking: identifying and describing, explaining, and analyzing, and evaluating, taking, and defending positions on public issues. A second category of skills essential for democratic citizens are those of participation or civic engagement, what is also called participatory skills. The National Standards identify participatory skills as interacting, monitoring, and influencing. To interact is to be responsive to one's fellow citizens: to question, answer and deliberate with civility, build coalitions and manage conflict in a fair and peaceful manner. Monitoring politics and government refers to the skills citizens need to track the handling of issues by the political process and by the government, and to the exercising of "watchdog" functions. Finally, the participatory skill of influencing refers to the capacity to affect the processes of politics and governance, both the formal and informal processes. Argumentation stands of course in the middle of critical thinking and participatory skills. The kinds of argumentative talks are highly diverse: disputes (to win), conflict resolution (to accommodate divergent views), critical discussions (to understand a compound issue), etc.

Numerous, and varied programs in civic education have been implemented in the world. The United States Agency for International Development (USAID) has undertaken a very large study to measure the impact of such programs all around the world. The most important finding of this study is that if civic education programs implement participatory methods, focus on issues that have direct relevance to participants' daily life they can have positive impact on democratic behaviors and attitudes. But many programs do not meet such criteria. We would suggest that the success of a program relies on the diversity of argumentative activities implemented in the program. Our suggestion does not rely on research: research on civic education focuses on changes in beliefs and attitudes only and not on learning processes.

In spite of the scarcity of research on civic education, the suggestion we just proposed seems reasonable in light of the success of one of these programs, Project Citizen, that has been developed by the Center for Civic Education in more than 30 countries in the world. Project Citizen involves early adolescents in the identification and investigation of important public issues in their own communities. They work cooperatively to propose, justify, and advocate a public policy which will address a particular community need they have identified. This program led to extreme change in students' beliefs about their critical thinking and participatory skills. However, typically for a program in civic education, the measure of progress concerned beliefs and attitudes, and did not concern skills. But does the change concern really skills? Especially when students participate in activities in which the realization of goals such as wining a debate is at stake? We doubt it. Rather, we suggest that reports on shift in practices are more instructive than reports on beliefs or on the acquisition of skills. Practices on which shifts may be traced are political debating, bargaining, and compromising. In addition to practices, several political scientists have proposed that the adoption of civic dispositions rather than civic skills is at focus in programs in civic education. Galston (1995) for example, identified "a commitment to resolve disputes through open discussion … and to engage in public discourse". This disposition includes "a willingness to listen

seriously to a range of views and the willingness to set forth one's own views intelligibly and candidly as the bases of a politics of persuasion rather than manipulation or coercion". The second disposition listed by Galston makes clear why what is needed for him in civic education is not the acquisition of skills: "To narrow the gap between principles and practices in liberal society…For citizens it can mean either a public appeal or quiet acts that reduce the reach of hypocrisy in one's immediate community". These dispositions add up to a long list of should be done recommendations to foster civic education. These dispositions are understood to stem from frequent classrooms discussions that progressively enable their emergence.

In summary, the enactment of varied argumentative activities seems to be much more essential in civic education than in mathematics, science, or even in history. However, systematic research on the implementation of such argumentative practices in civic education has not been done yet. Such necessary research should put to the fore the essentiality of argumentative practices in education to turn people to better citizens in their society.

Interestingly, like for mathematics, science, and history, the progressive adoption of argumentative practices in civic education points at a growing sensitivity to students' motivation and beliefs and to the role the domain – here democratic citizenship, for the sake of society.

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Argumentative Interactions and the Social Construction of Knowledge

Michael Baker

Abstract This chapter deals with two questions: firstly, what might students learn by engaging in argumentative interactions? And secondly, by what cognitive-interactive processes might they do so? An approach to understanding argumentative interactions, produced in problem-solving situations, is outlined, that sees them essentially as attempts to solve an interlocutionary problem, i.e. that of deciding which putative problem solutions to accept or not, by drawing on additional knowledge sources (termed "(counter-) arguments") that potentially change the degrees of acceptability of solutions. This process goes hand in hand with the exploration of a dialogical space and with the negotiation of the meaning of key notions, underlying the debate. The analysis of an example of argumentative interaction (involving two adolescent students in a physics classroom) reveals this exploratory process, together with the essentially unstable nature of students' viewpoints, given that they are engaging in argumentation with respect to ideas that are still under co-construction.

Keywords Collaboration, Argumentation, Learning, Problem-solving, Dialogue, Argumentation, Negotiation, Meaning, Conceptual change

1 Introduction

Life is full of problems that we cannot solve alone, either because we do not have the necessary abilities or because the problems necessarily concern others. An example of the first case would be my sending an SMS message on a portable telephone (I do not know how to do that without help, although I could possibly find out), and of the second, deciding on the acceptability of human cloning (this is a debate that should concern everyone, not just oneself). In both cases, one way of trying to solve a problem is to engage in dialogue with other people in order to coordi-

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nate ideas and efforts. But whilst proverbial wisdom says that "many hands make light work," it also proposes the opposite, that "too many cooks spoil the broth." In other words, solving practical problems with others can create another kind of problem – that I shall term *interlocutionary*, since it is concerned with relations between locutions, or utterances - due to the fact that there can be a diversity of proposals for solving the practical problem, not all of which can usually be accepted at the same time. Thus, an interlocutionary problem requires deciding, together, which solution, or combination of solutions, to accept to a practical problem. In fact, I shall now call such "practical" problems *praxeological* problems (Meyer 1982; Quignard 2000), they concern not only physical actions (such as those involved in mending a car) but more generally, problems that are embedded in social practices (such as deciding what energy policy to adopt, or even solving mathematics problems at school), that may be both formulated and solved in language exchanged in interaction.

So, how are interlocutionary problems solved? The following are three possibilities amongst many (excluding physical violence or appeal to absolute authority). Firstly, people could try to ignore the problem: perhaps one person does not want to offend the other by appearing "difficult"; perhaps there is a general feeling that the question is not sufficiently important to merit deeper discussion; perhaps they are short of time and want to move on, and so on. Secondly, people could restrict themselves to a simple exchange of divergent opinions: "yes that's right/no it isn't/yes it is/…." But such an approach does not generally produce the required result. Finally, each could express additional information and reasoning relating to the problem, of the kind that would potentially change the degrees of acceptability of the divergent solutions, and also examine the coherence of the sets of information and lines of reasoning expressed. I shall call this "argumentation in interaction," or more simply, "argumentative interaction."

In school settings, children are sometimes presented with praxeological problems, the attempted solution of which, in groupwork situations, may give rise to interlocutionary problems. And children are also sometimes presented with interlocutionary problems themselves (i.e. societal or other questions to be debated). In these cases, as mentioned above, schoolchildren may engage in argumentative interaction in order to try to solve the interlocutionary problem. However, the point of asking students to solve these various types of problems is not just that they should find solutions to them, but also that they should *learn* something by so doing, or, in other terms, that they should *construct new knowledge*. For example, in trying to build a model bridge together, students could construct new knowledge of forces operating on materials; in discussing human cloning they could gain better understanding of human biology. When knowledge is thus constructed in verbal interaction between students, the process by which this is achieved has been termed the *social construction of knowledge* (Perret-Clermont 1979, 2000).

This chapter is about the role of argumentative interaction in the social construction of knowledge. Intuitively, argumentative interaction should be important in this context since it involves extra thinking, the need to "dig deeper" into the question being addressed. The aim here is to explore precisely the processes by which argumentative interactions could favour the social construction of knowledge, and the nature of the new knowledge in this case.

In the next section, two complex foundational notions will be discussed: the "social construction of knowledge" and "argumentation." This will be followed by a general critical examination of what types of knowledge could be socially constructed in and by argumentative interaction, and how. The chapter closes with a general analysis of an example of an argumentative interaction between two students (in a physics classroom), that illustrates some but (necessarily) not all of the points made previously.

2 Some Theoretical Considerations

2.1 The Social Construction of Knowledge

The expression "social construction of knowledge" is quite frequently used in recent research on learning, in psychology and educational sciences. However, it can be understood in a number of different ways, depending on the theoretical perspective adopted.

From the standpoint of cognitive psychology, centred on the individual, referring to the "social" construction of knowledge simply means that *more than one person* is involved in that construction, possibly in an interactive situation, whose result – knowledge – is nevertheless seen as a property of the individual. Secondly, the "social" dimension of an interaction between students can be understood as that which is *not "cognitive,"* that is, not centred on the problem-solving task itself (e.g. relational problems, expression of emotion, interaction coordination, etc.). Thirdly, the term "social" can refer to the fact that the interaction takes place between *social actors* (rather than machines, for example), who have specific statuses, roles, origins, and so on. Finally, a number of theoretical approaches, such as "situated learning" (Lave 1988), see *knowledge as intrinsically a property and an emergent dimension of social groups*, or communities of practice. To the obvious rejoinder that people are quite able to learn from solitary reading of books, it could be replied – from a Vygotskian perspective (Vygotsky 1978, 1986) – that books themselves are social products, involving language, which is itself a social and historical product, that the individual human is nevertheless a social being, and that reading and thinking can be seen as species of operations with signs, of (internal) dialogue.

My own position with respect to these visions of the social and the cognitive depends firstly on distinguishing the two dichotomies "individual/group" and "cognitive/social": both individuals and groups can have both cognitive and social dimensions. On the one hand, it is not meaningful to sharply distinguish the cognitive and social dimensions of collective activity (Perret-Clermont et al. 1991), moreover, given that the fundamental "building brick" of communication, the speech-act, encapsulates the cognitive and the social (Trognon 1999). On the other hand, interactive learning, seen as fundamentally a social-and-cognitive process, needs to be studied in a way that nevertheless takes into account the articulation between processes happening within the group and at the individual level. This can be seen as a process of "internalisation" (Vygotsky op. cit.), or rather, of becoming "autonomous" in carrying out a task. In other terms, the

problem is to relate learning that takes place within the timescale of dialogue itself with longer-term learning in the individual (Trognon 1993). In order to understand the problematic nature of comparing what happens in dialogue with what happens after it, possibly on the individual level, we need to discuss what the term "construction" could mean here.

It is a fundamental tenet of an "interactionist" approach to verbal interaction, that meaning is negotiated, constructed collaboratively, in the exchange (e.g. Kerbrat-Orecchioni 1990). If an interaction has genuinely occurred, this means that what is thought and said is subject to mutual influence: it will not be possible to identify the "individual thought" (at least, on the basis of analysis of an interaction corpus). How could one, therefore, genuinely compare what an individual thought in a dialogue with what that individual thought after it? In the context of verbal interactions, "social construction" should be thought of – as a first pass – as "*co*-construction" (of knowledge), or a construction in which several interlocutors have participated. It seems that a coherent approach would be to compare like with like, i.e. to compare what is co-constructed in one dialogue with what is co-constructed in a subsequent dialogue. Thus "knowledge," in this context can understood relative to the interaction (what the interlocutors mutually accept), rather than from a purely normative or external point of view. More precisely, it will be an invariant across interactive situations.

To go a little further on the notion of "co-construction," it could be said that it depends on an architectural metaphor, as if each participant contributed discrete "bricks" of knowledge. Given that meaning is negotiated in interaction, this means that the "bricks" themselves must be mobile, open to change, to alternative meanings. A better term might thus be that of "co-elaboration," given that this term encapsulates the idea of each "working on" (lat. *elaborare* = produce by work, or work out) the contributions of the other. Learning in interaction can thus be seen as a process of joint *appropriation* of knowledge that is co-elaborated in interaction. Appropriation occurs when interlocutors integrate each other's dialogical contributions into their own, or more precisely, when locutors reason from hypotheses based on propositions expressed by their interlocutors (Trognon and Batt 2003).

In what follows, I therefore propose to understand the "social construction of knowledge" as referring to the knowledge that is co-elaborated, appropriated and mutually accepted in, by and across cooperative problem-solving dialogues.

2.2 Argumentation

As Rigotti and Greco have pointed out (in this volume), argumentation is a device for informing, for helping the interlocutor to recognise (the reasonableness of) something (I shall call this the "thesis," "T") after having given the necessary information (I shall call this an "argument," "A") for so doing. In order to understand the role of argumentation in the social construction of knowledge, we need to examine its specific characteristics in the context of collaborative problem solving.

2.2.1 Argumentative Situations

If, as I have suggested, argumentative interaction can be seen as a means for attempting to solve an interlocutionary problem, then the thesis, T, whose acceptability is to be determined on the basis of an argument, A, will be a putative *solution* to a praxeological problem. At first sight, therefore, it might appear that the most simple *interactive argumentative situation* could be defined as follows: locutor L1 accepts a solution S, interlocutor L2 does not; L1 produces argument A for S (that thereby becomes a thesis, T) in order to enable (or oblige) L2 to accept S/T. This would be an "adversarial" argument, since the goal of L1 is to convince L2. However, argumentative situations involving students are much more varied than this initial characterisation (e.g. Baker 2002), and these variations are important for understanding the social construction of knowledge. The defining characteristic of argumentative contexts in students' collaborative problem-solving dialogues seems to be that of *diversity*, of solutions, attitudes towards them, and ways in which solutions and attitudes can be distributed across participants. Such diversity is associated with a diversity of argumentative *goals* (Walton 1989) that go beyond the attempt to convince. Four possible argumentative situations are shown in Fig. 1.

Although situations (1) and (2) (shown in Fig. 1) could give rise to adversarial attempts by I1 and I2 to refute each other's solutions and accept their own, this is not necessarily the case. Often, students are not very sure about their proposals, and in that case, each can provide both arguments for and against each of the solutions being discussed, in a "cooperative" attempt to arrive at an intersubjective decision. In situations (3) and (4) a single student has expressed divergent solutions and his or her partner helps in trying to decide between them. In fact the symbol "←X→" in Fig. 1 indicates a second requirement for argumentative situations, which is some

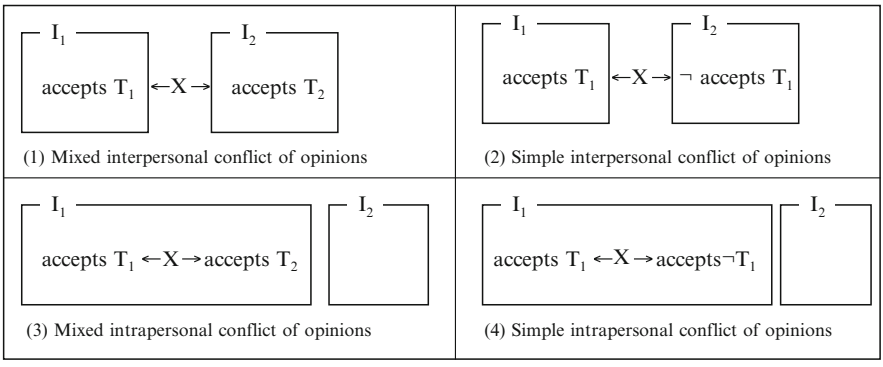


Fig. 1 Four possible argumentative situations

perceived *need to choose* amongst diversity (otherwise, people could just "live with" alternative points of view, or solutions to problems).

2.3 Solving Interlocutionary Problems

We can now look at how the interlocutionary problems are solved, assuming that students attempt to do so. Given that the argumentative situation comprises a diversity of solutions and/or attitudes towards them, the interlocutionary problem can be solved if the degree of acceptability associated to different solutions is modified, so that one emerges as the most acceptable. There are basically two ways of doing this: engaging in *argumentation*, or *negotiating the meaning* of the solutions being considered. Let us consider each briefly and in turn.

Producing an argument A with respect to a thesis T involves searching for additional information that is relevant to T. Once an argumentative relation between that information and T is established, the information becomes an argument for it (when it increases T's acceptability) or against it (when it decreases its acceptability). The information that is searched for can come from a variety of sources, including everyday life, previous schooling and of course, the problem solving situation itself, in which case arguments may correspond to the "bases" (premises) on which the students initially proposed the solutions. An argumentative relation is established between A and T when it is possible to find some "warrant" (Toulmin 1958) or "principle" (Grize 1996) that authorises the transition from A to T. For example: L1 states that (T) "Napoléon was a dictator." When asked why, L1 replies (A) "He was Corsican." Supposing that L2 accepts A, and the (contentious) generalisation (that renders explicit the relation between A and T) "Corsicans tend to be dictatorial," then if L2 accepts A, this would increase the acceptability of T for L2. Whilst in everyday argumentation "warrants" often correspond to *doxa*, "what everyone belives," in school situations, they can refer to important abstract principles in a problem-solving domain. In that case, the interactive processes that require the argumentative relation to be made explicit can themselves be important for the social construction of knowledge. It should also be noted that the search for arguments can itself lead to better verification of solutions.

Negotiating the meaning of possible problem solutions solves the interlocutionary problem to the extent that it is no longer believed to obtain: if you change the meaning of a solution then you change its degree of acceptability as a solution. There are several ways in which such negotiation of meaning can take place. One way is to try to make the meaning of key notions referred to in the solutions more precise. For example, in the above example, L2 could ask "but what do you mean by a 'dictator'?", and L1 could reply "someone who seizes power himself by military force." Another way is to dissociate notions from each other, which can be an effective argumentative strategy (Perelman and Olbrechts-Tyteca 1958/1988), or alternatively to associate them (Baker 2002). In the example above, L2 could say "Being a dictator and being dictatorial, in the sense of authoritarian, are not the same things; so I

agree on the latter, but not the former." According to Naess (1966), making theses more precise is an integral part of argumentation itself. The requirement for expressing oneself clearly can be seen as part of the socio-relational pressures, requiring preservation of face (Muntig and Turnbull 1998), imposed by socio-cognitive conflict (Doise and Mugny 1981).

2.4 Playing the Argumentative Dialogue Game

Finally, the (counter-)arguments that students do (not) express - and thus the quality of the solutions that they accept, together with the knowledge that they construct and the meanings that they negotiate - are in part governed by what may be termed "rules of the argumentative dialogue game." These rules can be quite diverse. Some of them are logical (Barth and Krabbe 1982), as in the case of the requirement for *coherence*: when two arguers L1 and L2 have opposed points of view, if L1 can show that L2 contradicted himself, then this would appear to disqualify L2's line of argument. Other rules seem to relate to a special form of *cooperative activity*, involving jointly working towards a determinate outcome of the debate. Thus, for example, arguing round in circles (incessantly repeating a given argumentative move, with no evolution in points of view) would seem to be precluded since it simply wastes everyone's time (unless, of course, what is at stake in the debate is situated elsewhere, on an affective plan, concerned with self- and other images, etc.). Similarly, there seems to be a constraint (incorporated in Barth and Krabbe's, *op. cit*., formal dialectical models) to the effect that when one arguer's position is criticised, that person must defend their view against that criticism, otherwise, no genuine dialogue could be said to be taking place.

2.5 Intermediary Synthesis

The social construction of knowledge can be understood in terms of what is co-elaborated, appropriated and mutually accepted in cooperative problem-solving dialogues. In order to understand the role of argumentative interactions in this context, they can be characterised as attempts to decide on alternative solutions, by transforming attitudes towards them. Attitudes can be transformed by searching for related knowledge that can function as arguments and by transforming the meaning of theses and arguments. This can be done not only in the attempt to defend or refute theses in an adversarial manner, but also in the framework of a more dispassionate and cooperative search for the (intersubjective) truth of the matter.

On the basis of the above brief theoretical discussion of argumentative interactions and the social construction of knowledge, we can now turn to the following two questions: what learning goals could be achieved by attempting to achieve argumentative goals, and what might be the interactive processes involved?

2.5.1 What Could Be Learned from Argumentative Interaction?

It is not immediately obvious what could be learned from argumentative interaction (or, as I shall term in more briefly, "debate"), either for teachers or for researchers. For example, in 1999, two teachers of French (as well as researchers) wrote the following [my translation]:

> Debates have been somewhat abandoned by teachers of French for a number of years, because of their low 'pedagogical output'. Apart from how to organise them… it is the objective to be attained that needs to be better defined.
>
> (Guerrini and Majcherczak 1999, pp. 103-104).

In part, perceived low "pedagogical output" may be due to the fact that the kind of learning that occurs in and from debates may be quite subtle, and difficult to evaluate. For example, if a teacher attempts to note students' participation in a classroom debate whilst it is taking place, this may be relatively imprecise. For this reason, learning from debates is commonly evaluated by requiring students to write some kind of synthesis of what took place and what they learned.

One way of getting to grips with pedagogical objectives of debating is to posit a distinction between process and product, between *debating skills* and what could be termed *knowledge of debates*.

Debating skills correspond in part to being able to respect the ground rules of argumentative interaction mentioned above, for example, defending one's view against criticisms, and to that extent they may be seen as special cases of communication skills such as being able to express oneself clearly and relevantly in a discussion. In addition, students could learn various more or less technical aspects of argumentation, such as the strategies of leading the opponent to contradict himself, reversing the burden of proof, attacking a thesis directly rather than replying to arguments for it, redefining the thesis, and so on, as well as how to identify common "fallacies," or diverse species of logically unsound or pragmatically unfair argumentation.

But – I would claim – these technical aspects of argumentative discourse are much more associated with technical or specialised (e.g. legal) texts and debates rather than with students' debates. The problem, at least with adolescents rather than young children (Stein and Bernas 1999), resides not so much in mastery of general argumentative or spoken communication skills, that seem to be a part of everyday discourse, as in knowledge *of* debates themselves, of which students may have incoherent, irrational and sketchy understanding.

The nature of knowledge of debates can be understood in reference to what has been termed a *space of debate* (Baker et al. 2003). A space of debate can be seen as a "problem space" that is *situated* in a specific communicative context, that of argumentative interaction. The situated nature of the space of debate can be seen from two aspects. Firstly, knowledge of a space of debate is by nature argumentative. For example, there is a difference between "simply" knowing that "k: certain plants can be genetically modified in order to make them resistant to herbicides," and knowing that k can be both an argument for and against genetically modified organisms, when situated within the space of debate corresponding to the question of

their advisability. Secondly, the type of knowledge that is expressed and elaborated in argumentative interactions is quite specific to them, given that the emotional, relational and dialogical context of disagreement leads to selecting or suppressing certain types of information as arguments. In other terms, if, in an argumentative interaction, the aim is to defend one's own view and refute that of one's partner, then the most effective arguments must be selected, each person's understanding is strongly influenced by their partners'.

More concretely, learning objectives associated with a space of debate can be understood in relation to the following of its constituents, to be discussed below: *questions-theses, opinions, arguments, viewpoints and fundamental notions*.

One of the first problems that students face is to understand the precise questions that have been and can be posed in a space of debate. Thus, for example, in the space of debate on euthanasia, one pedagogical goal would be that students are able to go beyond the question "is it right or wrong?" to identify other related and more specific questions, such as "is it possible to exert sufficient legal control over euthanasia?"

A second set of pedagogical objectives relate to personal opinions. In the first place, it is quite possible that students do not possess them (!). In a classroom experiment on debating the advisability of genetically modified organisms (reported in Baker et al. 2003), students were asked to write short texts arguing their personal opinions on the question, after having read associated documentation. "But Monsieur," said several students "what should I do, I don't *have* an opinion on GMOs?" The point of the exercise was of course that they should develop such a personal opinion, and that it should be appropriately argued for. A second recurrent problem is that students do not understand the distinction between opinion and argument: stating a negative opinion does not correspond to an argument, and expressing an argument – perhaps hypothetically, "for the sake of argument" – does not necessarily imply a specific opinion. More generally, with many questions the goal would be that students develop less "all or nothing" opinions, that are perhaps more subtle or conditional ("I agree if … but not if …").

With respect to arguments, a clear pedagogical goal is not only that students know sufficient arguments in favour of their opinions, but also that they know the main arguments against, and even how they would reply to those counter-arguments. An associated general objective would be internal *coherence*, between the set of arguments and the opinion expressed.

Although argumentative interactions occurring during resolution of specific problems should generally draw on a single principle source of knowledge (e.g. in geometry, on geometrical and perhaps algebraic knowledge), debates on the level of society as a whole commonly draw on a variety of "viewpoints" with which the student should become acquainted. A "viewpoint" can be seen as encompassing a particular domain and value system, and is expressed by a particular social actor. For example, for the debate on human cloning, domains could be scientific (biology), ethical and economic, and value systems could originate in specific cultures, religions, political systems or other "visions" (e.g. of the "value" of scientific progress). Social actors might be "the European citizen," "the government," "the medical profession," and so on. Similarly, a debate on tauromachie (bullfighting) could give rise to understanding that there is a

global underlying conflict between "traditionalist," "æsthetic" and "moral" points of view on this question.

Finally, such viewpoints, as well as questions-theses and arguments themselves, are associated with certain fundamental notions that could be more clearly understood as a result of debate. In the case of euthanasia, GMOs, cloning and tauromachie, the notion of "living beings" is generally at stake. Specific viewpoints will also have specific associated notions (e.g. economic, ethical, scientific) that could become better understood by the students. To that extent, learning from debates must be seen in the context of other types of learning in disciplines associated to the question debated. Debates could be seen as means for engaging students' personal motivations in questions, prior to the deepening of specific aspects of them in other classes.

In summary to this section, I propose that the learning goals associated with pedagogical debates can be seen in terms of *broadening*, *deepening* and *refining* students' understanding of argumentative knowledge in a space of debate. Their understanding is broadened when they know a greater variety of questions and arguments from different viewpoints; it is deepened when they know arguments on arguments on arguments … as well as the main underlying concepts; it is more refined when the students have a more clear and subtle personal opinion on the question, that is associated with an appropriate set of arguments. Such types of learning are relatively subtle and "costly" to evaluate.

Let us now turn to the question as to the interactive processes by which such pedagogical goals might be achieved.

2.5.2 How Might Students Learn from Argumentative Interaction?

Our discussion here can build on the above characterisation of the processes at work in argumentative interactions, operating in a space of debate comprising theses, opinions, arguments, viewpoints and notions. Recall that argumentation in the sense of debate is a dialogical game that transforms opinions with respect to complex sets of problem solutions, on the basis of expressing and negotiating the meaning of arguments. The three main classes of processes by with students might learn from argumentative interaction, to be discussed below, therefore concern opinion change, expression of arguments and negotiation of meaning.

2.6 Opinion Change

Argumentation, in the context considered here, functions as a means of transforming the degree of acceptability of problem solutions, from the points of view of students, it influences which solutions will be retained or rejected, and thus types of learning that are understood in terms of measures of the quality of solutions. Two simple cases would be where the better-argued (defended) solution is mutually accepted, and where a putative solution is refuted and thus not mutually accepted.

But such cases of argumentative "defense-acceptance" and "refutation-rejection" are problematic, in both theoretical and empirical terms. The first problem concerns the distinction between acceptance and belief (Baker 2000a): for reasons relating to the dynamics of debate, a student may be obliged to accept or reject a solution, but may not genuinely believe in it in the first case, and may continue to believe in it in the second. The existence of such differences can be determined by analysing the dialogue following the argumentation sequence in question; but it nothing further is said relating to that sequence, the question must remain unanswered. A further empirical problem relates to the fact that there is nothing to guarantee that the best solutions are in fact retained and not rejected. In one case of problem-solving in physics, however, it has been shown that more elaborate physical models "win out" as a result of argumentation.

Some results have also been obtained concerning acceptance and rejection of problem solutions in argumentative dialogues between students. For two different science problem solving domains (Baker 1996, 2003), it has been shown that students' attitudes are more often *weakened* (e.g. from initial acceptance to uncertainty or rejection) than *strengthened* (e.g. from rejection to acceptance) as a result of argumentation. In other words, instead of choosing the most acceptable solution, students proceed by elimination of "flawed" solutions. This is understandable, given that, since the students' knowledge is supposed to be under construction in the learning situation, students are not likely to have firmly entrenched opinions to be defended (Nonnon 1996).

Finally, although opinions have been discussed above principally as all-or-nothing acceptance or rejection, in fact changes may be much more subtle. For example, as a result of discussing a question, students' initial unthinking certainties may be eroded, leading to unsureness and search for additional information (perhaps from the teacher).

In sum, the solutions to problems that students produce and retain can of course be influenced by argumentation, but their dialogues may need to be closely analysed in order to determine the extent to which retained solutions reflect individuals' beliefs. It seems to be easier to criticise and to reject, rather than to provide argumentative support, in exploratory collaborative learning situations.

2.7 Expression of Arguments

It is now well established experimentally that students who *explain* their problem solutions to others, whether experimenters (Chi et al. 1989) or peers (Webb 1989), can learn better by so doing. By rendering their problem-solving processes explicit, students may restructure their knowledge, or at least become able to produce a more coherent discourse (Crook 1994) on the question at hand.

Such learning mechanisms could be at work in argumentative interactions, where explanations can take the special forms of replies to requests for clarification, or more generally, argumentative defenses. It should be noted however, that the nature and degree of elaboration of "explanations" (justifications, arguments, …)

will be very different in argumentative and non-argumentative interactive contexts (Baker 2000b). Whereas non-argumentative explanations may be quite extended, within a cooperative goal of "helping" or informing (since what is to be explained is not generally disputed), argumentative explanations are influenced by the rules of debate, by the necessity to defend a view from criticism, and may thus be more restricted and focussed.

More generally, not only are explanations *qua* arguments strongly influenced by the interlocutionary problem context, but in the context of dialogue itself, there is something problematic with the notion of "making explicit" preformed ideas upon which the solutions proposed were presumably based. In certain cases it is clear that the information expressed as an argument does not correspond to the thinking upon which the student's proposal was based. For example, in the case study described in Baker (1999), one student "made explicit" arguments for his solution that were based on constraints of the problem; however, it was clear that the (mis) understanding upon which is solution was based related to electrical current. Within that same study it was shown that in other cases, what students render explicit as arguments does seem to genuinely reflect that deeper underlying understanding.

What this means is that we should see explanation in interactive argumentation as a new kind of re-creative thinking in and by dialogue, which is *situated* in the dialogue context (Edwards 1993), rather than as a process of rendering explicit preformed views. Such a process could be positive in four main ways. Firstly, it quite simply involves extra reflexion on the praxeological problem, within the attempt to solve an interlocutionary problem that is triggered by the former. Secondly, such interactive reflexion can lead to greater internal coherence and elaboration in a student's own view. Thirdly, and again quite obviously, arguments that are expressed by locutors can then be acquired by their interlocutors. Fourthly, search for and creation of arguments could lead to a wider search throughout the problem space, and thus better verification of solutions in terms of problem constraints.

2.8 Negotiation of Meaning

In an earlier section of this chapter it was mentioned that negotiation of meaning is an integral part of argumentative interaction. Engaging in argumentative interaction requires increased cognitive work (in comparison with non-argumentative interactions), that is in a sense required by socio-relational pressures. To state the point simply, social pressures force meanings to evolve.

Such transformations of meaning can occur in different argumentative contexts, and in different ways. Given our previous discussion of the space of debate, transformations concern potentially theses, arguments and underlying notions.

Theses are the responses to the question debated, which are defended or criticised by argument. If the question is "Is obligatory tipping in American restaurants a good thing?" (the example is taken from Walton 1992), then one thesis is "No, tipping in American restaurants is not a good thing." As Walton (op. cit.) has pointed out, one rather large-scale transformation that can take place concerns the

"deepening" of the *questions* that are debated. Thus, in the just-mentioned example, an everyday occurring debate on the question of tipping (is it some kind of degrading "charity" for the servers, or rather a nice way of rewarding good service?, etc.) changed gradually into a debate on a more fundamental or "underlying" question: "to what extent should commercial affairs be regulated by legislation?" Such everyday examples could have correlates in educational situations: trying to solve a specific question in history, for example, could lead to discussing a question about the epistemology of science (what counts as historical "proof").

A second macroscopic transformation (Baker 2002) concerns the very way in which the space of debate is represented, or conceptualised, involving dissociating notions from each other or, to the contrary, associating them. This corresponds to what Perelman and Olbrechts-Tyteca termed "argument by dissociation and association." Suppose that A says to B: "you behaved in a racist manner in excluding that person from the club." In reply, B could try to counter-attack (e.g. by citing other occasions when B has been shown not to be racist), but another approach would be: "B: you must distinguish between racism and discrimination; my act was discriminatory, on the grounds of …, but it was not racist." Such dissociations can of course be spurious or more or less motivated in particular domains. In physics problem solving, it has been shown that conceptual dissociations can enable students to "dissolve" verbal conflicts by preserving a separate "domain of validity" for each student's solution (Baker 2002). Conceptual associations can similarly be means for finding compromises, by combining proposals under single concepts (e.g. "You say it's air friction and I say that it's loss of energy at impact; but they're the same thing, they're both a form of loss of energy.")

There are two more argumentative contexts for negotiation of meaning: during argumentation and at its outcome. In the first case, students can be led to more or less extensively *reformulate* their argumentative defenses when under attack (Baker 1996). In the second, when it seems impossible to decide between solutions on argumentative grounds alone (stalemate), then students may attempt to combine solutions into more or less superficial compromises.

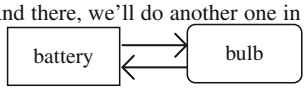
In sum, argumentative interaction creates a special context that obliges reflection on and negotiation of the meaning of questions, theses, arguments and underlying notions. As with any aspect of collaborative problem-solving interactions, there is no guarantee that the meanings that students thus elaborate will be the preferred ones from a normative point of view.

3 An Example

I shall now present a summary analysis of a brief sequence from an interaction corpus, shown in Table 1, with the aim of illustrating many of the points made previously.

The extract is taken from a corpus of dialogues collected in a secondary school physics class (students aged 16–17 years). Dyads of students were asked to draw a diagram, called an "energy chain" (Tiberghien 1996), to represent storage (reservoirs),

Table 1 Extract from a physics problem-solving dialogue (energy chains)

N°/Locutor	Dialogue
192/Myriam:	We'll put the transfer. And there, we'll do another one in the other direction, it's the second one 
193/Raphaël:	Ah no, no, no, no!
194/Myriam:	Ermm yes we will, but the circuit really has to be closed
195/Raphaël:	And yeah, but the battery
196/Myriam:	Ah yes, but there's no energy that's there's none when, in fact, the bulb doesn't produce energy, so the wire that comes back to the battery, it's just to close the circuit, it's not a transfer
197/Raphaël:	Yeah, but hang on, there's a negative pole. So it goes from the negative pole to the negative pole? And from the positive pole to the positive pole
198/Myriam:	No, from the positive pole to the negative pole
199/Raphaël:	That's exactly what I thought !
200/Myriam:	((laughs))
201/Raphaël:	I said to myself that there ! Well, right, there's another thingie there. It's not funny, so there
202/Myriam:	A positive pole, a negative pole
203/Raphaël:	there, there
204/Myriam:	We don't even have a battery
205/Raphaël:	Right…
206/Myriam:	No but look, there really is a second transfer to close the circuit. But in fact, it's not a transfer, it's just to close the circuit, so that the energy can flow through
207/Raphaël:	Wait, the current circulates from the positive pole of the battery to the negative pole of the bulb, but that thing there, on the base …
208/Myriam:	And after it comes back from the positive to negative or from the negative to positive. Mmm
209/Raphaël:	Positive, negative and to negative … Well yes there is, it's right, there are two transfers
210/Myriam:	But no ! there aren't two transfers
211/Raphaël:	Yes there are !
212/Myriam:	But no, because look, you can't, or else …
213/Raphaël:	But in any case, if there's only one, it doesn't work, I'm sorry
214/Myriam:	But yes, but that's all you keep saying
215/Raphaël:	Ah yes it is, in fact, there's only one mode of transfer, it's true
216/Myriam:	No, there's only one transfer because
217/Raphaël:	The mode of transfer it's …
218/Myriam:	Look, you go from the positive to the negative
219/Raphaël:	Yes, yes, no but
220/Myriam:	After that it goes plus to minus, minus plus, yes, no, but what I mean to say is
221/Raphaël:	There's only one mode of transfer which …
222/Myriam:	It's a question of whether, I agree with you that there's a second wire that closes the circuit, but it's a question of whether it's a transfer or not
223/Raphaël:	No but ok, no, it's not a transfer

transfers (arrows in the diagram) and transformations of energy in simple experimental setups. In the present case, Myriam and Raphaël (names changed) are drawing an energy change for a setup where a battery is linked to a bulb by two wires (the bulb lights up).

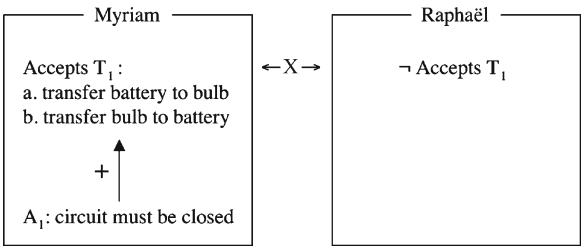


Fig. 2 Initial argumentative situation

In the dialogue so far, the students agreed that the battery is a reservoir and the bulb a transformer of energy. The (praxeological) sub-problem here is: what is/are the transfer(s) of energy between battery and bulb? In line 192, Myriam proposes that there are two "transfers" (this precise term is important), one from the battery to the bulb and one from the bulb to the battery. This is rejected by Raphaël (193) and defended by Myraim in 194, with the argument that "the circuit has to be closed." Thus the initial argumentative situation (a simple interpersonal conflict of opinions, as in Fig. 1) can be represented as in Fig. 2.

In the ensuing sequence, from 195 to 211, a suprising reversal takes place. Myriam retracts her thesis almost immediately in 196, thanks to a *conceptual dissociation* that she realises between energy and electricity (electrical current): the bulb doesn't produce energy … the wire is not a transfer (of energy), it's just to close the circuit. Notice that the thesis focussed on now has become *more precise*, being focussed on the transfer (arrow) from the bulb to battery: [T_1:a. transfer battery to bulb, and b. transfer bulb to battery] = precision ⇒ [T_1': b. transfer bulb to battery]. Myriam now no longer accepts T_1'.

However, it seems that the reference to electrical circuits has triggered Raphaël's thinking; focussing on flow of electricity between positive and negative poles, he now accepts T_1, which he initially rejected (!). This is a perfect illustration of the *volatility of students' opinions* alluded to earlier in this chapter: since their knowledge is under co-elaboration, their interactive thinking is in movement, they are not (all, always) in a position to adopt entrenched opinions. During this sequence, Raphaël has "*explained*" his reasoning successively, in response to Myriam's rejection; but it must be said that this does not seem to have produced a good outcome.

At this stage (lines 192–211), the argumentative situation can be represented as in Fig. 3. Notice that Raphaël has "taken over" Myriam's initial thesis, together with her argument.

In a sense, Myriam's change of mind can be seen as *negotiation of meaning of the argumentative link* between A_1 and T_1: together with *negotiation of the meaning of the term "transfer"*: it is true that the circuit must be closed (A_1), but this is not an argument for there being a transfer of energy from the bulb to the battery.

In the ensuing part of the dialogue (212–223), three additional points can be made. Firstly, in 214, Myriam makes an implicit reference to a dialogue rule

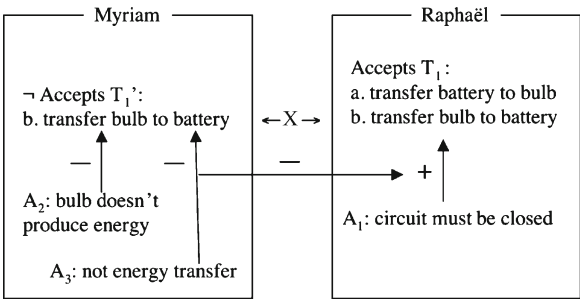


Fig. 3 Subsequent argumentative situation (up to line 211)

("that's all you keep saying"), to the effect that Raphaël's repetition of his argument is not productive dialogue. Secondly, in 215 it seems that Raphaël is also attempting to negotiate the meaning of "transfer" (of energy? A mode?), but this does not appear to come to a clear outcome. Thirdly, it appears that it is Myriam's more clear *reformulation* of her conceptual dissociation, in 222, that finally tips the balance in favour of Raphaël's rejection of the bulb-to-battery transfer thesis:

222/Myriam: It's a question of whether, I agree with you that there's a second wire that closes the circuit, but it's a question of whether it's a transfer or not

In conclusion to this brief analysis, the question arises as to what knowledge the students might have socially constructed (as this is defined earlier in this chapter) as a result of this argumentative interaction sequence, and how? On the basis of the above analysis, one possibility would be that the students' have refined their understanding of the differences between electrical current and energy. They seem to have achieved this as a result of an individually and collectively oriented search around a dialogical space of meanings, involving flexible changes of opinion on both sides, and negotiation of the meaning of the technical term "transfer." Their argumentative interaction appears as a combination of adversarial attempts to convince the other, and reflexion on the meaning of the problem(s) with which they are confronted.

4 Concluding Remarks

Life is full of problems that we cannot solve alone. But when we try to solve them with others, the diversity of alternatives that can arise requires both finding arguments for and against, in order to decide between them and elaborating better understanding of the problem.

But such reflexive search for meaning and foundations does not necessarily guarantee better understanding. The most that can be said is that reflexion in interaction has taken place (which is itself not something to be taken for granted), and that it appears to have lead to joint appropriation of new ideas.

Such subtle changes occurring in interactions can be difficult to evaluate, both for educators and researchers. For the former, a more realistic alternative to interaction analysis might be to evaluate some joint or individual production (for example a textual synthesis) produced in the light of the debate. For the latter, the discovery of general interactive learning processes requires a painstaking inductive approach, across interactive situations.

In the final analysis, the design of interactive learning situations faces the problem of the inherent unpredictability of such interactions. General guidelines – but not failsafe rules – can nevertheless be proposed. The topic must be sufficiently rich to be debatable, the students must have the required prior knowledge, the global situation must lend itself to the appropriate communicative actions.

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Argumentative Design

Jerry E.B. Andriessen and Baruch B. Schwarz

A central responsibility of higher education would be to initiate students into conflict (MacIntyre, 1990, p. 231)

Abstract This empirical chapter discusses the educational design of argumentative activities. Productive argumentative activity may be encouraged, for example, by elicitation procedures, argumentative scripts, by confronting subjects with hypothesis testing, and by pairing peers that have differences of opinion. What are the main results that research has delivered in such cases? A second section of the chapter is devoted to the designed use of collaborative technology for fostering and representing argumentation. Experiments using scenarios which feature a blend of technology and human interaction are discussed.

Keywords Collaborative learning, Argumentation, Computer support, Pedagogical design

1 Introduction

In contrast to argumentation in informal settings (conversations during family dinners, disputes between siblings or friends), argumentation in educational contexts about "scientific knowledge" rarely occurs spontaneously, and is difficult to sustain. It is then imperious to design activities in which participants are expected to engage in argumentation. We call this effort "argumentative design." Argumentative design concerns the design, by a teacher, researcher, or educational professional, of collaborative situations in educational contexts in which participants take on productive argumentation, or the exploration of a dialogical space, as Nonnon (1996) puts it. Defining the productivity of argumentation is a tough issue and depends on the aim of the discussants. In educational contexts in which understanding is a favored objective, productive argumentation may refer to at least two criteria (1)

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several arguments are raised or challenged during the discussion, and (2) participants capitalize on the arguments that emerge during the discussion in subsequent activities, but it may refer at other criteria such as (3) discussants refer constructively to their peers, or (4) all participants actively participate in the discussion. The operationalization of these criteria is not a simple matter and decisions about how to measure a criterion for productivity in argumentation are often also specific; however, in spite of its fuzziness, we use the term "productive argumentation" onward having in mind that its meaning is adapted to specific educational goals. In educational situations, argumentative design is an arrangement that includes the presentation of a discussible issue, but that leaves the precise nature of the discussion to the participants. In other words, argumentative design cannot (and should not) prescribe productive argumentation. According to the (socio-) cognitive conflict (neo-) Piagetian idea, one might have envisaged that simply confronting students with data that challenge their views (what is generally called "anomalous data") or with other students with different views would trigger productive argumentation. However, research on the viability of the use of the cognitive conflict paradigm to trigger learning (such as conceptual learning) showed the relative failure of such interventions (Limon 2001). The few successes and the many failures in adopting the cognitive conflict paradigm support the importance of a meticulous design.

Argumentative design is then a very difficult task. Although the articulation of clear principles on argumentative design is still premature, we review here several studies which allow us suggesting some directions. We take for granted the fact that the social setting should generally involve groups rather than individuals although this issue is not as clear-cut as it appears intuitively. In this chapter we first consider the central role of motivation in argumentative design, namely in encouraging productive collective argumentation. We then consider conditions set in advance that may encourage productive collective argumentation. We review conditions such as initial cognitions, and disagreement. We then consider the role of external resources such as (multiple) texts and devices that provide feedback for discussants (e.g., hypothesis-testing devices) for structuring argumentation. We then go further in argumentative design by considering ways to structure the very interactions occurring in collective argumentation. These include interventions (generally done by the teacher) that include prompts of different kinds (epistemic, social), and interventions to instill argumentative norms of talk. The last section of this chapter focuses on the role of computer tools in structuring collective argumentation. While for the rubriques previously reviewed, computer tools have primarily provided simple facilitators, a burst of development in the last two decades has produced tools that enable collective argumentation whose nature is inherent different from face-to-face collective argumentation: a-synchronous and synchronous discussions provide different dynamics, different kinds of interaction and in general, of argumentative practices that necessitate new ways to consider argumentative design. In addition, many of these tools provide structures and (graphical) representations that turn collective argumentation to an object of reflection rather than a tool in educational practice.

2 On the Motivation to Argue

As stated by Schwarz and Glassner (2003) the form and content of argumentation are highly sensitive to the goals of the discussants. Since, as shown in chapter "Argumentation as an object of interest and as a social and cultural resource," argumentation in scientific issues is extremely demanding, discussants must be highly motivated. Intrinsic motivation stemming from overcoming puzzlement/surprise, uncertainty, and understanding which is relevant to learning in general is particularly adequate for argumentation.

An understanding about the lack of spontaneous argumentation in educational settings has to start with the question what makes people engage in argumentation anyway. Stein and colleagues (e.g., Stein and Albro 2001) studied the development of oral argument skill in real world contexts. Characteristically, their approach was to ask children and adults to remember past conflicts with significant others, and to replay these conflicts using different strategies, and to remember the nature and content of face-to-face interaction that occurred during a negotiation. Children first learn to argue within their family context, they argue with the purpose of achieving personally significant goals such as possession and ownership (Hay and Ross 1982). Children's early conflict experiences have a profound impact on their views and understanding of social rules, relationships, family processes, and the self (Erikson 1963; Piaget 1932; Sullivan 1953). Children have been observed to be very sensitive to changing context of arguing, in one situation being seemingly irrational and incapable of clear thinking, while in another situation being highly rational and understanding and arguments among peers in informal contexts are often relevant for educational contexts. Young children argue about possessions, and disputes with liked peers ended frequently in win-loss scenarios, while conflicts with disliked peers ended in standoffs or required intervention of a third party. Outcomes of arguments have been shown to be dependent on the knowledge of each position by the arguers (Stein et al. 1997). Winners know more about their own position, compromisers have more knowledge about both positions, while losers have less knowledge about either position. Concerning memory for arguments, which can be linked to some type of learning effects, winners and losers learn in different ways. Losers seemed to acquire information from the winner about the problems of their own position and the strength of the opponent's position. Winners offered the most challenges and clarifications, which helped them to remember what was said. They were poor at remembering the losers' reasons, and rationale for choosing the losing position. Compromisers were best at remembering both sides, therefore Stein et al. advocate going for compromises during learning interactions, because winning does not lead to better recall.

The significance of such work for designing argumentation for educational purposes is twofold. First, concerning recall of arguments, we should strive for cases that compromise. In addition, in order for most recall to occur, both positions of the argument must be relevant to the arguer's personal goals. Second, preknowledge as well as the interpersonal relationship have a profound effect on the argumentation itself, and by implication, in the student's conceptions about argumentation. Understanding argument is related to understanding social conflict and goal-directed action. In learning

contexts, students will be motivated to engage in argumentation only if they feel confident about their knowledge being sufficient, and the social challenges are manageable and that they can gain from it.

The above findings from social psychology are important for education, but we should be aware that putting to the fore the recall of the reasons brought forward in a discussion is not the only possible conception of learning by argumentation and brings back the fluid meaning of productivity in discussions. Modifications of belief, broadening, and deepening of ideas, or becoming more socialized in argumentation in general can also be relevant assets of arguing to learn (see Baker, this volume).

Doise and Mugny (1984) provided additional important insights from social psychology. They recognized that socio-cognitive conflict is regulated either epistemically or relationally. This suggests that noncognitive factors, such as achievement goal orientations (e.g., Ames and Archer 1988; Butler 2000) and personal expectations and dispositions towards argumentation, affect the way in which peers behave in socio-cognitive conflict task settings and gains from such settings. Darnon, Butera, and colleagues (Darnon et al. 2006, 2007) showed that while mastery goals (a focus on learning and personal improvement) positively relate with learning gains from argumentation, ability goals (a focus on individual ability comparisons) do not. Since achievement goals can be modified from ability to mastery goals, this indicates that the educator has the responsibility to instill an atmosphere of quest for meaning construction instead of competition. More generally, task design should take into consideration learner goals, needs, activities, and educational contexts. For example, the way social conflicts are understood, addressed, and (not) resolved in that context has an impact on the way students handle their conflicts, and the way argumentation is seen. The educational context which is embedded into the educational system, and represented by the teacher, strongly influences eagerness to argue and should direct the design of learning environments (Quintana et al. 2005). In this chapter, however, we focus on the level of argumentative tasks rather than on the level of the educational context, although it does not fully explain why argumentation occurs.

3 Conditions for Productive Argumentation

The motivation of individuals to commit to argumentation is a prerequisite for triggering collective argumentation, but is far from sufficient to ensure that it will occur. Argumentative design concerns at the first place an arrangement set in advance, then the structuring of argumentation itself. We label the arrangement set in advance as conditions for productive argumentation. These conditions are multiple, and in the present chapter that focuses on conditions, we do not pretend to be exhaustive. In their chapter, Muller Mirza, Perret-Clermont, and their colleagues deal in detail with social factors that foster or hamper productive argumentation. We limit ourselves here to a cognitive perspective: we review the role of grounding, shared understanding and negotiation of common goals, the role of initial cognitions and the role of agreement and disagreement in members of a group participating in a discussion.

3.1 The Role of Grounding, Negotiation, and Shared Understanding

In a highly influential article, Clark and Schaefer (1989) proposed that for a conversation to proceed, partners must mutually believe that both partners have understood what the contributor meant to a criterion sufficient for the current purposes. They called this the grounding criterion, and grounding became the process of the development of common ground, or a degree of shared understanding, in conversation. Note that what is considered to be sufficient grounding is left up to the partners, related to the purpose of the conversation. In argumentation, one may suppose the need for a relatively high level of grounding. Allwood et al. (2000), for example, discuss an additional obligation to evaluate, which is needed in the case of conflicts, because Clark and Schaefer's economy principle of "least collaborative effort" is insufficient to sustain (or even start) a reasonable argumentation. This obligation follows the maxims of ethical consideration (e.g., allow the other party to seek pleasure in the activity, give adequate and correct information), proposed by Allwood et al. A higher criterion for grounding could also be associated with productive argumentation. Of course, meeting such a criterion involves extra effort. Within this higher criterion, one may suppose that partners that disagree on something, in addition to arguing about it, have to come to a joint understanding about their common ground in order to understand each others arguments. Such a process has been called negotiation (Baker 1994). Of course, this may involve argumentation as well, but the main purpose is to converge on underlying common ground.

Converging on shared understanding about the task is also crucial for teacher-learner interactions. Both teacher and learner need to talk and engage in joint activity about the resources of their common knowledge and common interests or goals. Talk is the principal tool for creating this framework, and by questioning, recapping, reformulating, elaborating, and so on, teachers are usually seeking to draw pupils into a shared understanding of the activities in which they are engaged. This shared understanding functions as a dynamic frame of reference which is reconstituted constantly as the dialogue continues, so enabling the teacher and learner to think together through the activity in which they are involved. If this shared understanding is successfully maintained (through grounding actions), misunderstandings will be minimized and motivations will be maximized. The teacher will be able to help the learners transcending their established capabilities and to consolidate their experience. If the dialogue fails to keep minds mutually attuned, however, the scaffolded learning grinds to a halt. Shared understanding is a mutual achievement, dependent on the interactive participation and commitment of both teacher and learner and on negotiation of common goals; but a teacher must take special responsibility for its creation and maintenance. It is a continuing, contextualizing framework for joint activity, whose effectiveness is likely to depend on how well a teacher can create and maintain connections between the curriculum-based goals of activity and a learner's existing knowledge, capabilities, and motivations.

3.2 The Role of Initial Cognitions in Fostering Productive Argumentation

Of course, people cannot participate in a discussion if they are not minimally knowledgeable on the issue at stake. But what is the meaning of this "minimal knowledge"? Depending on the task at stake, researchers have pointed at the importance of having a mental model or strategy of their own for the task at stake: Without any mental model or strategy, discussants cannot deploy any explanatory frame in their discussion. For example, Glachan and Light (1982) showed that students that did not have any strategy to tackle the "Hanoi towers" game could not gain from interaction with peers in solving the game since they did not provide reasons in their interactions with peers. Miller and Brownell (1975) showed that in conservation tasks, conservers were not influenced by nonconservers, because they could give consistent reasons for their solution when arguing with their peer. In contrast, the nonconservers kept asserting their solution without invoking reasons in favor of their assertions.

A promising direction for argumentative design concerns differences in initial strategies or mental model (the term "initial" concerns an evaluation done by the teacher or the researcher at the individual level before participating in collective argumentation). Such differences may naturally lead to the articulation of different arguments and to the emergence of new arguments agreed upon by the parties. This is what happened in the study on the Hanoi towers conducted by Glachan and Light (1982). Schwarz et al. (2000) arranged students in dyads of students with different mental models of the mathematical concept of decimal fraction (measured by systematic errors that students did in problem solving). Their coupling in heterogenous dyads led to conceptual learning. Posthoc analyses showed that students engaged in productive collective argumentation.

3.3 The Role of Disagreement in Fostering Productive Argumentation

The state of different initial cognitions is often translated in a state of disagreement between discussants. However, this is not necessary: discussants may develop different perspectives and reasons that reflect their personal views without reaching overt disagreement. In fact, disagreement should be treated cautiously: disagreement by itself may lead to polarization. For example, Lord et al. (1979) presented arguers with written sources of which some confirm and some contradict their personal standpoint; the arguers tended to be progressively more one-sided. Moreover, when two disagreeing arguers aim to win, the quality of their arguments may tend to decrease (Stein and Miller 1993).

The role of disagreement may then be either beneficial or detrimental. On the one hand, the fact that conflicting arguments are stated in the discussion may lead to learning (Doise and Mugny, 1979, 1984): Disagreement brings different arguments to the discussion space. Such arguments risk to be one-sided (see also Stein and Albro 2001). However, disagreement may also create social inhibition that may hamper

learning. For example, in a recent study, Asterhan and Schwarz (2007) confronted students with different mental models on evolutionary theory to solve a problem. Some students did not express overt disagreement while discussing a problem involving evolutionary theory. These students progressed in their explanatory schemes of evolutionary theory. Other students adopted an adversarial style in which disagreements were overt. These dyads did not progress in their evolutionary theory. The experimenter presented to dyads a model of dialectic argumentation that favored the challenge of conflicting ideas. Many dyads that began their discussion by disagreeing, considered together conflicting views and tried to accommodate them. Thus, these students dodged the social inhibition that disagreement may create.

In conclusion, in spite of the potentiality of the arrangement of different initial cognitions, and in spite of the potentiality of subsequent disagreement among peers, this disagreement is not always desirable and may inhibit learning gains. Disagreement is often overcome by discussants as a collaborative collective argumentation in which different perspectives and jointly accommodated. Another way to avoid social inhibition concerns another arrangement in argumentative design, the use of external resources to structure (productive) argumentation. We will see that external sources make it possible to confront subjects with information that conflicts with their initial cognitions, without offending them, since in this case some of the social drawbacks of disagreement are neutralized.

The present chapter on conditions for collective argumentation is partial in two senses. First, as mentioned before, our list of conditions does not include many factors, for instance social factors. Secondly, the conditions we detailed may only trigger collective argument without structuring and sustaining it. In the next two chapters, we show how structuring and sustaining argumentation may be reached.

4 The Role of Resources in Structuring Argumentation

Like for the chapter about conditions to trigger productive collective argumentation, this chapter is partial. We focus on the role of hypothesis testing devices in structuring collective argumentation as a special case of feedback in this endeavor. Also we limited ourselves in considering the role of texts in structuring argumentation and did not include the more general role of libraries, the inclusion of which would have opened the way to another important aspect of the role of resources, the use of search functions to structure argumentation.

4.1 The Role of Hypothesis Testing Devices in Fostering Argumentation and Learning

Among the resources that may foster productive argumentation, hypothesis testing devices are central, especially in science education. These resources include measurement instruments (balances, meters, etc.) and simulations in computers. The presence of such devices even in the case students check their own hypotheses through the device

and find they were wrong, they are very often inclined to overlook the data the device provides. This is the case with individuals confronted with outcomes that contradict their conclusions: they are generally not able to capitalize on the contradictions that come from hypothesis testing for conceptual change (Tolmie and Howe 1993). However, Howe and colleagues (Howe et al. 2000) have shown that the reason why individuals do not gain from hypothesis testing is that dialogue is needed to resolve the conflict. And indeed Howe and colleagues (Howe et al. 2000) showed that when students worked in small groups and were asked to "reach consensus" on a problem in physics, hypothesis testing led to conceptual change. A quantitative analysis of the dialogues of the discussants showed that change was shown to be accompanied by productive argumentative activity (meaning, as aforementioned, that in addition to learning gains, the dialogue itself contained several arguments, and that they were challenged in some way). Schwarz and Linchevski (2007) showed similar results that led to productive argumentation and subsequent conceptual change in the realm of conceptual reasoning: dyads and not individuals could capitalize on a hypothesis testing device to deploy productive argumentation and subsequent conceptual change. Schwarz and Linchevski showed that the design of the task was tailored to lead to disagreement among peers and conflict with the results of the measurement. The peers were then motivated to settle these disagreements and conflicts.

4.2 The Role of (Multiple) Texts in Fostering Argumentation and Learning

Texts seem another natural candidate for eliciting productive argumentation. In fact, as noticed by Schwarz (2003), collective argumentation around multiple texts representing divergent views has been an important practice adopted in the past by intellectual elites (e.g., by Scholastics and Talmudists in the middle Ages). For different reasons, this practice has almost vanished for several centuries. Its adoption is now considered positively in schools, but as a practice, it is still uncommon, even in universities. Obviously, cautious design is the rule of the game to trigger productive argumentation. Questions such as whether to ask students their initial reasoned opinion or not, whether to discuss texts before discussing the issue or not, whether to present challenging texts in the middle of a discussion, etc. are important issues whose answers should be adapted to the age of the students, the content to be learned, and the initial knowledge of the students.

Since the use of multiple texts in discussions is still an uncommon practice, research on this issue is quite limited. Of course, many studies have been focused on learning from texts or on extracting arguments from multiple texts (e.g., Wiley and Voss 1999). However, these studies have not focused on argumentation itself but on subsequent gains only. This neglected issue seems important for learning scientific knowledge: Since students have huge difficulties to engage in argumentative talk around scientific issues, studying when and how texts are incorporated in argumentative talk, is an important issue. A few studies have concentrated in this

very issue of whether and how texts provided to students fed argumentative talk and led to subsequent learning in some cases. For example, de Vries et al. (2002) provided a text on acoustics to dyads of students and asked (through a software) about their agreement or their disagreement for each sentence of the text. When peers did not agree, the system proposed them to discuss their disagreement. Even in this very structured setting, students had a very hard time to deploy productive argumentation and generally did not advance their conceptions in acoustics. Anyway, the lack of research on how to design texts to optimize learning, how to present them to students, and why in certain conditions, learning is promoted and in others is inhibited by texts, is flagrant. Since, in spite of the absence of systematic research on this issue, educators begin to use multiple texts in classroom discussions (e.g., in history and civic education as shown later on), it is timely to suggest several reasonable hypotheses to be checked and refined in research.

A first hypothesis concerns the role of texts to enhance argumentation: texts make public common opinions about issues. Therefore they provide resources for students to operate argumentative moves such as elaborating their own arguments by using information in texts or challenging the arguments held by others, again by capitalizing on information included in the texts.

The rare studies in which the role of texts in argumentation was analyzed indicate that the first hypothesis should be specified. In a case study, Schwarz (2003) showed that providing texts at the beginning of a discussion between students is too complex if the reading of the texts is not structured. Baker (2003) used the CONNECT environment to present texts to dyads. The students were invited to discuss texts. The reading was highly structured: for each statement, students were asked whether they agreed, and disagreed and to propose reasons for their (dis)agreement. When students disagreed in their judgment, they were asked to settle it. In another study, Schwarz et al. (2003) proposed to elementary school students multiple short texts that provided resources pro and con a moral issue – whether to perform experiments on animals. The students read and commented texts together, then discussed the issue under consideration. While, in this case, argumentation was found productive – the study showed that reading the texts promotes further the quality of argumentative writing in individual essays, although it was difficult to identify pieces of information "included in the texts presented" that the students used. Rather the reading of the texts triggered quite associatively productive talk. Such a use seems appropriate for the moral issues students discussed but does not seem to fit for discussing scientific issues.

In chapter 9 of this book, Andriessen discusses a case in which undergraduates were asked to collaboratively use a computer map editing tool to display the author's reasoning in a scientific text. Discussion was through electronic chat. Although the resulting maps were of reasonable quality, that is, they displayed the main reasoning of the text to some extent, there was hardly any argumentation in the dialogues. This apparent contradiction could be understood as students trying to copy the main points directly from the source text, without discussion being needed, because for them, text represented authority. These students did not argue because argumentation would only complicate matters, which did not match their interpretation of the assignment.

Another untapped research direction concerns the form and content of the texts. Two main forms of texts seem to have potentialities for learning. The first one is a narrative form. A narrative form can more easily be appropriated, but it is not easy to incorporate in the elaboration of a well structured argument. On the other hand, providing texts in the form of arguments can leave the reader indifferent. Concerning content, providing texts that present conflicting or completing arguments (or multiple texts) seems to be of great potential for learning. If we take into consideration the possible arrangement of initial cognitions of the students (see above), the encounter of students with completing or conflicting multiple texts opens a very interesting direction in research.

5 On Designing Interactions to Promote Productive Argumentation

So far, we presented argumentative design as a series of factors, or arrangements that were anterior to argumentation. However, as often mentioned in this chapter, argumentation risks to remain unproductive if exclusively left in the hands of the learners. Sustaining the argumentative process is often a necessary action. We present in this chapter several approaches on designing interactions to promote productive argumentation.

We should initiate this part of the review by warning that designing interactions to promote productive argumentation is an extremely hard task. It is natural to look at teachers when they animate discussions in their classes. Yackel (2002) analyzed several protocols from different teachers that mediated collective argumentation. She showed that in order to help in the emergence of arguments, teachers needed to have both an in-depth understanding of students' conceptual development and a sophisticated understanding of the concepts that underlie the instructional activities being used. Since this enterprise is very difficult to sustain, a first simpler step in coping with the design of interactions has been to focus on prompts, isolated actions that may promote productive argumentation.

The first important step in this direction was to recognize that offering an explanation may not always be the best kind of prompt. Palincsar and Brown (1984) were one of the first who suggested that for learning to be meaningful, rather than offering an explanation, it is often better to lead students towards further inquiry. There is some empirical evidence, for example by Pilkington and Parker-Jones (1996), supporting the idea that by adopting an inquiry style, by prompting the students' reasoning, justification of conclusions, or stating implications from data, a tutor can increase their understanding by reflection. Ravenscroft and Pilkington (2000) report research on tutor strategies and speech acts that are likely to be important in productive educational dialogues. Among all argumentative prompts, it is useful to differentiate between moderating and mediating ones. Moderation concerns prompts encouraging participation, answering challenges, clarifying, focusing on topic or even giving reasons. Mediation concerns the very constructing of arguments by pointing at contradictions, bringing new data, challenging

an argument. Both kinds of prompts are useful. However, it seems that while teachers can learn quite easily the techniques and prompts for moderation, mediating argumentation seems extremely difficult.

Another way of prompting for fostering productive argumentation consists of feeding discussants with useful information in the course of their discussion. For example, Asterhan and Schwarz (2007) provided a part of a protocol featuring two disagreeing discussants proposed reasons for their views about a problem on evolutionary theory and challenged each other. This argumentative prompt was given in the middle of the discussion between peers and changed the characteristics of the discussion to more argumentative and led to resilient conceptual gains.

Mercer, Wegerif and their team propose a dialogic approach for promoting collective argumentation that differs from the prompting approach in the sense that the teacher's interventions are not isolated and linked only to specific goals but belong to a culture that the teacher instills in classroom talk. It consists of encouraging students to implement rules of exploratory talk (called ground rules) in their talk. In Exploratory Talk, partners engage critically but constructively with each other's ideas. Relevant information is offered for joint consideration. Proposals may be challenged and counter-challenged, but if so reasons are given and alternatives are offered. Agreement is sought as a basis for joint decision-making and action. Knowledge is made publicly accountable and reasoning is visible in the talk. The teacher's role in instilling ground rules consists of including "reasoning words" such as "what," "how," "if" and "why" as the children are lead through the activity. The teacher accepts and discusses challenges made and respects them. The children are given a demonstration of how to consider the validity of alternative suggestions. The teacher invites children to speak so that as many people as possible feel able to join in the discussion, and ensures that an agreement is sought and reached. In this way, through careful modeling of the ground rules for talk, the teacher is demonstrating to the children how effective collaboration can be as an integral element of intellectual activity. The children are engaged in the discussion, their points of view are sought, they have some influence on the discussion and the actions that are taken. And by being engaged in a dialogue in which Exploratory Talk is modeled, they are being prepared to use it when they continue the activity in small group discussion. This approach also called "dialogic teaching" (Alexander 2005). In their educational program Thinking together, Mercer and colleagues (Dawes et al. 2004) showed that argumentation turns to be very productive as general thinking skills were promoted (Wegerif et al. 1999). In chapter 8, Mercer exemplifies this approach and shows the kind of discussions that deploy in classrooms.

In the Kishurim program, Schwarz, Glassner, and de Groot (Schwarz and Glassner 2003; Schwarz and de Groot 2007) adopted a similar, dialogic approach. However, the project proposes additional ways to design and structure argumentation. The first way concerns arranging successive activities for transforming arguments according to the goals in these activities. A typical succession of activities includes the presentation of a dilemma, individual argumentation in a written essay reflecting a personal opinion, brainstorm argumentation in a teacher-led discussion, round of turns argumentation in which the teacher controls a pre-established order of asking for arguments and all students have time to express their viewpoints, round of turns

counter-argumentation in which the teacher orchestrates another controlled round of turns to figure out the reasons an opponent could raise and each student attacks his or her previous argument, small group dialectical argumentation in which small groups of students collaborate to construct their arguments, preparing the defense of an argument, in which students collaborate to design a multimedia representation based on their small group dialectical argumentation, and defending an argument in which students use their presentation to convince their audience (the whole classroom) that they are right. There are many variants of such practices, but the idea under this sequentiality is that arguments and argumentation should be adapted and transformed according to specific goals and that the discussants should be aware of the need for these transformations. A second important specificity of the Kishurim program is that argumentation is structured by using a computerized tool that represents graphically dialogues as they develop. The advantages and drawbacks of such a tool and many other tools in structuring argumentation are reviewed in the next chapter.

6 Design of Computer Supported Argumentation

In the previous sections, sometimes we discussed designs in which computer tools were employed, sometimes they were not. In the present section, we try and focus on the role of such tools for the design of productive argumentation. This means that we inquire specific possibilities for such tools, different from, or in addition to, argumentation mediated by oral or written modes of communication. In our discussion, we partly follow the division proposed by Andriessen et al. (2003): the computer as channel of communication, the computer used for structuring interaction, the computer as a representational tool for representing arguments, and the computer as an active guide. This last rubrique refers to intelligent computer support. With respect to effective design of meaningful argumentation, this type of support has not yet reached sufficient maturity, and we will briefly discuss it in the section on structuring interactions. It is important to note that the field of Computer Supported Collaborative Learning (CSCL) is only recently starting to become an established community. During the nineties of the previous century the thinking about the role of the computer has shifted from that of a mediator or moderator, to that of a medium which is part of the educational environment, or activity system, if one prefers that, to be studied in relation to that environment (Koschmann 1996). The research that is reported in the next sections is not always specifically addressing argumentative design, but is about effects of using technology on learning processes.

6.1 Computer Mediated Argumentation

In this case, learners work from behind their computer screens and communicate through typing their messages at the interface. Interaction mediated by computers

cannot simply inherit the pragmatics involved in oral interaction, nor those of written correspondence. As a communication channel, this medium lacks the nonverbal expressions that characterize oral discussion, and which degrades the interpretation, especially of affective and social cues. Also, keyboard typing is slow and error prone. Hence, grounding is problematic in this form of communication, and argumentation may suffer from it. As a tool for structuring and representing interaction, however, the computer still has many interesting possibilities that have been addressed in a number of studies.

Pioneering work was conducted by Veerman in the period 1995–2000, and focused on synchronous computer support for argumentation and its effect on constructive activities. These are learner actions that were considered to be conducive to elaboration of knowledge and supporting collaborative learning: adding, explaining, evaluating, summarizing, and transformation of information. Based on a series of studies using and reviewing various electronic systems affording collaborative interaction, she found that the more participants were actively engaged in checking shared understanding during an electronic discussion, the more constructive activities were found. She called this indirect forms of argumentation, as a contrast with regular argumentative forms such as claiming, backing, or counterargumentation. Stimulating direct forms of argumentation (by instruction or menu-based dialogues) appeared to be useful only when students are well prepared and have sufficient knowledge on a topic. Her studies reveal that argumentation can be provoked by task characteristics rather than by features of the electronic system. In order to support argumentative processes of multiple perspective taking, argument checking and argument elaboration a combination of structured and unrestricted interaction at the user-interface was recommended. Support is especially needed in order to co-ordinate communication and to establish and maintain a conceptually oriented focus. From our current perspective, nearly ten years later, these issues directly refer to problems with grounding and shared understanding at the level of conceptions.

Synchronous discussion involves participants interacting at the same time. Technology adds the possibility of asynchronous discussion, or participants discussing at their own time and react to what has been contributed to the discussion. This kind of discussion has been practiced a lot in the context of understanding scientific texts in higher education contexts. An overview about the role of such forums for supporting argumentation is provided by Andriessen (2006). Although the extended time for reflection in asynchronous discussion affords more understanding and better prepared contributions, the learning results of asynchronous discussions are limited. People do not tend to spend extra time on it, and due to the unpredictability of timing of receiving answers to contributions, the risks of slow and unfinished debates is great. Often it is necessary to oblige students to contribute, but in general that does not enhance the depth of the debate. Argumentation in asynchronous environments for the purpose of understanding texts has even been considered as undesirable by some: van der Pol (2007) reports the results of using an (asynchronous) anchored annotation tool, in which the absence of argumentation in responses to clarification questions in the context of understanding scientific texts is considered as a sign of efficiency.

Schwarz and Glassner (2007) have studied floor control in synchronous e-discussions, a mode of communication which is basically synchronous but for which discussants wait for their turn while looking at the developing discussion – an asynchronous feature. While this mode of communication led to more productive argumentation than "pure" synchronous communication, students feel frustrated in their waiting (see later on).

Munneke et al. (2007) compared argumentation in electronic chat with argumentation in asynchronous discussion, with respect to broadening and deepening of issues pertaining to genetic modification. Synchronous chat proved to be superior both with respect to broader (more topics) and deeper (more elaboration of topic) argumentation. However, the texts that students had to write after the debate were broader and deeper for the asynchronous case. The asynchronous use of this communication medium seems to create a violation of principles related to immediacy, principles that are related to persistence of social, cognitive as well as didactical presence (Garrison et al. 2001), and which are necessary for argumentative debates. At the same time, not only the on-line actions should be considered, but also longer term effects and developments.

6.1.1 Using Computers for Structuring Interactions

During the last two decades of the previous century, many researchers held high hopes for the possibility of computers to structure and manage collaborative interactions (Jermann et al. 2001; Reimann 2003). For structuring, the designer (or teacher) could make decisions about, for example, group composition, task selection, and task structure. This also involves decisions pertaining to use of media for specific purposes, including roles of participants within such uses. A scenario refers to the selection of subtasks and participants' roles, while a script refers to more detailed approaches concerning the desired types of interactions themselves.

Concerning management of collaborative interactions, Reimann (2003) distinguishes mirroring/awareness tools, metacognitive tools, and advising/moderating tools. All of these require at least that the system collects relevant data, constructs a model (interpretation) of these data, and on the basis of this, intervenes, advises, or guides the interaction. With respect to argumentation, such a system should be capable of interpreting not only that an argumentative contribution has been made, but also consider the extent to which such a contribution was appropriate, in the light of a domain-specific model of argumentation within the objectives of the assignment. Only when there are clear ideas about these, design specific ideas can be built in. The first version of Belvedere (Suthers et al. 1997) was designed for users to construct an argumentative representation of an issue, and the system interpreting certain features of the representation, on the basis of a set of "rules of thumb," such as the balance (equal numbers of contributions) between arguments pro and con, and the presence of sufficient backing for a claim (e.g., a backing for each hypothesis). In later modifications of the system (see below) the researchers removed this coaching component. In general, we agree with Reimann (2003), that

research in the area of computer support for management of interactions is often based on over simplified understanding of what collaborative learning is about.

Concerning structuring and management of argumentative interactions, we discuss a number of approaches here (1) structuring the argumentation based on effective interactions; (2) using representations to constrain argumentative interactions; (3) using technology for detailed scripting; and (4) structuring interaction at the communication interface. It should be noted that the studies we report are representative of the topics, but were not always addressing the design issues that we discuss in this chapter. Therefore, they may look somewhat artificially forced into our cages, and their results often are richer than we may suggest here.

The idea behind Academic Talk (Fig.1) (McAlister et al. 2004) is to actively build in (more or less) proven to be effective features of educational dialogue into an interaction scenario. The term dialogue game (Levin and Moore 1997) denotes observable patterns in teacher-led dialogue, such as helping, information-seeking, information-probing, and instructing. Pilkington and Mallen (1996) used such patterns to generate prescriptive inquiry and debating games in computer simulation-based learning. Academic Talk manages conversations between peers, through the use of topic threads and argument strands which keep reply messages next to their antecedent messages. Sentence openers are used by the students to start their locutions in an argumentative discourse frame: I think, Why do you think that, Is there evidence? Further structure is provided through offering preferred reply-openers derived from dialogue game rules. McAlister et al. did an evaluation of the system by using a

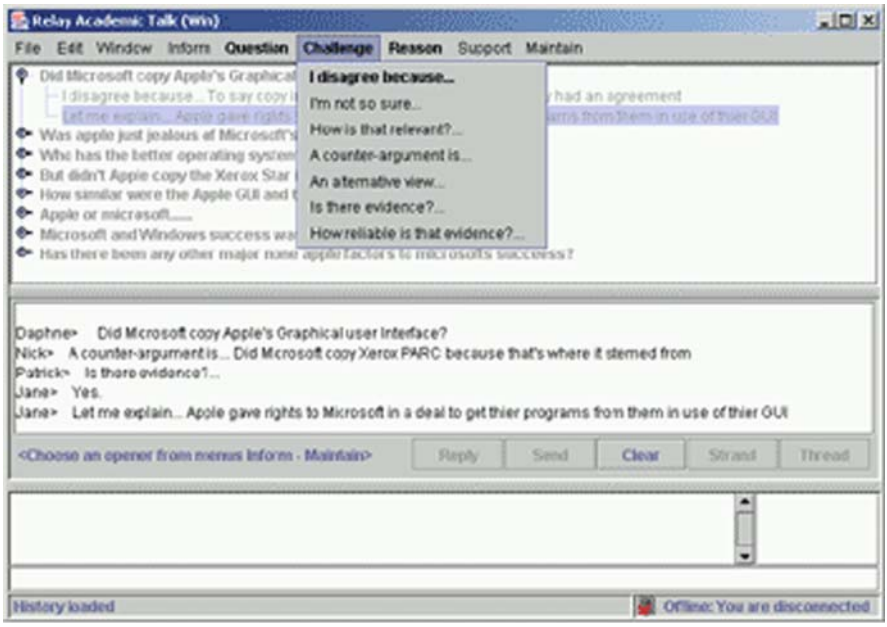

Fig. 1 Academic talk: menu based argumentation

scenario that included student preparation (considering various perspectives in source materials), two online group sessions (comparing issues, debating positions) and a facilitator-led consolidation phase (summary of key arguments). The experimental group using Academic Talk was compared with a control-group using chat only. It was an experiment conducted with volunteer university students. The main differences between the two conditions in terms of dialogue moves were a higher frequency of the moves explore (inviting views on the issue), withdraw (disagreement), and noncommitment (signal that argument is unconvincing) in Academic Talk, while the moves Inform, Inquire, and Reply were found to be more frequent in chat. With respect to argumentation, it was significant that Talk stimulated rebuttals and that a third of the talk episodes demonstrated extended argumentation, while none of the chat episodes did. The authors conclude that the structures dialogues in Talk can be characterized by the use of constructive conflict, while the chat episodes could be characterized as uncritical acceptance of ideas.

6.2 Constraining Argumentation

CSCA software has been designed for the purpose of scaffolding student's seeking of warrants and evidence for supporting claims. Cho and Jonassen (2002) used Belvedere (Suthers 1998) to provide students with predefined argumentation constraints: hypothesis, data, principles, and unspecified. Users construct argumentative diagrams using these categories, to be linked by for, against, or and relations. The choice for this medium is inspired by research by Veerman et al. (2000), who compared argumentative contributions in chat, discussion forums, and belvedere discussions, and found that the last type was most argumentative, assessed as checking, countering, and contrasting each others locutions. Cho and Jonassen investigated in more detail the argumentation in unconstrained (discussion-forum) and constrained discussion (Belvedere) groups, as well as the problem-solving contributions those arguments actually made to the discussions. In addition, they compared well-structured and ill-structured problems, as well as transfer to individual argumentation. Participants were 60 volunteer university students, working in groups of three. The results showed effects of scaffolding on argumentation, especially in the ill-structured groups. Students using Belvedere provided relatively more claims and backings than those in the forums. Belvedere groups also produced more problem solving comments. These effects transferred to higher quality individual argumentation in individual posttreatment problem solving exercises.

6.3 Scripting Argumentation

Within certain approaches to learning it may desirable to have more control on the interactions between learners. One way to structure interactions is to design predefined collaboration scripts, with or without CSCL. Scripts are sets of instructions

prescribing how students should behave and how they should solve the problem. The script could include instructions such as "explain the reasons why you hold your opinion," "try to challenge the views you don't agree with," "try to help by giving more reasons when you agree," "try to help each other to reach an acceptable solution" or "try to convince each other that you are right." Such scripts especially fit collaborative problem solving but are also important when students engage in dialectic processes.

Scripts can vary in the detail they provide, which is also related to the nature of the problem and characteristics of the students. One can use scripts complimentary to tutor feedback after the session. The idea of effectiveness of scripts is based on the idea of integrating usually separate activities: individual, cooperative, collaborative, and collective activities (Dillenbourg 2002). There is a risk of overscripting, in which case natural tendencies in interaction are brought to a standstill, and predescribed steps are taken without much reflection by the participants (Häkkinen 2004; Weinberger et al. 2005). On the other hand, scripted cooperation, especially in well-defined tasks and domains, are able to guide learners into certain interaction patterns (O'Donnell and Dansereau 1992, Baker and Lund 1997, see below). Weinberger et al. (2005) conclude that scripts can facilitate specific processes and outcomes of argumentative knowledge construction. Learners with scripts construct arguments of higher structural quality and acquire more argumentative knowledge than learners without scripts. The acquisition of domain specific knowledge however, depends on epistemic quality of the arguments constructed in online discussions and the focus of elaboration.

Anyway, as noticed before, it has been shown that fuzzy and general scripts risk leading to poor learning outcomes. For example Howe and colleagues (Howe et al. 2000), showed that scripts such as "discuss the issue" and "discuss the issue until you reach agreement" have very different discussions and to different learning outcomes. Explicit and precise scripts are definitely preferable, although the preference for a specific script seems to pertain to pedagogy.

As an elaborated example that may help understanding about argumentation in scripted CSCL, the following discussion of the early work of Baker and associates may be instructive.

In a series of experiments (Baker and Lund 1997; Quignard and Baker 1999) electronic media were used to structure the collective activity, that is, to structure communication, the sequence of subtasks and the semiotic representations involved.

CHENE (Chaines ENErgetiques) is an interface allowing the construction of graphical schemas of electronic circuits (Fig. 2). The first version required two pupils to sit behind the same screen and to collaborate while discussing orally. The electronic communication version of the software was called C-CHENE, and had as a special feature the structured communication interface, through which the dialogue between the students could be mediated. (Fig. 3).

The dialogue chat box was replaced by dialogue buttons, the labels of which based on work by Bunt (1989) and Allwood et al. (1991): task regulation, coordinating agreement, and interaction management. The research is reported in the well-known Baker and Lund (1997) article. The argumentative interactions by undergraduate

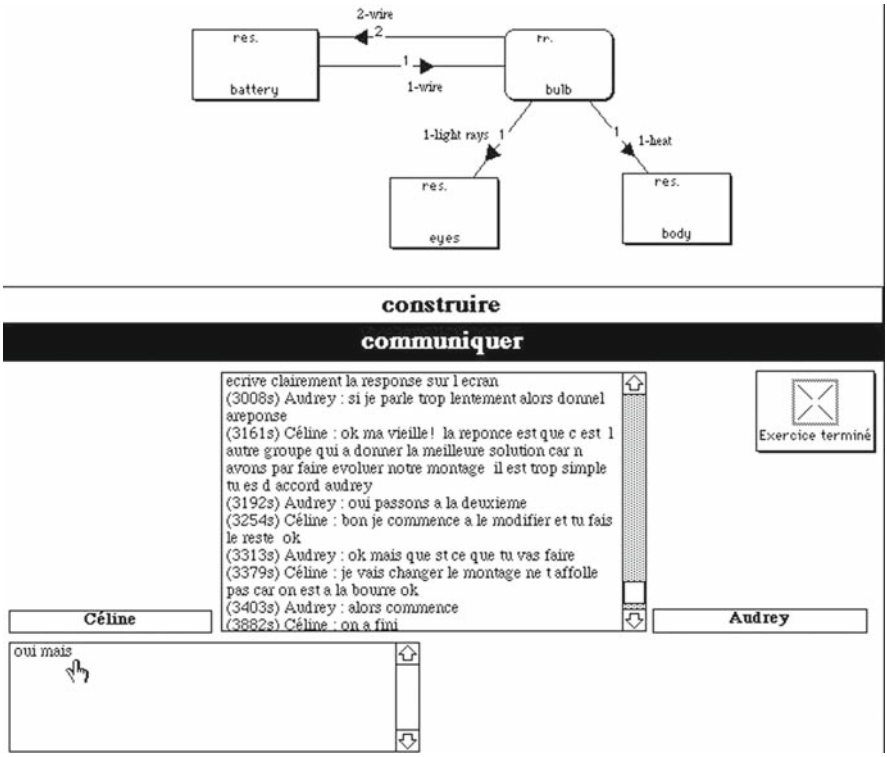

Fig. 2 CHENE's interface

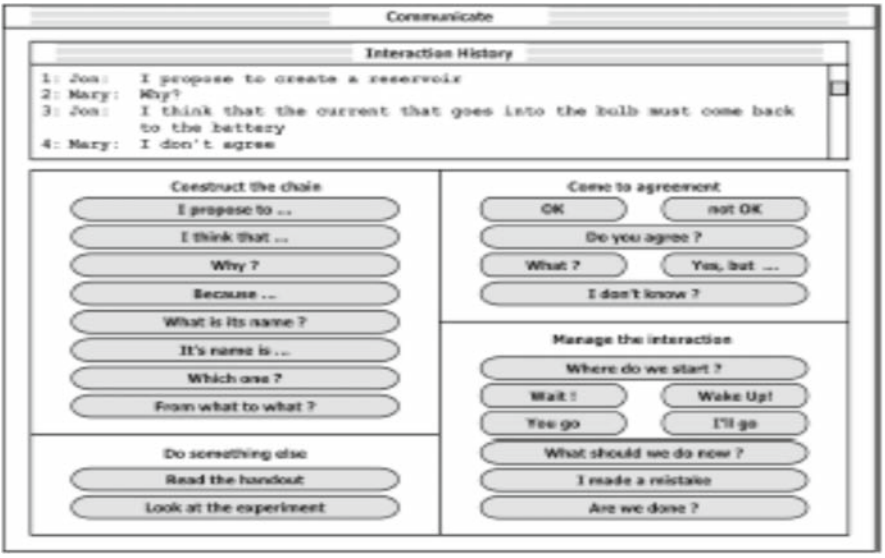

Fig. 3 Structuring argumentation at the communication interface

students with the buttons interface were not necessarily more epistemic, but structured interactions were more symmetrical, when compared to free interactions. Note that the participants were not discussing genetic modification, but were involved in scientific problem solving, a domain were final solutions were hard to find, but available in principle. Whether or not participants arrived at solution is not solely dependent on the software, but also on the (knowledge of) the partners. In such cases, if partners focus on the solutions too much, but forget to communicate, i.e., to argue, problems are less likely to be solved. Unfortunately, the structured interface seemed to reinforce the tendency to focus on solutions. Students using the structured dialogue box are less engaged in epistemic interactions (less than 7% of their contributions) and seem satisfied with drawing the graphical solution. On the other hand, although the students communicated less in the CMC situation, than in CHENE, their interventions concerned the most complex aspects of the problems (Tiberghien and de Vries 1997). Instead of co-constructing the solution, the students cooperated asymmetrically, in the style of: draw, and I will indicate when I do not agree. In fact, a major problem with this electronic interaction was the impossibility to be engaged in chatting and drawing a graph at the same time.

A more radical approach to the design of the task situation was needed. The research with Connect (Fig. 4) differed from C-CHENE in the following respects (1) A different task: sound in physics, a topic with more variety in concepts, notably concerning vibration and propagation; (2) Careful constitution of dyads, based on individual preparation and calculated subjective distance (Quignard 2000); (3) Separation in the task sequence of discussion and collaborative writing; (4) explicit demand (in the interface) for opinions about different text segments; and (5) Explicit instructions for argumentation.

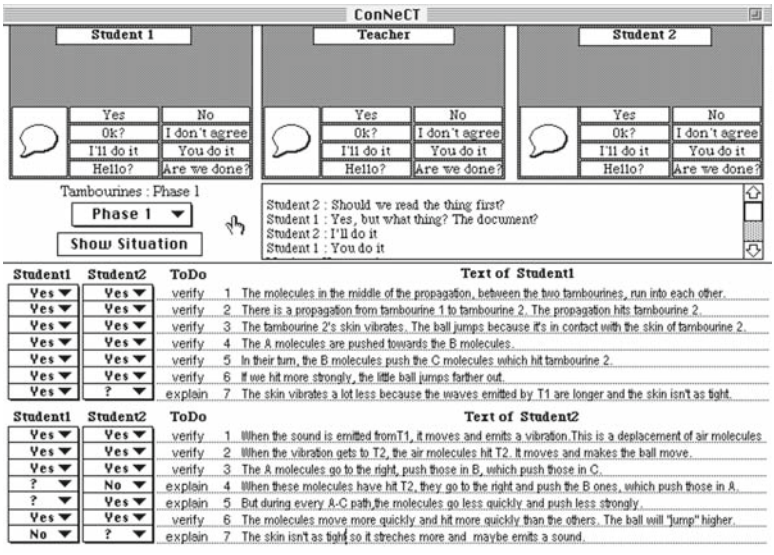

Fig. 4 Connect interface

Student pairs were asked to individually write a problem solution text, for example concerning a problem about sound propagation. The interface allowed display of the two individual texts, each phrase on a different line, and for each sentence both partners could indicate yes, no or "?" to indicate their attitude. In the case of disagreement, the participants were encouraged to discuss their differences. After that, the participants were asked to produce a common text. It seemed that the separation of task phases and the method of dyad constitution were successful. Somewhat more than half of the interactions were judged as epistemic. However, opinion did not change very much, at best established opinions were weakened somewhat (Baker 2003). It is also possible to structure computer mediated communication in such a way as to foster epistemic interactions about scientific notions. However, quite a complicated environment and instructional arrangement is needed, notably (1) a task eliciting debate; (2) a cognitive preparation of the participants; (3) multiple representations to use; (4) good partnerships; and (5) a clear description of what should be debated. Baker concludes it is too much asked of argumentation to be solely responsible for coconstruction of scientific concepts. Rather, it is a means to develop the critical spirit, for better understanding of the problem. Concerning this critical spirit, work on DAMOCLES (Quignard and Baker 1999) showed that participants were not satisfied with finding a solution; they wanted to know its correctness explained by the teacher.

Work by van der Puil (van der Puil et al. 2004; van der Puil and Andriessen in press) used a structured interface to foster "professional collaboration." The research aims to explore what it takes for dyads to develop and use their relationship during collaborative learning tasks, in this case, collaborative writing. Not only individuals have to get used to each other and construct a mode of collaboration which is appropriate for meeting assigned task goals, but also they are in a process of transition between traditional and more advanced forms of education, where advanced means more learner responsibility (and uncertainty), more collaboration between learners and more knowledge negotiation (Andriessen 2005). Microanalysis of a small number of dialogues between collaborative writers showed that argumentation depended on the development of an interpersonal relation between the participants. In order for argumentation to develop, social barriers have to be overcome. This was shown by the fact that some argumentation fragments ended with efforts to restore the collaborative relationship, indicating some discomfort by the participants caused by the argumentation activity. The structured interface was designed to induce professional collaboration by suggesting (not imposing) roles, rather than speech acts (1) Coordinate, (2) Generate (generate, evaluate), (3) Deepen (develop, criticize, compare, explore), and (4) Write (write, revise) in the form of sentence openers. Quantitative results indicated that on average only 28% of the produced sentences confirmed the intention of the chosen sentence openers, while an additional 8.6% at least confirmed to the role associated with the openers. While the structured dialogue system did not succeed in raising the collaboration to the professional level, signs of it being appropriated for regulation were clearly present. For social regulation it was often necessary to dodge the suggested sentence openers.

Hence, what can be said about using structured dialogue interfaces with respect to eliciting and guiding argumentation? It seems that one gets what is asked for:

arguments. However, it is questionable if the same effects were achieved as in the case when similar arguments would have been raised spontaneously by the participants. If the interface too much constrains participants' dialogue moves, they will try and dodge the system. The design of structuring dialogue interfaces is an interesting line of study, but the delicate aspects of such a design are still in its infancy. Effects are related to the compatibility of it with the tasks and the motivation of the participants, which makes learning by structuring interfaces as uncertain as always. If anything, one may think that this kind of research has shown that argumentation when "enforced" by an interface such as CONNECT is by no means a strong learning result. Finally, more work should be done to frame argumentation within a pedagogy and didactics which clarify the objectives of the assignments and as such provide meaning to the activities. Providing structure also requires a clear sense of direction on the part of the designer.

6.4 Argument Representations

In many demanding tasks, external representations are provided to facilitate their execution. In many of these representations, primitives, or what is also called an "ontology" expressed the argumentative components or moves necessary for engaging in argumentation. Participants are then asked to build a representation (a diagram) using the tool, for example displaying the pros and cons of supporting research on genetic modification. This development raises old issues concerning the relation between action and tools (a) Are the tools appropriate for productive argumentation? (b) Are the actions supported by representational tools really argumentative? (c) Should educators and researchers valor understandings emerging for the use of the tools, the adequate use of the ontology during the argumentative process, or both? (d) What is the nature of argumentation with such tools? Our review in this section shows how the CSCL community has partly tackled these difficult questions.

6.4.1 Representational Guidance

The start of this line of inquiry was with Belvedere 1.0, a diagrammatic environment intended to support secondary school children's learning of critical inquiry skills in the context of science (Suthers et al. 1997). The diagrams were first designed to engage students in complex scientific argumentation with the help of an intelligent tutoring system. For example, one version had visual primitives for propositions categorized as Principle, Theory, Hypothesis, Claim, Report, or Unspecified; and for relations categorized as Supports, Explains, Predicts, Conflicts, Justifies, Undercuts, Causes, and Conjunction. Research showed that most interesting argumentation was not within the diagrams, but was expressed in the oral dialogues external to them (Suthers 2003). The diagrams were later redesigned to encourage focus on evidential relations between data and hypotheses. Rather than being a

medium of communication or a formal record of the argumentation process, the representations were now viewed as resources (stimuli and guides) for conversation and reasoning (Collins and Ferguson 1993; Roschelle 1992; Suthers 1998). This motivated research about comparing representational formats with respect to some role during reasoning, and argumentation.

Suthers and colleagues compared threaded discussion, tables, texts, and graphical representations in several studies (Suthers 1999, 2001, 2003; Suthers and Hundhausen 2003), and also compared face to face and online collaboration using Belvedere (Suthers et al. 2003). Representational notations can differ on what information they are capable of expressing (Stenning and Oberlander 1995), what information they make salient (Larkin and Simon 1987), and what epistemic processes they promote (Collins and Ferguson 1993). The hypothesis was examined that these characteristics affect argumentation during collaborative learning. For example, cells with missing information in a table, or labeled boxes in a graph, or the ability to link in graphs, may affect various aspects of the discussion. It is difficult to provide a short synopsis here, because listing results does not do justice to the different designs and contexts of research from which they were derived, and dependent variables do not always explicitly involve argumentation. We discuss some examples of this work.

Suthers and Hundhausen (2003) had their participants in pairs work through 15 information pages on a science problem, and were asked to record data, hypotheses, and evidential relations in Text, Graph, or Matrix. Once finished, they were given a post-test and had to work together on an essay summarizing their findings. Dependent variables were the participants' (oral) utterances, a multiple choice recall post-test, and the contents of the written summary. Results indicated sensitivity for the representations in the focus of the discursive activities they elicit. Visually structured and constrained representations can provide guidance that is not afforded by plain text: Users of Matrix and Graph revisited previously discussed ideas more often than users of Text, as was predicted from the greater salience of ideas and prompting for missing relations in the more structured representations. However, Matrix users revisited data and hypotheses mainly to fill in the cells that relate them, due to the exhaustive prompting of the matrix. There were no significant differences between the groups' post-test and essay scores. The Graph group had most overlap with the essay and the contents of the Graph.

A study by Suthers et al. (2003) compared online and face-to-face collaboration in the use of graphs, and showed that using graphs in online communication resulted in a greater total number of epistemic classifications and a greater percentage evidential relations than the face-to-face condition. However, participants in the face-to-face condition discussed significantly more often than online participants. Online participants rely more on the knowledge representation medium (the graph) for their interaction and discuss less in the chat than when in the face-to-face condition. The epistemic classifications in the graph condition were not always the result of extensive discussion. And finally, the quality of the essays was lower in the online group, perhaps the result of less elaboration during the interaction leading to less shared understanding.

6.4.2 Mediating Argumentation Through Using Diagrams

Schwarz and Glassner (2007) carried out a comparative study on the Digalo tool,[1] a tool that represents argumentative moves graphically and enables discussants to collectively construct a discussion map synchronously (Fig. 3 in chapter "Argumentative Interactions and the Social Construction of Knowledge,"). The two variables manipulated were the use of argumentative ontology and the enacting of floor control. The ontology was informal – providing primitives derived from informal conversation. Floor control provided a variant of synchronous communication for which discussants wait for their turn and at the same time look at the discussion as it deploys. Subjects were junior high-school students who used for the first time the Digalo tool (Fig. 5). Glassner and Schwarz showed that in the condition of floor control and informal ontology, discussants used less chat-style utterances, references to peer contributions were more numerous, and arguments were more relevant. The floor control and the use of ontology led discussants delaying their interventions, thus taking into consideration interventions by their peers, and reflecting on the argumentative nature of their interventions. This study suggests the potential of an untapped kind of communication, synchronous communication with floor control

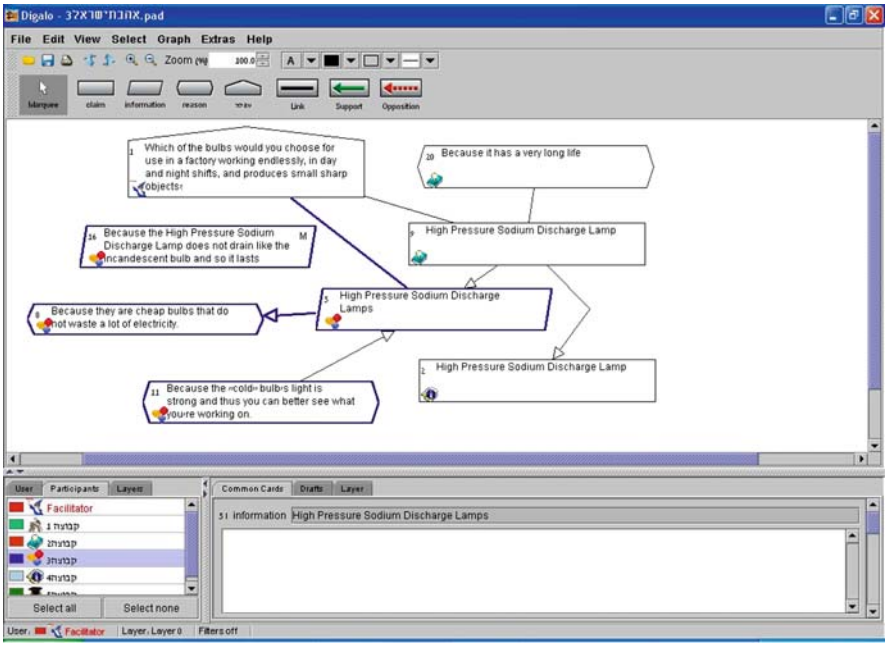

Fig. 5 Digalo's map

[1] The Digalo tool (http://zeno8.ais.fraunhofer.de/digalo/index.html) has been developed in the framework of the EC funded Dunes project (IST-2001-34153).

for productive collective argumentation. It also shows that the use of properly designed tools can be immediate, intuitive and that CSCA tools provide environments for new forms of informal argumentation.

6.4.3 Scenarios for Using Argumentative Representations

Van Amelsvoort's (2006) work was carried out in the context of the SCALE-project,[2] using a tool called DREW.[3] Her focus was on the role of task design and graphical representation tools in supporting argumentation-based learning. The target groups were secondary school students. By means of discussion, students are to explore the space of debate of an issue. The space of debate is described as all views, arguments, decisions, facts, emotions, and consequences of an issue. Students explore the space of debate by broadening and deepening it. Broadening has to do with the different viewpoints that can be taken in the issue by different stakeholders, the different subtopics that are distinguishable in the issue and the arguments that accompany them. Deepening the space of debate has to do with being able to argue about argumentation, seeing the relations between the different views and subtopics, and understanding the more fundamental issues and questions involved.

The results of a series of experiments during which various ingenious forms of task designs were employed, all serving to make students more aware of the potential usefulness of the diagrams, could be described as mixed. Student pairs and triplets obtained highly variable results and displayed different processes, almost irrespective of training in argumentation, tool use, being allowed to select their own topics, extensive preparation, etc.

A paradox was noted between two different uses of diagrams: communication and structuring. The two uses of diagrams seemed to be incompatible for students; they are either aimed at reasoning through the diagram, or at structuring argument. Of course a diagram always has a structure, structure is also a way to communicate, and communication has a structure. However, students should be more clear and explicit about their reasoning in a diagram, which means they should combine reasoning with structure. Solving the apparent incompatibility between communication and structure in a diagram can involve dividing communication and structure tasks, or help students learn a special form of diagrammatic reasoning. Another problem was the lack of transfer between different phases of task design, as well as the lack of appropriate translation between diagrammatic and textual representations (such as chat or text). Constructing a diagram and synchronously chatting about it were taken as parallel and separate activities. From a pedagogical viewpoint, this points to the direction of not artificially dividing tasks. From a theoretical viewpoint however, it may

[2] SCALE: (IST-1999) (Internet-based intelligent tool to Support Collaborative Argumentation-based Learning in secondary schools (http://:www.euroscale.net; http://drew.emse.fr).

[3] Dialogical Reasoning Educational Webtool: http://drew.emse.fr. DREW contains a large variety of CSCL tools, including argument graphs and structured CHAT.

be interesting to divide argumentative subtasks such as summarizing, countering, and concluding, to investigate how students use the given tools in any of these subtasks.

6.5 Computer Supported Collaborative Argumentation and Education to Dialogic Thinking

So far, the experimental results we reported on the effects of Computer Supported Collaborative Argumentation (CSCA) tools were for the most limited to experiments that lasted no more than several hours. A different approach has been adopted by Schwarz and colleagues (Schwarz and de Groot 2007; Schwarz and Glassner 2003) as they integrated the use of the tools in long term courses aimed at fostering dialogic thinking. The design of the tool DUNES was driven by several pedagogical principles autonomy, collaboration, commitment to reasoning, ethical communication, procedural mediation, etc.) that were instilled in activities with and without the computer tools. In this environment, Schwarz and de Groot tried to characterize argumentative aspects of written texts as a result of a long term course in history in which the teacher fostered dialogic thinking by often using the Digalo tool. Contrarily to Suthers' findings that showed that using graphical representation of components of argumentation would increase the number of reasons, counterarguments, etc. in subsequent essays, Schwarz and de Groot showed that the most significant differences could be seen in the coherence of the texts, their openness (the number of perspectives) and in the decisiveness of the writers rather than in the number of (counter-)arguments. Such findings question the domain of validity of experimental research with CSCA tools: Schwarz and de Groot concluded that when the CSCA tools become part of the culture of the class, other processes and other kinds of effects may occur. Such a direction towards the integration of CSCA tools in the classroom culture is a necessary step, and we conjecture that several argumentative norms will be instilled in classrooms dedicated to fostering dialogic thinking mediated by CSCA tools. For example, Schwarz (2003) has shown how the practice of dialectic argumentation around distributed texts is enabled by CSCA tools and challenges epistemological beliefs in science and in history.

6.6 Some Conjectures Concerning Using Argumentative Representations in Argumentative Design

We have discussed a number of studies involving argumentative representations, and it seems that results show that there is an effect of using such representations. However the nature of such an effect depends on the learning environment, the scope of the study, and also the degree of integration of the work into student practice. It seems that the most significant factor of uncertainty remains the actual use of the computer tool by individual users or small groups of users. We have to see computer

tools not as traditional tools such as hammers or even books, but as factors affecting the learning environment and the way in which people work. Therefore, studies about tool appropriation over an extended period of time, specifying in detail how the use of tools evolves in various learning situations, seems essential (Overdijk and van Diggelen, in preparation).

7 Conclusions

The philosophical and political changes that shook our society during the twentieth century brought to the fore change in education. Among those changes, fostering critical reasoning and dialogism – to a large extent what we called productive collective argumentation, are of utmost importance. These changes cannot be undertaken without intensive commitment. Argumentative design connects between the intentions of the reformers and practice. We saw in this chapter that, as a central lever for change, it is a new and an extremely complex task. It involves new kinds of resources (e.g., multiple contradicting texts), or varied social and cognitive arrangements. But the more challenging facet of argumentative design is that it involves new modes of communication and their structuration, as well as the elaboration of new tools for sustaining productive collective argumentation. The multiple choices that accompany argumentative design turn this new topic to a central, exciting, and challenging field in research and development.

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Part II
Practices

Developing Argumentation: Lessons Learned in the Primary School

Neil Mercer

Abstract In this chapter, I argue three main points: first, that one of the most important aims of education ought to be to develop children's capability for argumentation; secondly, that teachers can make a significant contribution to this development; and thirdly, that the development of children's use of language as a tool for argumentation helps the development of their individual intellectual capabilities. To do so, I first discuss the importance of children's engagement in dialogue for the development of their thinking and understanding. I then consider education as a dialogic process, in which both the talk between teachers and learners and the talk amongst learners have important roles to play. Finally, I describe some classroom-based research which has enabled teachers to encourage the development of children's use of spoken language for thinking and arguing effectively together, and which has also provided empirical support for the relationship between thought, language and social activity claimed by the Russian psychologist Lev Vygotsky.

Keywords Argumentation, Reasoning, Classroom talk, Cognitive development

1 Introduction

In this chapter, I argue three main points: first, that one of the most important aims of education ought to be to develop children's capability for argumentation; secondly, that teachers can make a significant contribution to this development; and thirdly, that the development of children's use of language for effective argumentation helps the development of their individual intellectual capabilities. To do so, I will first discuss the relationship between children's engagement in dialogue and the development of their understanding. I consider education as a dialogic process in which both the talk between teachers and learners and talk amongst learners have

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important roles to play. I then describe some classroom-based research which has enabled teachers to develop children's skills in reasoning and argumentation. I will thus also show how a focus on the development of effective argumentation can provide answers to some intriguing questions about the relationship between the development of thinking and engagement in dialogue.

2 Argumentation and Development from a Sociocultural Perspective

Psychological and anthropological studies of adult–child relations, observed in many cultures, support the view that growing up is an "apprenticeship in thinking", an induction into ways with words and ways of thinking which is achieved through dialogue (for example, Heath 1983; Rogoff 1990, 1995; Wells 1992). This research has highlighted the importance of the role that parents and other people play in helping children learn, in the course of everyday joint activities, how to use language to get things done. Adults do not only allow children to participate in activities and use language to provide them with information, they also instruct them in ways to talk and model effective ways of talking. And children, on their part, may take active roles in using language to solicit help, obtain information and transform what they are given into the form of their own new understanding. They can also contest what they are told, by adults or other children, and gain understanding from engaging in argument. The information children gain through language may sometimes be, or at least appear to be, incompatible with experience gained in other ways, or with their existing understandings which have been formed through past experience. Language provides both a means for generating a motivating kind of cognitive conflict and also a means for resolving it. Using language, children can actively test their understanding against that of others, and may use argument to elicit relevant information and explanations from adults and other children about what they perceive – and what they want to know. When we come to consider the development of children's argumentative abilities, it is important to appreciate the dual role that language takes in that process of development. On the one hand, children are learning how to use language: it is the prime cultural and psychological tool for constructing arguments that children need to master. On the other hand, language is also the prime tool for conducting the teaching and learning process. Children can learn about argumentation through dialogue about it with a more knowledgeable member of their community.

3 Guidance from Adults

Research on the casual adult–child interactions of everyday life has revealed that adults often rely on particular techniques or guidance strategies for generating a common frame of reference during an episode of teaching-and-learning. For example, Wertsch (1985) observed parents of young children using two techniques. The first, which he calls "establishing a referential perspective", is when an adult responds to a

child's apparent lack of comprehension by referring to other shared knowledge. Imagine, for instance, that while on a country walk a parent says to a child "Look, there's a tractor". If this reference fails (that is, the child doesn't seem to realise which object is being referred to), the adult may then say something like "Can you see, that big green thing with enormous wheels?" In doing this, the adult is drawing on resources of common knowledge to build a shared contextual frame of reference, based on the reasonable assumption that the child's understanding of basic features like colour and appearance will help them identify the strange object in question. Coupled with this technique, adults use a kind of reverse process which Wertsch calls "abbreviation". This is when, over the course of time, an adult begins to assume that new common knowledge has been successfully established, and so when talking to the child makes progressively more abbreviated or cryptic references to what is being discussed. For example, the next time the same parent and child are out in the countryside, the parent may first point out "another big green tractor", but then later just refer to "the tractor". In these ways, by creating common knowledge and then gradually assuming its existence, the adult first provides a "scaffolding" to support the child's developing understanding and then dismantles it as the child becomes able to sustain their new understanding independently. It is important to note that from such experiences the child can gain not only a better understanding of the experience being discussed with the adult, but also of how language can be used effectively as a tool for describing and consolidating shared experience.

Research in schools has revealed that teachers also depend on the use of particular linguistic strategies for guiding, monitoring and assessing the activities they organise for their pupils (in ways described in Edwards and Mercer 1987; Mercer 1995). All teachers ask their pupils a lot of questions. Most teachers also regularly offer their students *recaps* – summaries of what they consider to be the salient features of a past event, which can help students to relate current activity to past experience. Teachers also often *elaborate* and *reformulate* the contributions made to classroom dialogue by pupils (for example in response to a teacher's questions) as a way of clarifying what has been said for the benefit of others, and also making connections between the content of children's utterances and the technical terminology of the curriculum (Lemke 1990; Wells 1999). These strategies seem to be in common use throughout the world, even though teaching styles and ways of organising classrooms vary within and across cultures (see Alexander 2000 for reviews of relevant research; Edwards and Westgate 1994; Mercer 1995).

Of course, like the tools of any trade, teachers can use these common discursive strategies relatively well or badly. For a teacher to teach and a learner to learn, both partners need to use talk and joint activity to create a shared framework of understanding from the resources of their common knowledge and common interests or goals. Talk is the principal tool for creating this framework, and by questioning, recapping, reformulating, elaborating and so on teachers are usually seeking to draw pupils into a shared understanding of the activities in which they are engaged. This shared understanding may be thought of as an "intermental development zone" (IDZ) in which educational activity takes place (Mercer 2000). The IDZ is a dynamic frame of reference which is reconstituted constantly as the dialogue continues, so enabling the teacher and learner to think together through the activity in

which they are involved. If the quality of the IDZ is successfully maintained, misunderstandings will be minimised and motivations will be maximised. If this is successful, the teacher will be able to help the learner transcend their established capabilities and to consolidate their experience in the zone as improved capability and understanding. If the dialogue fails to keep minds mutually attuned, however, the IDZ collapses and the scaffolded learning grinds to a halt. The IDZ is a mutual achievement, dependent on the interactive participation and commitment of both teacher and learner; but a teacher must take special responsibility for its creation and maintenance. It is a continuing, contextualising framework for joint activity, whose effectiveness is likely to depend on how well a teacher can create and maintain connections between the curriculum-based goals of activity and a learner's existing knowledge, capabilities and motivations. (The relationships between the idea of the IDZ and the well-established sociocultural concepts of "scaffolding" and the Zone of Proximal Development are discussed in Mercer 2000). Later in the chapter I will describe some research which built on these ideas in a programme designed to develop children's skills in argumentation.

4 Learning in Peer Groups

A sociocultural perspective helps us appreciate the reciprocal relationship between individual thinking and the collective intellectual activities of groups, and this relationship is particularly important when considering the development of argumentation. We use language to transform individual thought into collective thought and action, and also to make personal interpretations of shared experience. Not only the intellectual development of early childhood but the whole of human life depends on the maintenance of a dynamic relationship between the social and the psychological – the "intermental" and the "intramental". Ways of arguing are not invented by each generation: they are part of the culture of language use that children grow into, that they hear going on around them and in which they are legitimate peripheral participants (Lave and Wenger 1994). But as well as learning from the guidance and example of adults, children (and novices of all ages) also learn the skills of thinking collectively by acting and talking with each other. Any account of intellectual development which was based only on the study of dialogues between older and younger generations of a community would of course be inadequate. Members of a younger generation use language amongst themselves to generate their own, shared understandings and to pursue their own interests. Each generation is active in creating the new knowledge they want, and in doing so the communal resources of the language toolkit may be transformed. But it is worth noting that even the rebellious creativity of a new generation is, in part, the product of a dialogue between generations.

Language offers children a means for simulating events together in play, in ways which may enable the participants to make better sense of the actual experiences on which the play is based. The Dutch researcher Elbers (1994) collected some interesting examples of children engaged in this kind of play activity. Like many chil-

dren, when they were aged 6 and 7, his two daughters enjoyed setting up play "schools" together with toy animals. They would act out scenarios in which, with one of them as the teacher, the assembled creatures would act out the routines of a school day. But Elbers noticed that one typical feature of their play school was that incidents which disrupted classroom life took place with surprising frequency. Here, presented as Sequence 1 below, is one such example (translated by Elbers from the Dutch). Margareet is the eldest girl, being nearly 8 years old, and here takes the role of the teacher. Elisabeth, her younger (6-year-old) sister, acts out the role of a rather naughty pupil.

Sequence 1: Play school

Margareet: Children, sit down.
Elisabeth: I have to go to the toilet, Miss.
Margareet: Now, children, be quiet.
Elisabeth: I have to go to the toilet.
Margareet: I want to tell you something.
Elisabeth: *(loud)* I have to go to the toilet!
Margareet: *(chuckles)* Wait a second.
Elisabeth: *(with emphasis)* Miss, I have to go to the toilet!!
Margareet: OK, you can go.
Elisabeth: *(cheekily)* Where is it? *(laughs)*
Margareet: Over there, under that box, the one with the animals on, where the dangerous animals… *(chuckles)* under there.
Elisabeth: Really?
Margareet: Yes
(Elbers, op. cit. p. 230.)

In this sequence we can see a child appropriating an adult's way with words. "Now, children, be quiet" is exactly the kind of teacher-talk that Margareet will have heard every day in "real" school. But Elbers suggests we can also interpret this sequence as an example of children reflecting together on the rules which govern their behaviour in school, and how the robustness of these rules can be tested. They can play with ideas of power and control without risking the community sanctions which such behaviour would incur in "real life". This kind of example illustrates something important about how language use in play activities – and the more formal curriculum-based activities of the classroom – may contribute to children's development as language users. Language can be used by them to simulate social life, to create virtual contexts in which they can practice using the genres of their culture to think together about their shared experience in the communities in which they are cultural apprentices. That is, language enables children to think together about social experience; and social experience enables them to acquire and practice using ways of using language to think collectively. For children, playing with discourses is an important way of assimilating the language resources of the community in which they are growing up. However, we cannot assume that all children will necessarily encounter all the useful language genres of their culture in their home experience. For some, the observation of, or participation in, an extended, reasoned discussion may be a rare event. This is why schools have a special role to play in the development of children's argumentation.

5 Learning to Use Language to "Interthink"

In everyday life outside school, the "ground rules" of everyday communication are usually taken for granted, and there is little meta-discussion or joint reflection on how things are normally done. Education should help children gain a greater awareness and appreciation of the discourse repertoire of wider society and how it is used to create knowledge and get things done. Some valuable, practical ways of using language may not be used much in the informal activities of everyday childhood life, and so children can hardly be expected to learn them. School life should give them access to ways of using language which their out-of-school experience may not have revealed. It should help them extend their repertoire of language genres and so enable them to use language more effectively as a means for learning, pursuing interests, developing shared understanding and – crucially – reasoning and solving problems together. That is, classroom activities should not only encourage children to inter*act*, but also to inter*think* (Mercer 2000). However, the importance of language as a tool for "interthinking" has not been acknowledge within most education systems, and it has not figured prominently in school curricula. In all levels of education, from primary school to university, students usually seem to have been expected to work the "ground rules" of effective argumentation out for themselves.

Classroom research has also shown that in most of the dialogue between teachers and pupils, it is rare for pupils to ask the teacher questions, and even less common for pupils to challenge explanations or interpretations of events that are offered by teachers. Reasons for this, in terms of power relations and conventional norms of social behaviour, are not hard to find; but the fact is that teacher–pupil dialogues do not offer much opportunity for pupils to practice their use of language as a tool for reasoning more generally. A more suitable setting for productive argumentative dialogue, one might expect, would be collaborative activity amongst pupils without a teacher present. However, observational research in classrooms suggests that when pupils are asked to work together in groups most of their talk is either disputational or blandly and unreflectively co-operative, only involving some of the children and providing no more than a brief and superficial consideration of the relevant topics (Barnes and Todd 1995; Bennett and Cass 1989; Wegerif and Scrimshaw 1997).

Since the early 1990s, my colleagues and I in the UK have been working with teachers to develop a practical programme of instruction and activity for schools called *Thinking Together* (see http://www.thinking-together.org.uk). The programmes of lessons designed for children of different ages are available in Dawes et al. (2004), Dawes and Sams (2004) Sams et al. (2004) and Dawes et al. (2005). The research itself has been described in Wegerif et al. (1999), Mercer et al. (2000), Mercer et al. (2004) and Mercer and Sams (2006). The programmes consists of a set of Thinking Together Lessons which are designed to have a careful balance of teacher-led and group-based activities. Each lesson begins with a teacher-led session which is used establish explicit aims for each lesson, to raise children's awareness of how they talk together and how language can be used in joint activity for reasoning and problem-solving. This then leads into a group-based task in which children have the opportunity to practise ways of talking and collaborating; and this in turn

feeds back into a whole-class session in which the teacher and children reflect together on what has been learned. In this way, the children are given structured opportunities to practice their strategies for questioning one another, requesting information and reasons from one another, and negotiating a compromise and an agreed course of action. The group tasks include topics directly relevant to curriculum subjects such as English, science, maths and citizenship. The children work in mixed ability, mixed sex groups of three. One particularly important lesson in the first part of the teaching programme focuses on the establishment of "ground rules for talk". In this lesson, the class work together to devise a set of rules for talking together which all agree are sensible, and which when implement should ensure that all voices are heard and relevant ideas are shared. These ground rules are displayed in the classroom, and are intended to become an important reference point for the children. The following notes by one of the teachers who has been closely involved in the research illustrate how teachers set about putting the programme into practice. (*I have added one explanatory comment, based on observation, in italics.*)

Teacher's notes: My aims for the children in teaching the talk lessons

During class lessons, I wanted my class to feel part of a team, rather than individuals pulling in different directions. I felt that group work would help the children to achieve this spirit of co-operation, and so I began to incorporate group activities into science, maths and literacy. When observing and working with the children in their groups, I found that one or two of them would often take full control of the group. Other group members would under-achieve, becoming frustrated because they could not find a way to get involved. And the typical, invisible child, often with many ideas, would simply give up and copy down the results of the other children. Discord was also created when the groups were asked to collect resources. Often, the children would return separately, each clutching the same resources, with no one in the group coordinating what was there and what was missing. Snatching of resources was evident and everyone talked at once, resulting in a heated, unhappy environment, the focus becoming group domination rather than the lesson objective.

It concerned me greatly that in a world where teams of people work together in many different areas of employment, the children in my class, however academically able, would be held back from progressing towards their chosen careers because they had no fundamental social skills. I was also aware that however much practice I gave them, putting the children to work in groups was not improving their team skills. I felt that in order for them to develop their full potential once they became adults, my pupils needed to be taught how to talk and listen as part of a team while they were children.

My main aims were therefore:

to improve the children's learning skills when working as part of a group

to improve the children's talking and listening skills

to help the children to recognise that each individual has different qualities to offer to a working group.

Grouping the Class for the Talk Lessons

The Year 4/5 children were grouped in single year groups and were split amongst four teachers. They were then organised into groups of three. Each teacher then carefully chose each child's role. To do this, I needed to know the children well, and so we waited until 6 weeks into the academic year before starting the programme. Once the groups were established, the

teacher gave each child a role within the group. Each child knew that part of their value for the group was that they were a good listener, a good writer, or especially good at getting on with others. I made it clear to the children that equal value was placed on each of these roles. I also highlighted the personal qualities that were needed to take on these roles.

An Example of a Particular Lesson

The most effective lessons were set in contexts which the children saw as real life situations. In one particular lesson, "Dog's Home", the children were given descriptions of a six dogs, and descriptions of five families who wished to adopt a dog. The children then had to match each dog to a suitable owner. To make the situation more realistic, the unfortunate dog which was left over was scheduled to be "put down" (killed). This encouraged effective reasoning as the children had to convince each other of why each dog went with each owner.

They also had to justify "putting down" the last dog (which actually got a reprieve at the end of the lesson). Finally each group presented its conclusions to the class, and everyone had the opportunity to talk together about how well their group had discussed the work. The children realised that not all groups came to the same conclusions, but that differences of opinion could be created by equally valid reasons; for example, one group placed the Great Dane with an old lady in a small flat *(which the teacher queried in the whole class-discussion as an odd choice)*. The group argued that the old lady would not have to bend down to stroke the dog!

6 Encouraging Exploratory Talk

The kind of language use the Talk Lessons were designed to encourage can be called "Exploratory Talk", a way of using language which was first identified by the educational researchers Barnes and Todd (1995). The way we define this is as follows:

Exploratory Talk is that in which partners engage critically but constructively with each other's ideas. Relevant information is offered for joint consideration. Proposals may be challenged *and* counter-challenged, but if so reasons are given and alternatives are offered. Agreement is sought as a basis for joint decision-making and action. Knowledge is made publicly accountable and reasoning is visible in the talk.

Real conversation may not exactly match this definition but may approximate it, more or less, to the extent that it incorporates these features. Talk which shows some of these features is illustrated in Sequence 2 below. It comes from our project data and is the talk of three children (aged 10) working together on a computer-based science activity called *Tracks*. This provides a simulated environment in which weights are pushed along surfaces of material with different frictional qualities (ice, grass, carpet), and in which the sizes of the weights and forces can be varied systematically. In the sequence, the children are making predictions and carrying out experiments to test them.

Sequence 2: Tracks

Luke: So one of those… no, one grass, and one ice. And the weight's the same, so two again, and both things on four.
Nicola: Yes, two.

Luke: Both on four. Yes.
Nicola: Why don't you do one – oh, you have already! Now press 'ready'. The top weight will go faster…
Paul: Would it?
Luke: Yes, because it's a smooth.
Nicola: Yes. Because it's slippery, it'll go faster. Yes, it does.
Luke: Why?
Paul: Because if there was a rough surface and the bottom one was one ice…
Nicola: If there was a rough surface, there's more friction, it would slow it down.
Luke, Paul: Yes.

We see Luke, Nicola and Paul all offering opinions and giving reasons to support them. They seek each other's views and check agreement. Relevant information is made explicit. All the children are actively involved, their reasoning is often made explicit in the talk, and they come to agreement before taking joint action. These are all features of Exploratory Talk, which contribute to the quality of their interaction as effective argumentation.

There are good reasons for wanting children to use this kind of talk in group activities, because it is a very functional kind of language genre, with speakers following "ground rules" which help them share knowledge, evaluate evidence and consider options in a reasonable and equitable way. That is, Exploratory Talk represents a way in which partners involved in problem-solving activity can use language to think collectively – to "interthink" – effectively, with their activity encapsulated in an intermental zone of their own construction. Other experimental and observational studies have demonstrated the value of talk of this kind in problem solving (Teasley 1997; Lyle 1993; see also Littleton and Light 1999). This kind of argumentation is embodied in some important social practices, such as those used in science, law and business, and it is reasonable to expect that education should help every child to become aware of its value and become able to use it effectively.

7 The Guiding Role of the Teacher

The success of the Thinking Together intervention requires teachers to become aware of the crucial nature of their role as guides and models for the development children's argumentative skills, and to act out that role in their interactions with the children. To help develop this awareness, before beginning the intervention teachers attended a session in which they were asked to reflect on the ways they explained, guided and modelled children's participation in working groups, and to try using some specific strategies for doing so. One of our interests was in the extent to which this in-service aspect of the intervention was effective. We wished to see how teachers implemented the Thinking Together intervention through their talk with children during the plenary sessions of lessons, and in their interactions with children while engaged in group activities. We will focus here on the extent to which teachers modelled Exploratory Talk when interacting with the children, as it is the aspect most directly involved with the teacher's role in shaping children's use of language

for solving mathematical problems. To do so, we will make some comparisons between the ways two teachers in our target schools interacted with children during Thinking Together lessons.

Sequences 3 and 4 below show how the two teachers in project schools used part of the initial whole-class session of thinking Together lesson to introduce a maths activity using a piece of software called *Function Machine*, in which the children are asked to consider what operation might have been carried out on one number in order to end up with another. As well as deciding on the operation, the groups have to come up with a strategy for discovering it and for testing their ideas about it.

Sequence 3: Teacher A

Teacher: OK, I'm going to make it like a bit of a quiz – something for you to think about in your groups. If you hit 'Random' the machine is going to decide on a rule for itself. Here's the machine. This is the bit where you put the numbers into the machine. The machine does some work on them and it has an output box where the numbers go to once it's done its work on them, OK? So, to put a number in you need the cursor in the input box then put a number in so. [*A child keys in '4'*] Four, thank you Amos, four it is. Now all we need to do is activate the machine. This thing lights up when you hover over it so hover over that, activate that and it has turned it into minus one. Now your job as a group is to try and think what might the machine be doing. Discuss that in your groups and when you come up with an idea, test what you think by putting some more numbers in. Has anyone got any ideas as to what the rule might be for an example? Alan? Alan says it might be 'take away five', four take away 5 would be minus one. What does anybody else think? Well we'll try that. So we need to clear it and put some more numbers in to test it. So he says take away five. Let's put another number in so we can test it by taking away five. Two? Right, if we put two in and it is take away five, what should it be? Come in Laura, come and sit down. Minus three? Minus three so if our rule is right, and we activate it, it will come up with minus three. That's what you are trying to do, see what the rule is, then test it with more numbers [*Activates software*] Oh! Minus five. Oh dear. So what would you do now? What would you have to do now in your group? You'd have to think about it again and see if you can think of another rule it might be.

Alan: It could be minus two

Teacher: Um – I don't think so. When you have eventually worked out what it is this box down here reveals the programme. This is quite a hard one really. This one says "Double the input and subtract nine". But a lot of them are a bit more one-stage operations, like add 4, multiply by three, divide by two something like that. So if you get mega–mega stuck and you try it several times and you can't work it out you can have a look at it. And then think of a number you can put in and see if you can say what will come out. So we know this doubles the input and subtracts nine, so think of a number we could put in and what would come out if it's doubling the input and subtracting nine. OK? Mary?

Mary: Eighteen

Teacher: Eighteen. So if we put eighteen in and double the input what are two eighteens – thirty-six? And then subtract nine – what's thirty-six take away nine? [*A child responds – inaudible*] Twenty seven? – Yes twenty-seven. OK let's try it then – so if we get rid of that – I think this is going to work – put eighteen in, activate that – yes twenty-seven. So once you've done that you can start all over again with a different thing. You press clear to clear it all then select "Random" from down in this bottom corner now the machine has got a new rule in it – shall we try this one? Give me a number…thirty-six. Oh I forgot the cur-

sor that's why it wouldn't go in – we need the cursor – remember that. Now – thirty-six went in, Activate…thirteen! Thirty-six went in, thirteen came out.

Elenor: Take away three and take away twenty.

Teacher: What might it have done? You'd be in your groups now saying what might it have done. One of you would say something and then someone would say something else, they you'd discuss it and try it.

Elenor: [Teacher's name] it's twenty three.

Teacher: Well that's where I'm going to leave you to try that.

Sequence 4: Teacher B

Teacher: OK. I'm going to put a number in (*looks at class quizzically*).
Louis: One thousand.
Teacher: OK Louis immediately said one thousand. Is that a good number to put in?
Child: No
Teacher: You are shaking your head. Why do you think it is not? Shall we come back to you? You've got an idea but you can't explain it? OK Louis had one thousand. Anybody think yes or no to that idea? David.
David: Start off with an easier number.
Teacher: Start off with an easier number. By an easier number what kind of number do you mean?
David: Um. Something like, lower, five.
Teacher: Fine. A smaller number, a lower number, yes. Louis can you see that point of view?
Louis: Yes
Teacher: If we put in a thousand we could end up with a huge number. If we put in five do you think it will be easier to work out what the machine has done?
Class: Yes
Teacher: Everyone agree?
Class: Yes
Teacher: OK I'm going to type in five.

We can see that Teacher A essentially engages in a monologue, running through the procedures which the children will have to follow. The information provided is very relevant, but the event is not very interactive. The children are asked for some suggestions, but their teacher provides few opportunities for them to do so. Questions are not used to elicit reasons, or to explore children's understanding: they are used mainly to elicit arbitrary numbers for putting into the machine. Even when the teacher appears to ask for their opinions, a response slot is not provided for them to do so; the teacher answers the question posed. (For example: "So what would you do now? What would you have to do now in your group? You'd have to think about it again and see if you can think of another rule it might be." And "You'd be in your groups now saying what might it have done. One of you would say something and then someone would say something else, they you'd discuss it and try it.") No clear feedback is provided to the responses by Alan and Elenor. This teacher does not seek the reasoning behind children's responses, or use techniques such as reformulations to ensure that children's contributions are represented publicly and clearly in the dialogue. This teacher does not model features of Exploratory Talk or in any other way reinforce the relevant "ground rules".

In contrast, in Sequence 4 the second teacher embodies some of the ground rules for Exploratory Talk in whole-class dialogue. Like the first teacher, Teacher B shares relevant information with the class about the nature of the number which is to be put into the input box of the function machine. But this teacher also initiates discussion about the number by questioning the first suggestion made by a pupil, and follows this with requests for reasons for opinions and assertions. The language used in this whole-class session shows some of the common features of teacher-talk, as set out earlier: lots of questions, repetitions, and reformulations. However, Teacher B uses these not simply to quiz children about their factual knowledge, or to correct their factual knowledge, but to engage them with the problem and ensure that their views are represented in the dialogue. The teacher's contributions include "reasoning words" such as "what," "how," "if" and "why" as the children are lead through the activity. The teacher accepts and discusses the challenges made to Louis's suggestion, while respecting the contribution he made in initiating the discussion. The children are given a demonstration of how to consider the validity of alternative suggestions. The teacher invites children to speak so that as many people as possible feel able to join in the discussion – and finally ensures that an agreement is sought and reached. In this way, through careful modelling of the ground rules for talk, the teacher is demonstrating to the children how effective collaboration can be as an integral element of intellectual activity. None of the children makes an extended contribution to the dialogue, so it may be that this interaction does not serve as a very good example of what Alexander (2005) calls "dialogic teaching" (see also Dawes 2004). But the children are engaged in the discussion, their points of view are sought, they have some influence on the discussion and the actions that are taken. And by being engaged in a dialogue in which Exploratory Talk is modelled, they are being prepared to use it when they continue the activity in small group discussion.

Overall, our classroom recordings showed that Teacher A rarely modelled Exploratory Talk during the introductions to the lesson. Although the class had agreed a set of ground rules for talk in the early part of the project, no time was spent recalling these with the class; the children were just told that they would be working in their "Thinking Together" groups to carry out the maths activities. In addition, little time was spent in working with the class on an activity during the introduction to the lesson; the possibility of developing group strategies to solve problems was not discussed.

In contrast, our observations show that the Teacher B commonly did model Exploratory Talk with the class during whole class introductions. In all parts of the introduction, the teacher would initiate discussion with the class and often gave opportunities for children to talk together before making contributions to the whole class discussion. Teacher B made it clear that reasons should be given to support suggestions, that ideas could be challenged and that alternatives would be considered before attempting to reach a class agreement. Time was also spent in shared recall of the class's "ground rules" for talk and in discussing why each of these was important. Examples of the kinds of things that might be heard if this kind of talk was going on were elicited from the class and recorded on the whiteboard. Finally, there was some discussion of the need to devise a strategy to solve the mathematical problem. Teacher B's engagement with the children was thus more "dialogic" in both its structure and content.

8 Analysis of Children's Argumentation

I have presented below two examples of children's discussion in groups to illustrate some kinds of variations in the quality of the argumentation talk we observed which can be related to the impact of the Thinking Together intervention on joint problem solving in maths. They also come from lessons using "Function Machine" and are taken, respectively, from the classrooms of the teachers who feature in Sequences 3 and 4 above. The children are expected to talk together to agree on a number to enter, then they are asked to consider the output number that is generated. This information is used to form a hypothesis about the function which has been applied to the original number, and this is then tested. The lesson plan provided for the teachers stressed that one aim of the group work should be for the children to try to devise a strategy for identifying the function involved.

Sequence 5: Group A: Sylvia, Alan and Sabena

Alan:… 39 add 5. Half the input is 30, half of 9 is…
Sylvia: We can't do this number 'cos we can't do decimals. Let's start again. *(She enters a number)*
Alan: OK, 30. That's your turn.
Sylvia: Twenty-eight. I've got a rule right – if you halve that it's 30 then you take away 10, and then from the 30 take away…
Alan: I've got an idea. That's 14, then you're adding 2.
Sylvia: I know – I've got it half the input…
Alan: It's my turn.
Sylvia: No – you don't know what to do – I know.
Alan: Yeah but it's my turn.
Sylvia: Wait…
Alan: No. Me and Sabena should have two turns then.
Sylvia: No, but wait a minute. I didn't have a turn before. I didn't have a turn. 33 and then add 5. *(Presses key to reveal answer.)*
Alan: My turn.
Sylvia: I've got an idea, I've got an idea.
Alan: You're always having a turn.
Sylvia: Yeah, but I'm faster than you and you can't do anything.
Alan: No.
Sylvia: Shut up *(inaudible)*
Alan: Shall we go with the first number I had?
Sylvia: Uh, go with a number that's very easy– like, uh, 15.
Alan: One.

Sequence 6: Group B: Kylie, Rebecca, Maya and Tony

Kylie: 3! I think it's take away…
Rebecca: What do you think? I think it's take away 3.
Maya: Half
Kylie: Half the number. I think it's half the number.
Maya: Me too. Maybe…
Tony: Yeah.
Maya: Let's try number 4
Kylie: 4?
Maya: Yeah –should be 2
Rebecca: Click on there. Click! (Indicates to Maya where to click.)

Kylie: Stop arguing. We're being recorded and we've got a microphone. We didn't agree on 4 did we?
Others: Yeah.
(4 entered and 2 appears in output)
Kylie: (To Tony) So what do you think?
Tony: I think you have to add on two more.
Kylie: No 'cos, I think like Rebecca, I think it's halving because we had 6, and it ended up 3. Now we've got 4 and it ended up in 2. Do you think half the number or subtract? Do you want to check? Do you want the reveal thing?
Tony: No, I think it's what Maya said.
Rebecca: What did you say?
Maya: I said try 4 and it would come out half.
Kylie: Tony, do you want to try a different number, try once more?
Rebecca: Let's see if we put in an odd number and see what happens.
Kylie: Yeah an odd number. (Short interruption while they adjust the seating to make sure that Tony has enough room and remains included in the group) Do you want to all try 5?
Rebecca: Try 5 yeah?
Kylie: Do we all agree?
Tony: Yeah
Maya: Nought… 2.5
Kylie: We thought it was half the number. (To teacher, who has joined the group).
Rebecca: Half the number.

The children in Sequence 5 are not engaged in productive argumentation, and this was typical of their interaction throughout the activity. They do not attend to each other's suggestions and no agreement is sought about how to proceed (e.g. about abandoning the first number). We can see that the children act individually. Sylvia's assertion that "we can't do decimals" remains unchallenged and unsupported; she enters a new number without any consultation with the rest of the group. Although Alan and Sylvia both have ideas about the function in the next part of the transcript, they express their thoughts in parallel rather than interacting about them. Later, the talk degenerates into a disputational exchange about turn-taking. The third child in the group (Sabena) is ignored, says nothing and is only referred to by Alan to back up his claim that Sylvia is taking too many turns. Their concern with turn-taking shows that the group is not following an appropriate, shared set of ground rules for productive argumentation.

Sequence 6, in contrast, is illustrative of a more collaborative approach. One of the four children involved (Tony) had been recognised by the school as having special needs related to learning difficulties and had not been well integrated into group activities. Here, however, he is actively included, his contributions are treated as valuable and the others ensure that he is able to follow and participate in the discussion. They check that he has understood and seek to clarify their suggestions and explanations. Although Tony does not make many verbal contributions to the discussion, he is engaged with the group talk and participates by following the conversation carefully. The initial dilemma –whether the function is "halving" or "subtract 2" – is resolved by testing other numbers. During the discussion surrounding this, though their reasoning is imperfect, the group engage with each other's ideas, collaborating to construct and test a hypothesis. Throughout Sequence 6, the children in Group B are careful to ensure that they have reached an agreement

before moving on to the next step. Note that Kylie models some of the key "thinking together" phrases that enable the group to structure their discussion and to talk effectively – phrases which have been regularly used and highlighted by their teacher. Although we cannot make a statistical comparison between particular classes (because of the relatively small numbers involved), it was noticeable that the children in Group B's more "dialogic" class achieved better post-intervention grades in the maths assessment than those in Group A's class.

9 Effects of the Thinking Together Programme

Comparisons between the talk of the children before and after they had done the Thinking Together programme showed that the ways they used language had changed significantly. Essentially, the children became more effective at joint argumentation. They began using more Exploratory Talk, and the increased use of this kind of talk was associated with improved success in jointly solving problems. Moreover, the results of this research also provided some insights into the link which sociocultural theory makes between social, communicative activity and individual learning and development. It was found that children who had experienced the Thinking Together programme became significantly better at solving problems alone, when compared with control children who had not (as measured by comparisons of their pre- and post-intervention performances on the Raven's Progressive Matrices test of non-verbal reasoning: Raven et al. 1995). That is, children's *individual* reasoning capabilities appeared to have been improved by taking part in the group experience of explicit, rational, argumentation and collaborative problem-solving. There were also positive effects on the children's attainments in the curriculum subjects in which they applied their reasoning and argumentative skills during the intervention (as described in Mercer et al. 2004; Mercer et al., 1999; Mercer and Littleton, 2007; Mercer and Sams 2006).

10 Conclusions

Children may not all have learned the same things from their experience in the Thinking Together programme, because they might enter it with different levels of skill and awareness in how to use language as an argumentation toolkit. It may be that some children acquired quite new argumentation strategies, having had them demonstrated by teachers and more skilled partners. Others may have benefited from practicing and extending strategies that they already had in their repertoire, but which they had not habitually used in group activities. In both cases, however, it seems that children's reasoning improved through having to justify and make explicit their own points of view in ways required by the ground rules of Exploratory Talk. In terms of the development of reasoning, a radical and intriguing possibility

is that through engagement in, and guidance in argumentation, children improve their reasoning skills by "internalising" rational dialogue so that they become able to carry on a kind of silent argumentation with themselves. That is, their experience may help them become more able to generate the kind of thinking which depends on the explicit, dispassionate consideration of evidence and competing options. That interpretation is consistent with Vygotsky's (1978) claims about the link between social interaction and psychological development, and with the view that the development of the skills of argumentation has a shaping influence on individual cognition.

If we are to help children develop their skills in argumentation, we need to use and redesign the normal interactions of classroom life to do so. This will mean transcending the tired old debate about whether teacher-led, whole-class teaching is "better" than small group activities where children work together without constant teacher input. This is not a choice that has to be made, or which should be made. Group activities offer learners good opportunities to practise and evaluate ways of using language to think collectively, away from the teacher's authoritative presence. But we cannot assume that social experience outside school provides all children with the discursive resources, the linguistic strategies, they need to construct effect arguments. Children need to be guided in how to talk and work together if discussion activities are to be of most benefit for their learning; and they may later need the intellectual leadership of a teacher to help them consolidate what they have learned from their joint efforts and relate it to the curriculum and other cultural reference frames. Thus in the Thinking Together programme, the more effective teachers have been those who organise and lead activities designed to highlight the pragmatic functions of talk for children, provide children with information and guidance and help them recognise and reflect on what they have learned. Their style of teaching approximates that which Alexander (2006) calls "dialogic teaching". They talk explicitly with children about the goals of classroom activities. Each teacher models "exploratory" ways of talking for the children in whole-class sessions – for example, asking "why?" questions at appropriate times, giving examples of reasons for opinions, and checking that a range of views are heard.

The success of the Thinking Together programme suggests that the guided development of children's argumentation skills is best pursued through a careful balance between teacher-led, whole-class sessions and "talk groups" in which children work and talk without constant teacher supervision. The organised continuity of this varied experience will help children to appropriate and practice new skills and strategies, evaluate the effectiveness of their actions and consolidate their learning.

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Argumentation in Higher Education: Examples of Actual Practices with Argumentation Tools

Jerry E.B. Andriessen

Abstract This practice oriented chapter presents one case of using interactive media for supporting collaborative argumentation by university students. The discussion is descriptive, focusing on the scenario and the tools that are used, and on examples of actual discussion by students. Some basic mechanisms of employing argumentation are illustrated, by students using computer tools (chat, forums, graphical tools) for producing an argumentative essay. The chapter shows some of the characteristic constraints that are involved in implementing argumentative learning in university practice.

Keywords Collaborative learning, Argumentation, Computer support, Pedagogical design, Higher education

1 Introduction

Argumentation, because of its inquisitive nature, may serve as a medium through which individuals sharpen and elaborate their thoughts. In an argumentative dialogue, participants attempt to convince each other by putting forward strong arguments in favour of the preferred position and by refuting the ones generated by the opponent. Especially when such a dialogue proceeds through relatively unfamiliar territory, participants may encounter new information and reasoning, both by their own construction as well as by the construction of the opponent. The assumption can be put forward that much learning, traditionally defined as the integration of new information with existing knowledge, occurs within argumentative interaction, at least when participants engage in a dialogue during which attempts at mutual understanding can be observed. These attempts for mutual understanding, during argumentation, may lead to shared knowledge and understanding of the domain. This process we call arguing to learn, or learning by argumentation, where the primary goal is not convincing the other, but increased understanding of a domain

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(Andriessen 2006; Andriessen et al. 2003). We think arguing to learn can be very useful for students trying to understand open problems, unclear domains, and, for the present purposes, increasing their understanding about scientific domains.

However, the traditional view on learning as information integration, and on the role of argumentation as a form of discourse that students can be instructed in, after which learning happens, is certainly too simplistic. Serious argumentation is not only a confrontation of ideas, but a confrontation of individuals, as in ways of thinking, expressing oneself, ones preferences, weaknesses, hidden thoughts, etc. In other words, argumentation always is personal, there is a person at stake, and social, there is interaction. In the (ideal) case of an educational situation were collaboration has matured this mainly should concern the role and the personal epistemology of learning, but probably, many other personal ideas are involved. This means that in the dialogues between students, especially in the beginning, participants always have to deal with the alignment of these personal worlds: what the other wants, what she is thinking, what she thinks about me, about what things can we talk, how much effort is going to be put in, etc. (Andriessen et al. in press).

Education does not deal with socio-emotional dimensions on a daily basis. Instead, the focus is on design for knowledge. Previous chapters have made clear that while many people suppose that argumentation is good for learning, in order for this relationship to show up, instruction must be well-designed. In this chapter, we present an example of an attempt at such a design, and show that this does not lead to the optimal result. While it may be possible to question the design, and the way it is enacted in practice, this is not the issue at stake in this chapter. It is an open question to what extent providing a safe socio-emotional climate, and realizing the intentions to learn that individual students bring along to their assignments can be dealt with by any design, or that it should be given more attention in any educational context, particularly by individual teachers. In the scenario that follows, there is some attention to differences in learning intentions, to the extent that learners are made aware of such differences.

We present a number of examples from actual discussions in one practice of higher education. They involve three assignments of computer-mediated argumentation, while participants chat and construct an argumentative graph at the same time. The three assignments are part of a course on understanding the affordances of graphical tools to support arguing to learn. Argumentation mediated by computers is interesting, first because many people think that computers can scaffold learning, second because on-line communication gives us a record of what is said, in a context in which communication has to be explicit about what individuals focus on, and shows their missed opportunities and default strategies. Moreover, we may be able to trace a development in students' argumentative strategies between the first, second and third assignment, which are 2 weeks apart each.

We will not systematically compare the discussions with these tools, as in a research report. Instead, we will briefly describe the tools and the assignments, to give an impression of the results, and present (in chronological order) a number of examples of discussions between students. By this, we hope to show some of the dynamics of computer mediated argumentation and learning in actual educational contexts. This may help instructors and learners to recognize and better understand the symptoms of learning in such discussions.

2 Description of the Course "Web-Based Learning Environments"

Web-based Learning Environments is a 10-week course for advanced students in Educational Sciences. The course consists of a sequence of assignments with not much lecturing, and it follows a general evolution in pedagogical scenarios, as described in Andriessen et al. (2003), from transmission based (understanding information), via studio-based (information sharing), to knowledge negotiation (developing new insights and knowledge).

At the end of this course, students are expected to have gained sufficient knowledge about the current and potential use of information and communication technologies (ICT) in collaborative learning educational settings to provide support and advice in actual practical settings. To reach this goal, the students are required to evaluate/assess the ICT-applications in the context of their own collaborative learning (Computer Supported Collaborative Learning – CSCL), especially concerning utility and user-friendliness in various contexts.

The course is presented in a blended set-up (face-to-face meetings and online learning activities), which is related to the main assignment of the course. Students are expected to finish this course by writing a scientific essay about how graphical tools can support learning. To foster negotiation and discussion, the essay must contain:

(a) An overview of the common assignments used in CSCL research, and the most important results of research on this topic (search and study of provided literature)
(b) An overview of the available tools for supporting collaborative learning, and their most characteristic similarities and differences (literature and web search)
(c) A systematic approach to the analysis of collaborative dialogues, including the advantages of limitations of this approach (hands-on experience + analysis)
(d) Discovery of the main design principles of CSCL tools for supporting electronic collaboration by university students (inquiry and reflection)

To achieve these goals, a series of learning activities in three different synchronous discussion environments supported by graphical tools, was designed. All learning activities take place in small groups. The course is split into four phases, which, in their succession, fit the pedagogical model described above: transmission, studio, and negotiation (2×). Each phase is characterized by specific assignments and activities.

2.1 Phase 1: Problem Description and Domain Understanding

During a period of 2 weeks, four texts are studied and discussed (within small groups) via an asynchronous discussion board (Blackboard or Sitescape). The tutors in this course initiate both texts and discussion questions. Tutors provide external feedback after discussion. Throughout the course, the discussion forum is open for new discussions, for document and task management, and for various content related discussions.

2.2 Phase 2: Further Understanding and Deepening of Domain Knowledge

This phase comprises two main assignments. Assignments focus on shared understanding, the first involves displaying in a graph the main points of the same text, and the second concerns the main similarities and differences of two different texts. To this end, another 25 texts are available for studying as theoretical background**.** Students have two CSCL environments at their disposal, which are used during the two argumentative knowledge-sharing exercises.

2.2.1 Assignment 2.1: Co-elaboration of an Argumentative Graph

To complete the first assignment students must discuss an article in pairs and construct a diagram, which contains the main points of the article, according to the students. The electronic environment used (VCRI,[1] see Figure 2) offers various tools necessary for analyzing the material: online diagrammer, word-processor, task-planner, chat-facility and discussion-forum. In this set-up, students also discover the elements of computer support and their impact on the collaboration process.

The scenario is as follows:

- Preparation: students are paired during the course and are asked to select a common text. They are supposed to thoroughly study that text and mark (either in the text, or on a separate file) the relevant points, the questions and their disagreements with the author. These points are supposed to be brought in during the next phase: the author's main points in the graph, but the private views in the chat.
- Collaborative session: students meet in the computer lab, or arrange a virtual meeting from their homes. They start VCRI (with which they have worked during the previous course) and log in to their session. The assignment is to negotiate about the construction of a graph which represents the main points of their jointly prepared text, in order for other students getting access to an overview of the main points of the article. These main points can be represented as Toulmin categories: claim, argument pro/con, support, counter, conclusion. This graph could then be input for the main assignment of the course: jointly writing a text on tools for CSCL.
- Analysis: Pairs of students are requested to analyse sessions of other pairs by using Rainbow and MEPA. The coding by Rainbow (Baker et al. 2007) provides a general classification of collaborative actions in a dialogue on an utterance basis. The classifications allow comparison of dialogues, especially with respect to the argumentative activities, knowledge sharing and summarization.

[1] http://edugate.fss.uu.nl/~crocicl/index.html

- Reporting: the groups report on the comparisons of the discussions, and the usability of the tool. The report is subject of a face-to-face feedback discussion between the group and the tutor.

The second assignment (2.2) is similar to the first one (2.1), with two major exceptions: (1) instead of discussing the same text, participants now have to prepare two different texts; (2) instead of VCRI, participants now use DREW[2] (see Picture 2).

2.3 Phase 3: Integration and Design

For the next assignment (3.1), participants were asked to discuss the design criteria for technology to support argumentation in CSCL. Students were requested to prepare this session at home, by using a checklist with criteria and topics to consider. For the meeting itself, we used Digalo (see Picture 3). In contrast to the other two tools, who support electronic discussion, Digalo requires participants to discuss orally. We did not record these discussions, so only the graphical objects are left for analysis. The students were asked to analyse and compare these products. Also, they were asked to evaluate the usability of the tool. The report was discussed with the tutor.

2.4 Phase 4: Discussion and Conclusion

For the final essay, the results of the analyses and a comparison of the three environments are reported. Through discussion students had established a set of criteria to be met by the "ideal" electronic tool to support collaborative learning. The format was to be that of a journal article, to be published in an actual journal.

3 Pedagogical Goals in Context

We want to focus on argumentation in the different assignments, more specifically, to relate the argumentation that we find, to the collaboration and objectives of the participants. These objectives are related to the goals of the assignments as provided by the teacher, but not entirely. We also assume that the students have their own personal goals that are related to the scenario of the assignment, their ideas about learning, and that of their university career in general.

The set up of the course means to serve a number of pedagogical goals. It may be important to survey these, in order to be better able to interpret the results that we report.

[2] http://scale.emse.fr/pws/

The students we are working with are advanced students in educational sciences. They choose this course because they are interested in CSCL, but do not know exactly what to expect and what is expected of them. They have introductory knowledge about ICT in education, and background knowledge in educational psychology, but do not know anything theoretical about dialogues, discussion or argumentation. They have experience with working in small groups, and can be quite efficient in the way work is distributed between them. At our institute we call their way of working "cooperation" or dividing tasks between group members, as distinguished from collaboration, which is sharing knowledge and understanding during joint problem solving.

Our idea was that students should acquire knowledge and understanding of argumentation support by CSCL by hands-on experience and reflection on those experiences. Specifically, we tried to exploit the use of multiple representations as communication media. Reflection was fostered in multiple ways: by analysis, reporting and discussion during sessions, and in asynchronous discussion forums. These were open all the time and students were very active in using them. In terms of recorded activities, the course is a success every year.

This is a course, not a research experiment, and we did not research in detail what knowledge students possessed beforehand, what their individual motivation was, and how their expectations about the course changed during the 10-week period.

4 Argumentation During the Various Assignments

The purpose of the assignment was for students to deepen their understanding of the information by co-constructing diagrams. Such construction was supposed to trigger argumentation, as the students were to arrive at agreement about the main points in the text that were to be included in the diagram. In addition, we hoped that the diagram as an artefact would help the students to focus on relevant topics.

The data that are going to be presented involve argumentation during the four assignments. We discuss a number of examples of argumentation and suggest interpretations, which may lead to realistic expectancies about argumentation and its role in university practice. We do not present a systematic overview, but a number of characteristic findings, their context, and some probable consequences.

For the analysis of the dialogues, students were asked to use Rainbow, a method developed in the SCALE project (Baker et al. 2007). In the results reported in this chapter, we use their analyses. The following table displays the Rainbow category system.

Students analysed their own discussions using Rainbow. These analyses were reviewed by the instructors and revised when necessary. Below we see the results of the Rainbow analysis for the VCRI assignment of the chats in all dyads. The picture shows an example of a graph constructed by pair 904.

The Rainbow table shows that the pairs engaged in a large amount of task management. This is a general pattern in our research; the students need to spend attention to the

Rainbow functional category	Brief definition
1. Outside activity	Any interaction that is not concerned with interacting in order to carry out the researcher-defined task, including socio-relational interaction that does not relate to interacting in order to achieve the task, e.g., talk about last night's party.
2. Social relation	Interaction that is concerned with managing the students' social relations with respect to the task (debating about X), e.g., greeting, leave-taking, politeness, expressions of frustration with the way the partner is interacting, etc.
3. Interaction management	Interaction concerned with managing the interaction itself: who will speak or not and when (coordination), establishing contact, perception, understanding, attitudes (communication management), topic shifting, time management, …
4. Task management	Management of the progression of the task itself: planning what is to be discussed, establishing whether problem solved or not, …
5. Opinions	Interaction concerned with expressing opinions (beliefs, acceptances, …) with respect to the topic debated; expression of opinions at opening and closing of phases of argumentative discussion.
6. Argumentation	Expression of (counter-)arguments directly related to a thesis (e.g., GMOs increase famine because farmers become dependant on seed companies).
7. Explore and deepen	Interaction concerned with (counter-)arguments linked to (counter-)arguments, argumentative relations, and meaning of arguments themselves (elaboration of them, definition, extension, contraction, i.e., any discursive or conceptual operation performed on content of arguments themselves).

		Outside	Social	Interact	Task	Opinion	Argument	Deepen		
		1	2	3	4	5	6	7	N	
Team 1	903	0.00	3.56	12.00	52.44	27.11	4.89	0.00	225	
	904	0.78	9.41	17.25	36.08	22.75	11.76	1.96	255	
	905	1.00	2.00	15.00	51.00	22.00	8.50	0.50	200	
	909	0.00	3.17	23.02	30.16	22.22	18.25	3.17	126	
Team 2	906	0.00	3.24	26.62	47.12	21.58	1.44	0.00	278	
	908	4.09	4.39	31.52	49.55	6.52	3.03	0.76	660	
	902	0.00	2.23	28.51	46.55	18.26	4.45	0.00	449	
Team 3	915	1.20	1.80	21.56	24.55	31.14	11.98	7.78	167	
	917	0.00	0.00	25.56	53.38	15.79	5.26	0.00	133	-3
	920	4.52	5.08	24.29	55.36	10.73	0.00	0.00	177	
Team 4	916	1.86	2.48	8.07	64.60	19.25	3.11	0.62	161	-3
	918	0.00	4.98	31.42	59.77	3.83	0.00	0.00	261	
	921	0.00	2.13	45.21	37.77	14.89	0.00	0.00	188	
	922	0.00	0.00	24.76	40.95	22.86	9.52	1.90	105	

construction of the graph on the screen. Task management involves three types of contributions: (1) with respect to the use of the tool: how to…? It does not work!, etc. (2) concerning task strategy: let's elaborate on this, we need an example, let's start with a claim, etc. (3) reflection and evaluation: is this a clear diagram, would you call this an argument, is this correct? The first type was the most frequent.

Of most interest are the frequencies of opinions, arguments and broadening/deepening activities. Student pairs differ a lot in this respect, and the frequencies of arguments and broadening/deepening activities is relatively low. Groups scoring relatively high on arguments (6) did not invent new arguments, but more often copied the arguments from the texts. It seems that the students' main epistemic activity is limited to stating opinions, rather than arguing.

5 General Results

We have run the course three times now. Improvements in the design have been made, and the version we presented here is the third version. Generally, students now receive more feedback than in the first edition. In particular, lectures more closely look at the students' interactions and their interpretations of analyses. In addition, students are asked to modify their third assignment in order to get answers to questions that came up during the course. For example, one student group decided to compare oral and electronic discussion during solution of the same problem. In another debate students decided to explicitly compare a group that focused on interaction in the chat with a group focusing on constructing a good diagram. Students were aware of the goal of producing arguments, but nevertheless did not produce them in their own debates.

Hence, in spite of improvements in the design, the pattern of high task management and variable but low amounts of arguments has not changed over the three editions. In addition, our idea of students gradually improving on this during a course has not been confirmed. Each assignment presents its own constraints, and due to the comparisons between the tools that were built in the design of assignments, students tend to blame the tools, in addition to the instructors and the assignments, for their low scores on arguments.

This tendency of not really going into depth during assigned debates also seems to be reflected in the reports that the students produce. Students are highly motivated to understand the constraints of these assignments, but do not get very far in discussing the affordances, and definitely do not exploit them in a manner intended by the course design. Students quote research claiming that more is there to be gained from a course when students have more sense of control about their activities, but are not able to make much of that control themselves. This seems a paradox: students are involved in their design, they receive extensive feedback on their activities, the assignments allow for extensive debate, but there is no serious discussion.

6 Examples of Argumentative Behaviour

A number of examples of interactions may help to understand what the students were doing.

Example 1: Copy/Paste the Claim

1	I think it is a good idea to start with some sort of claim from which we can work	Task
2	That would be the topic of the text, wouldn't it?	Task
1	For example: Using a trace diagram is a very succesful way of working	Opinion
1	The topic indeed	Opinion
2	:-)	Social
1	Do you think my last example was correct?	Opinion
2	Ehhhhm..	Opinion
2	let me look, it has to be here somewhere	Task
1	the title says it is a success	Opinion
2	"the aim of this paper is to evaluate a graphical method for analysing collaborative interaction"	Opinion
2	I took that from the end after heading 1	Task
1	I see it, yes	Task
2	important are the behavioral aspects	Opinion
1	but you cannot give arguments in favor or against that?	Opinion
1	well, let's just do it, after all, it is the goal of the text	Opinion
2	We could make a claim it is a success or so?	Opinion

Example 1 shows the start of a session, characteristically, students start off immediately with formulating the main claim of the author of the text. Participant 1 proposes such a topic and asks the partner if she agrees. This is answered by a search for an appropriate sentence summarizing what the text has to say. This sentence is found, and it is pasted into a box. They recognize the sentence is not stated in the form of a claim, and then decide to adapt it somewhat.

If we were to generalize from this short extract (and other examples), three main observations can be made:

1. Questions by the partner about the content of the text are answered by looking for a sentence in the text that provides the answer as exactly as possible. This sentence then receives the status of "argument."
2. The verification of the status of the sentence seems to be triggered by the parallel activity of constructing a graph. The ontology of the graph window labels gives rise to a check about the correct application of the label to the information. Is this a claim? Sometimes participants do overrule the labels, if that suits their purpose, albeit after some negotiation.

3. The task goal shows a strong product orientation: start with the claim and construct the argumentation from there. A main criterion is the amount of arguments, not really their nature.

Example 2: Looking for Arguments

In the next fragment, we see an example of looking for confirmatory information. Participants question the correctness of the information put into the graph. In line of the previous example, we expect verification in terms of a sentence in the text confirming the validity of the information. Instead of copy/paste (as in the case of the main claim of the previous example), we see the participants find information to which they assign the status of an argument (for conducting a research study). Note that this again is triggered by the activity of making a graph: in order to show the correctness of a claim in the graph, the participants look for information in the text, which is then linked to the claim as an argument.

1	Is it correct what I wrote?	Opinion
2	Yes, but maybe something should be inserted?	Opinion
2	In that "mult-robot systems research" there was a trace program which succesfully assessed system performance, but the system was never used to analyse human collaboration during problem solving	Opinion
2	That's why they went on studying Danish students?	Argument
2	Shall I insert this?	Interaction
1	That is correct. Before that, the study was done with robots. In the Danish study they tried the method with humans	Argument
1	This is a useful additon.	Opinion

Example 3: Self-Explanation

Self-explanation is the activity of an individual tracing the reasoning of someone (for example the author of a text) by trying to explain it for himself. It has been researched as a powerful learning mechanism, that is, those learners that engage in self-explanation learn more than those that do not (Chi and Van Lehn 1991). In a dialogue, self-explanation can occur with one participant explaining some reasoning to the other. The role of the other participant is more or less passive: there is no questioning or argumentation, the other is listening and acknowledging. Self-explanation may be distinguished from co-explanation, during which participants jointly try to reproduce the chain of reasoning. The following is an example of self-explanation.

1	Self-explanation positively affects learning, of course	Opinion
2	Yes, that is clear from the article	Opinion
1	And, because diagrams positively affect self-explanation this also positively affects learning, isn't that what appeared from the article?	Argument

2	You are entirely correct	Opinion
2	I am having a bit of trouble grasping the structure of the article	Task
1	Anyway, the advantages of it were more apparent in the diagram conditions	Opinion
1	Yes, I feel this sums up almost all which is important in the article	Opinion
1	Or is that too short?	Opinion
2	Short = clear	Opinion
1	Wait!	Task
1	There it says something about 3 ways by which there is a positive effect	Argument
1	Graphical representations with adcvantages for learning	Argument
2	Using text forces students to formulate an answer froom the text themselves. Is that an advantage or a problem?	Argument
1	Computational offloading, re-representation and graphical constraining	Deep

Concerning self-explanation in dialogue, it may be observed (perhaps by definition) that it remains a parallel, monological activity, both in diagram and in chat. Self-explanation in diagrams is rather common, is it rare when participants both contribute to the same element of a diagram. It is still interactive, in the sense that explanations have an addressee, and can be a reaction to some question or problem (e.g., "lack of structure") by the other participant.

Example 4: Co-structuring

In co-structuring, like in searching for arguments, the ontology of the graphical artefact triggers the categories for thinking, in this case at the level of task-structure instead of the level of a single argument. The participants jointly decide how to proceed with the assignment by giving it a structure, which matches that of the graph ontology. This triggers search for arguments, but in this case, also the elaboration of these, for example as refutations or counter-arguments. The collaborative aspect is in the task management, not necessarily in the elaboration of the arguments. Participants jointly decide to look for specific information and organize found information in terms of some negotiated elements of the ontology. This could involve re-organization of already represented content (in the graph) and definitely to re-representing found information.

A note about the role of structure in these tasks is necessary. We noticed in our teaching that students always claim to need structure. What does this mean? It seems to us that the co-structuring activity (initiated by the students themselves!), is creating a powerful common ground from which to work and to fall back to. Also, the structure serves to keeping them where they are, as if tied to strings. In another sense, the structure tells the students what to do next. Hence, structure is a multi-functional scaffold, with both conservative and creative dimensions. Structure can help a student to keep on going and provides a sense of direction. Conversely, structure can be a straight jacket preventing creativity and elaboration to emerge. Teachers therefore

should be careful with providing structure, it can serve important progress when it is there at the right moment for the right purpose, but when students stop thinking and simply follow the procedure, it should be removed immediately. Ultimately, of course, students should be able to create and use structure for their own learning goals. The example shows that ontology can serve as a scaffold for a structure which consists of a series of steps towards a goal. This goal-orientation means that an artefact will be produced. The role of structure in providing a meaning-orientation for argumentation and graph construction needs more investigation (see the chapter on argumentative design).

Example 5: An Argumentative Graph

1	We could also first write everything that could work against as negative arguments and then as refutations how to overcome it	Task
2	But that's an argument to support the conclusion	Argument
2	OK, I like the idea.	Opinion
1	Eh, yes. For example, counterargument: they have zero-history or for example the free rider effect can appear, and then as a refutation: good grounding is necessary	Argument
2	I shall begin writing a small part, you tell me what you think	Task

The examples presented so far concern the chat. Students in all cases worked on chat whilst constructing an argumentative graph in parallel. It is likely that there is a relationship between the graph and the chat, as both a part of the same interactive context. Research (van Amelsvoort 2006) has shown that students engage in various approaches in this respect, and that argumentative graphs show much variation in content (boxes and links) and structure (arrangement), and, most importantly, purpose. We will discuss the graph here, and not the accompanying chat.

The picture (Fig. 1) shows a graph constructed with DREW, during assignment 2 where two different texts had to be compared. The graph has three parts. One part is created by student 1, and is a summary of a text by Peter Reimann. It is a linear sequence of boxes, with numbered but not labelled links, altogether displaying a line of reasoning. According to the graph, the article discusses 3 types of tools that support group learning, and also some issues that need to be taken into account. The second graph displays the structure of a text by Jermann, Soller and Muhlenbrock. This text also discusses three types of systems for supporting collaborative learning. No further information is provided in the graph. The first two graphs are not linked, the third is proposed as an integration of the two texts, and has contributions from both students. The students notice the parallel in the types of tools that are discussed in both texts, mention a main common point at a very general level, and there is a theoretical node that is not comprehensible without knowing the source texts.

From an expert point of view, the graph merely shows what can be called the start of a review of main points and differences between the two texts. It is probably presented as an overview, and as such it may reflect a lack of discussion by its makers.

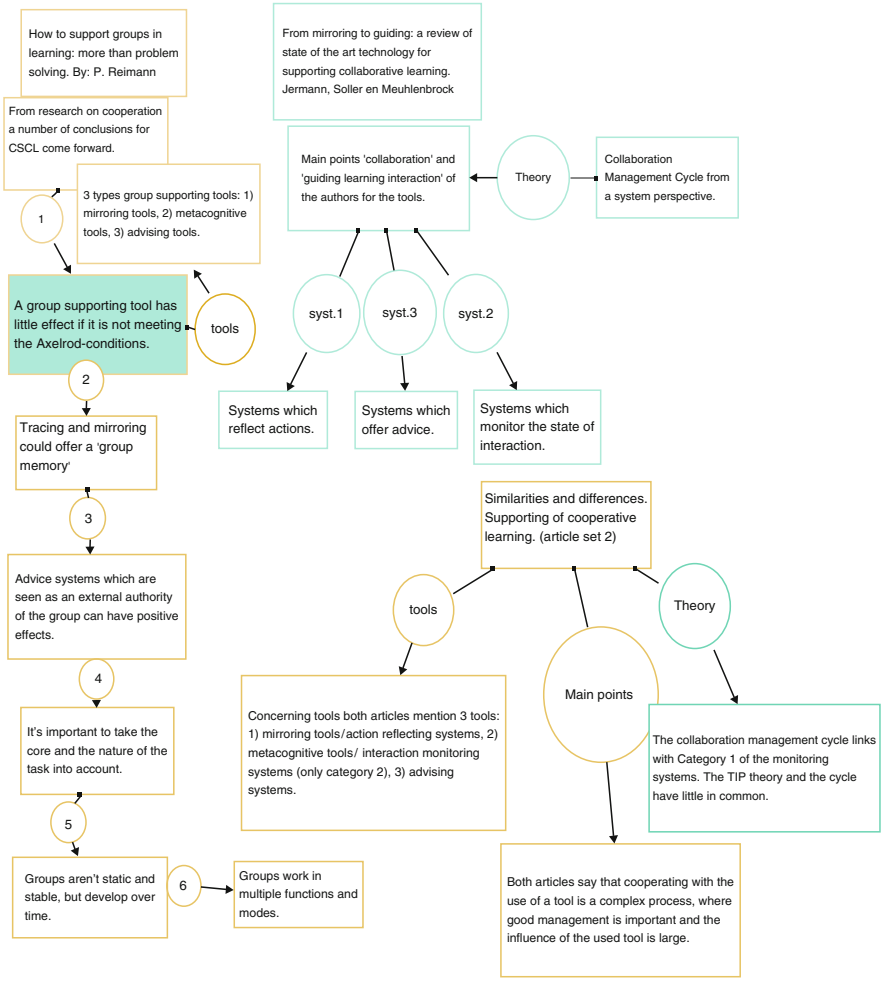

Fig. 1 The DREW graph constructed during assignment 2

As a structure, one could say that students efficiently make use of limited space. The summary graph uses the links to label the topical nature of the contributions.

7 Discussion of the Examples

Above, we showed some examples of argumentative activities observed during the discussions. These were the most frequent types. Other possible constructive argumentative activities could be co-explanation, self-argumentation, and, everybody's favourite: co-elaboration. If we require that in a dialogue co-elaboration at least

pants, we do not find any of it, save a few incidents. Students do not seem to be able to move beyond the point of finding what to say, and making some general points. While students are able to reflect on what they do, and the tutors explicitly discuss the lack of argumentation, the possible gains of more argumentation and possible strategies for engaging into argumentation, not more of it is observed.

It seems that the knowledge required for reading and understanding scientific texts is not evolved enough to rise above what is stated and question what the authors say. Also, there may be obstacles against expressing that one does not understand, or is not clear about the texts. Finally, the educational context does not enough monitor or reward deeper reflection, and perhaps social climate is not safe enough.

8 What Students Think

While the description of course actions may sound familiar to some, it may be instructive to ask one of students what she thinks about the course. Therefore, I asked one of the participants of previous year's course to give her comments about the above text, coupled with her memories about the course.

A student's opinion

Written by Ulrike Stam-Koot

… My most important motivation for participating in the course was that I wanted to understand more about using IT in education. I expected to learn more about electronic environments, such as Blackboard.

However, the course focused on online argumentation through various graphical tools. The idea was to collaborate on setting up a clear argumentation, while discussing about that process through chat. In addition we discussed asynchronously in an electronic environment, and these discussions were meant to process and deepen the theory used in the course.

Arguing Constructing a clear argumentation on the basis of the articles that were read turned out to be a serious challenge. In addition to the unknown tool, building up argumentation was difficult. Argumentation had not been not a part of the curriculum in Educational Sciences. Constructing appropriate claims and clear arguments therefore was hard. This may probably have been the reason why we in our discussions often did not get much further than repeating what we had read. Drawing a joint conclusion from various articles was easier said than done, because the authors did not always elaborate their arguments or did not even discuss them.

Furthermore, our group felt a serious time pressure, forcing us to become quite efficiency oriented. The main assignment was to produce a schema with arguments, but the quality of the performance was not our main concern. The notion that we could learn something from the experience only came afterwards. This was clear when looking at the references used for our final article, which were those that we discussed asynchronously, not those that were discussed during the argumentation assignments.

Discussing During working with graphical tools for argumentation we could argue synchronously through chat. Using chat for educational purposes was new for me, and discussing this way with three people was not easy. Especially problematic was trying to describe

> something which is on the screen and changing all the time. Therefore, we sometimes resorted to typing in the graph, so that the link between text and location was clear. Chat was definitely functional for expressing frustration about the tool. We did not succeed in explaining what the articles were about, this was much easier over a cup of coffee!
>
> I learned the most from the asynchronous discussions about the articles. The discussions were introduced with questions by the lecturer, and sometimes the discussion merely was about answering the question. But with more open questions a serious debate took place. In some cases we even used theory from other courses to clarify our points. For me, participating in these discussions was a way to organise all issues, and to compare my ideas with those of others. And then trying to explain why I did not agree with certain ideas, or by reinforcing certain options with additional explanations. I think that an important condition for a good debate is that others do not easily take for granted was is being said.
>
> The asynchronous discussions gave me ample time to reflect about formulation. On the other hand, sometimes during heated discussions misunderstandings could escalate. Written communication asks from the sender that he/she reflect on possible interpretation by the receiver, which sometimes turned out to be problematical. This is why sometimes students dropped from the discussions, but we were lucky to have a good student moderator who was able to resolve most of our misunderstandings.
>
> *Learning* I am afraid I learned most from the theoretical articles in the beginning. These more general texts about collaborative learning (with and without ICT) and about discussion and argumentation enriched by knowledge. And now I know that online discussions require appropriate questions or claims in order to elicit a good debate, and also that participants have to be willing to critically look at each other's contributions. The combination of constructing argumentation based on articles that were read was not very successful. Maybe it would have been better to first have an asynchronous discussion about these articles, and only after that a common argument could be constructed. I think arguing can be part of good collaborative learning, but argumentation does not guarantee good collaborative learning.

The student's comments point at specific weaknesses in the design of the course and about the information to the students, and about what was expected of them. Of course, such information is useful and will be taken into account in the next edition off the course. What is noteworthy is that the assignments were not considered to be serving their purpose: they were too difficult, due to (1) students' lack of experience with the medium; (2) students' lack of experience with this kind of argumentation; and (3) students' lack of knowledge about the (argumentative) goals of the authors of the scientific articles. The lack of time argument is ambiguous, because most students indicate not to have spent as much time on the course as they should.

With hindsight, and at a more general level, one may suppose that students lack a clear conception of what they have to do, especially concerning the standards for appropriate activity. Understanding a scientific text is not clear enough as a goal for an activity: how do I know when I understand? What degree of not understanding is acceptable? When does understanding begin and when does it end?

In addition, similar question arise concerning the role of the peer students: what do I do when someone else does not understand? What happens when someone else does not understand me? How do I behave when critical comments are put forward? What are the criteria for acceptable performance here? How do we develop them as a group?

Tool support does not help when it comes with more constraints, and no answers are offered to such questions. Willingness to consider what the other says is a condition, but not sufficient for deeper understanding. Constructing an argument already requires more understanding than students appear to bring to the task.

9 Discussion

In the chapter on design of argumentative activities we describe some options for designing argumentation in learning practices. In the current chapter, a specific attempt for implementation has been discussed. The scenario first involved students discussing scientific texts using asynchronous forums, then reflecting on (different) scientific texts using collaborative graphs, by representing main ideas, comparison of main ideas, and eliciting ideas for designing effective software supporting collaborative argumentation. Some main patterns of argumentation were described. The conclusion was that according to teachers and students, much was to be improved.

Students were serious and motivated to do the required tasks. Nevertheless, they did not argue very much, and much argumentation lacked depth. Most often, students repeated what was stated in the scientific texts. From students own reports it may tentatively be derived that students did not understand how to do the job, although they seemed to understand the instructions. This was not due to their exceptionally poor qualities with respect to argumentation. We propose that causes lie in the meaning (for the students) of the activities that we asked them to do.

One cause may be in the educational system of which these students are a part. within this system (university education), students are supposed to be able to read and understand scientific literature, and they are required to read and use this literature for many of their assignments. However, because they are generally required to summarise and synthesize scientific literature for their study assignments, and this work (and the evaluation by the tutor) merely stresses adequate copy-paste activities with respect to main points, as far as formulated somewhere in the text. Hence, students know what the text is about, and are able to recognise important messages in the text, but do not look for the reasoning behind such messages, nor are they investigating the interpretation of the data on which the message was based. As a consequence, they are incapable of reasoning with and about the information provided, as in argumentation with a peer student in order to agree about main points. Even further away is the sense of agency and ownership of the information, whereby students are able to use information for their own purpose. As a consequence, assignments that require more than elementary comprehension are extremely hard to do. Using technology merely serves revealing this problem, but supporting student reasoning requires a different design of the technology..

Another serious cause has to do with the same system, and concerns the roles of texts and authority. Most texts that students have to read have been selected by their tutors and therefore represent the position of authority, or a position to which

authority has formulated a stance. When asked to sum up main points, essentially students assume there is a clear solution, and although individuals may differ about that, the tutor has the final answer. As they are only beginners in the domain, students (correctly) assume not to have sufficient knowledge, and the authority based on it, to be seriously questioning the clear solution. The fact that a solution is unclear to a student is therefore attributed to lack of knowledge (essentially about other relevant texts), which can not be resolved by discussion with equally inexperienced peers, but needs to be rediscovered with help from authority only. Two ignorants cannot be right about scientific texts because they miss essential "other" knowledge. Texts represent authorities' viewpoints, and in a transmission-acquisition based system, authority should not be questioned. Students suppose they have to use that voice and make it their own. This is not by arguing, but by attributing lack of understanding to lack of information.

In addition, texts that report results of social sciences experiments have not been principally composed to argue about. The authors may have been written the text for the purpose of convincing the reader of their correct interpretation of their reliably assembled results, but the main purpose of the scientific texts that we use is informing and reporting, not arguing. Again, interpreting such texts as an argument, requires students to question the author of the text, while this author has produced a text to be as unquestionable as possible.

We think these are the main conceptual reasons that explain why students do not argue well enough. In addition to that, there are the social aspects of not losing face by being stupid or ignorant, or the irritation by someone who acts inappropriately, etc. Building up effective collaboration takes time as well.

As a conclusion, the affordances of argumentation, broadening and deepening the space of debate, also present the main obstacle: students need an assignment in which for them, broadening and deepening is an authentic activity.

9.1.1 Assignment 1

For this assignment each of you has prepared by thoroughly reading a text, until understanding the main ideas of the authors and understanding the relevance of the text for the purpose of this course: gaining insight into the characteristics of good web-based learning environments. Students that have not prepared for the assignment cannot participate and therefore have to do it at a different time.

We are going to work in the Chat and Diagrammer of VCRI. Above, you see a screendump of a possible configuration, with chat in the upper left and the diagrammer in the lower left.

The GOAL of the first assignment is to construct in pairs a summary diagram which makes clear, for a student who has not read the text, the reasoning of the author of the text. To this end you use the coloured boxes of the diagram, which stand for different categories of an argument: what is his/her central statement (Claim), what arguments support the claim (Argument in favour), what is the

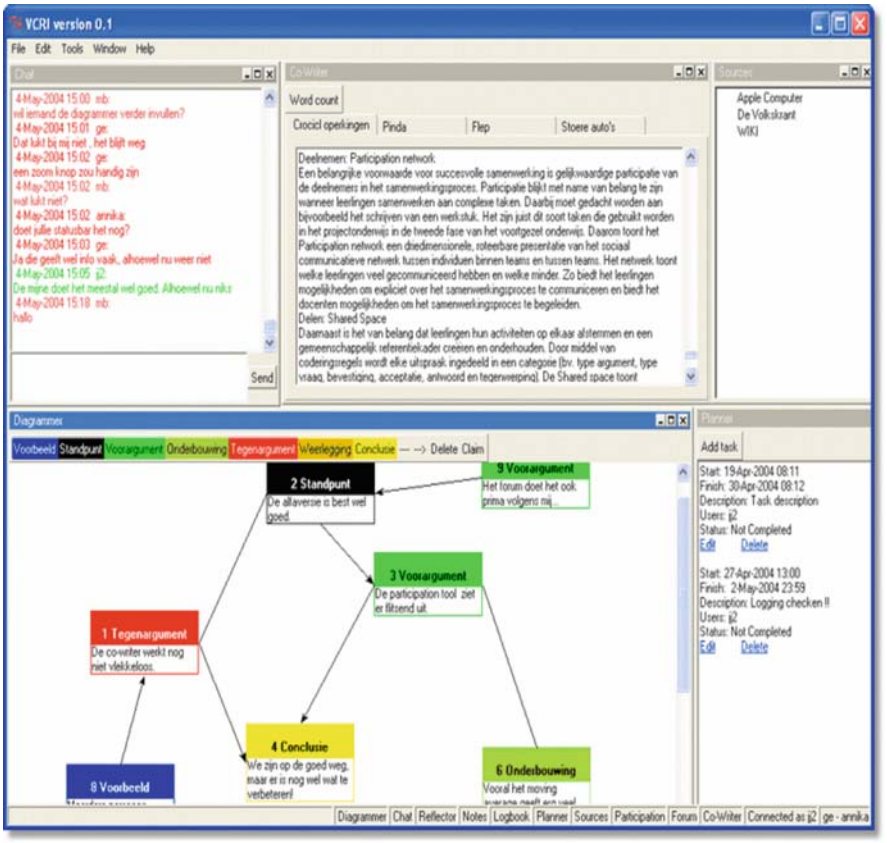

Fig. 2 VCRI, the virtual collaborative reserach institute, the tool used for assignment 1

information needed to understand these arguments (Support), Arguments in favour can be the topics the author discusses in relation to the claim. Supports can also be subtopics, belonging to the arguments. It is also possible that the authors discusses information that can be used against the claim (counterargument), and that he/she attempts to refute these counterarguments (refutation). For an adequate understanding of the reasoning examples may be needed (Example). In addition, the text may end with a Conclusion.

You will work in pairs to produce such a diagram. The idea is that working in pairs enhances reflection, and maybe deeper insights. It is very well possible that you may have to negotiate, discuss, or argue about what to put into the joint diagram. For that you can use the Chat. Please try to put ideas into the diagram after they have been discussed and agreement is reached about precise formulation. Phrasing of the text in the diagram is crucial for the understanding by someone else who has not read the text. Do not write too long texts in the diagram, try to make short and strong points.

Also of importance is the way you link the boxes of your diagram. We distinguish two types of argumentative links: positive, or supportive, and negative or contradictory. Always try and connect boxes, Boxes without any connections also have a meaning: isolated facts or arguments.

It is possible that you do not agree with the author on every aspect. This can be revealed by the chat discussion. Please try to explain your differences in the chat, not in the diagram. Both chat discussion and diagram will be analysed, so the discussion also matters.

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The Argumentum Experience

Sara Greco Morasso

Abstract How can argumentation skills be improved by engaging students in argumentative practices where they are helped to assume a healthy critical attitude, and provide reasons for their positions? What are the synergies of *learning to argue* and *arguing to learn* (see chapter "Argumentation and Learning," B. Schwarz)? This paper originates from these questions, and relies on the experience of teaching argumentation at university level, in the framework of the Swiss Virtual Campus project Argumentum (http://www.argumentum.ch). After presenting the aim and structure of Argumentum, this study focuses on a specific experience of argument production and analysis, occurred in the pedagogical scenario of argumentation classes at master level, at the University of Lugano. Students were asked to assume a specific position within a debate inspired by a famous historical controversy. Two different tools for constructing and analyzing arguments (see chapter "Argumentation as an object of interest and as a social and cultural resource," E. Rigotti and S. Greco Morasso) were introduced within this didactical experience, allowing a progressively more comprehensive approach to argumentative interventions, including the production of an argumentative intervention, and the analysis and evaluation of arguments. The online course Argumentum provided the technical platform for this exercise of argumentation. Finally, the paper elaborates on the lessons learned by this experience.

Keywords Learning argumentation, Argumentation, Pedagogical Design, Analysis of argumentative texts, Argument schemes

1 Introduction: The Taste of the Argumentum Experience

How it is possible to describe not only the organizational aspects but the "taste" of the experience bound to the online courseware on argumentation *Argumentum* (http://www.argumentum.ch)? This project, in fact, has involved and still involves various academic institutions (first of all the three partners universities of Lugano, Neuchâtel, and Geneva), hundreds of learners and different communities of

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scholars. In this context, the collaboration of teachers and learners in different educational contexts has favored the flourishing of a variety of interesting applications of argumentation theory in all the involved educational contexts.

The answer I have chosen to give to this opening question is focusing on a certainly limited but significant experience that, although it cannot describe the entire panorama of activities, challenges, and lessons learned, can however give the taste of what working with Argumentum has meant for teachers and students. By means of a specific example, thus, I intend to show step by step the teaching and learning style fostered by all the partners who have collaborated in Argumentum.

The choice of a learning activity that took place at the University of Lugano, though prepared in tight connection with the other partners, is motivated by the author's internal point of view and closeness to the described facts. In fact, and as a teaching assistant of the argumentation courses in Lugano, I have personally followed the development of Argumentum in Lugano, both in its content design and in its didactical use, by contributing to all lectures. The experience illustrated in this paper refers to one of the argumentation courses supported by Argumentum*:* *argomentazione nella comunicazione istituzionale* (argumentation in institutional communication), which is held by Eddo Rigotti in the "Master in Comunicazione istituzionale" held at the University of Lugano. In particular, it refers to the course edition held in summer semester 2006. This experience constitutes a typical example of *blended learning*, where online activities work as a support and integration of class lectures and discussion (Cantoni and Tardini 2006, pp. 181-182).

2 Outlining the Argumentum Project

Argumentum is one of the projects funded by the Swiss Virtual Campus, a federal program involving Swiss institutions of higher education, in order to promote the use of new ICTs in higher education in Switzerland (Cantoni et al. 2007, p. 111). The project, which has started in October 2004 and has concluded its implementation phase in July 2008, has been developed thanks to the collaboration of three partner institutions: the Institute for linguistics and semiotics at the University of Lugano; the Institute of Psychology at the University of Neuchâtel and the Department of Sociology at the University of Geneva.[1] Argumentum, like all other SVC projects,

[1] The team which has developed the project Argumentum is composed by: Eddo Rigotti (project leader, University of Lugano); Anne-Nelly Perret-Clermont (project partner I, University of Neuchâtel); Franz Schultheis (project partner II, formerly University of Geneva – currently University of St. Gallen); Sara Greco Morasso (project coordinator, University of Lugano); Nathalie Müller Mirza (formerly University of Neuchâtel – currently University of Lausanne); Jean-François Perret, Sheila Padiglia (University of Neuchâtel); Fabrice Clément (formerly University of Lausanne – currently University of Geneva); Stefano Tardini (executive director of the eLab, Lugano); Christian Milani and Patrizia Schettino (implementation and graphics, eLab). Many other co-authors and translators have participated to the project, who are too numerous to be mentioned here; I will only mention the substantial contributions by Martin Eppler (University of Lugano), Frans van Eemeren, Agnès van Rees and Eveline Feteris (University of Amsterdam), Douglas Walton (University of Windsor-CA), and Tania Zittoun (University of Neuchâtel).

is supported by a professional competence, service, and production centre, the eLab (eLearning Lab) of the University of Lugano, which is in charge of all the project's technical issues, such as the choice and setup of the Learning Management System (LMS),[2] the technical production of learning materials, the graphical design of the courses, etc (Tardini 2007).

The main goal of the project is to provide an online courseware for learning argumentation. The need for such an instrument was felt by all three partner universities and, nowadays, Argumentum is largely used not only by the project's partners but also by other national and international institutions in their didactical activities. Significant reasons for the introduction of an online support for teaching activities were the desire to foster the quality of teaching and learning, and sharing scientific resources between the partners and, more in general, in the community of scholars dealing with argumentation theory and practices.

Argumentation itself, which is an applied activity by nature – i.e. it can be only understood in its practical embeddedness in the various domains of our social life (see Rigotti and Greco Morasso, chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource" of this volume), has inspired the technical organization of the project. Argumentum, in fact, has been conceived of as a series of autonomous argumentation courses focused on specific application fields, among which financial communication, institutional communication, media and journalism, educational settings, social contexts and intercultural communication. Such a structure has allowed to answer the very diversified educational purposes of the partners involved, intending to suit the needs of different students (students from the three partner universities, attending different levels of education and different specializations; and continuing education students). The project includes a repository of learning objects (Digital Open Object Repository, DOOR), which allows sharing documents about the theoretical kernels of argumentation and of other materials (audiovisual examples, case studies, audiovisual interviews, bibliographic references…) between different courses.

3 Our "Challenge": To Learn to Argue by Arguing

The pedagogical style of the argumentation classes bound to Argumentum is based on a learning-by doing approach. Students are not only expected to gain theoretical notions on argumentation models and rules; indeed, they are also expected to engage in argumentative practices and to improve their argumentative skills. Such an objective is supported by two main means: on the one hand, students are asked to do some specific argumentation exercises, concerning both production and analysis-evaluation of argumentation. On the other hand, more generally, they are requested to critically evaluate all claims and arguments proposed in the develop-

[2] Initially, the courses were supported by the WebCT Vista platform. More recently, during the maintenance phase of the project, courses have been migrated to the platform Moodle, which allows a swifter management of the project contents, in particular concerning course updates.

ment of the course. The kind of critical evaluation requested does not consist in the "polemical obsession" of questioning everything, including even evident data; rather it is a commitment to the *reasonable* attitude which is keystone and inspiration of the argumentative activity (van Eemeren and Grootendorst 2004; Rigotti et al. 2006a). From a personal perspective, it could be said that students are invited not to be afraid of *socio-cognitive conflicts* (Light and Perret-Clermont 1989; Perret-Clermont et al. 2004) that may be helpful to their learning process and, in particular, to the construction of knowledge. In a word, the challenge of the course is proposed to students in terms of: "to learn to argue by arguing" (Tardini 2007).

In chapter "Argumentation and Learning" of this volume, Baruch Schwarz analyses the double possible exploitation of argumentation as a means for learning specific contents (*arguing to learn*), and as an object of study (*learning to argue*). Schwarz observes that these two directions for the interpretation of the argumentative activity are not mutually exclusive. Indeed, in relation to the experience discussed here, the endeavour of learning argumentation by arguing condensates these two directions, as it interprets argumentative practice as a means to learn argumentation. Theoretical reflection and practical engagement are, in this respect, closely related and reciprocally supportive, as it will be shown in what follows.

Before illustrating the theoretical and methodological instrumentation proposed to students for this learning activity in more detail, I will briefly describe the case-study selected as a basis for triggering the students' argumentative debate.

4 Facing the Controversy of Valladolid

An interculturally delicate problem emerged at the half of the sixteenth century has been chosen as the setting of this learning experience. In Valladolid, Spain, a group of Spanish conquerors met with some representatives of the South American Indians, in order to establish whether these latter were endowed with a human nature. This controversial issue shows to bring significant pedagogical advantages: in fact, albeit sufficiently far in our past to be tackled with a sort of detachment, which is necessary to the analyst of argumentation, it still shows to bring to light many issues that are relevant to the present-day cultural debate.

The materials used for this activity, collected by a group of historians didacticians (Bourdin et al. 2001), have been suggested and made available to the Lugano partners by the group lead by Anne-Nelly Perret-Clermont at the University of Neuchâtel. Indeed, these materials had been selected as an object of study for students' exercises within the European project Dunes, in which the Neuchâtel group has participated (Andriessen et al. 2004; Muller-Mirza et al. 2007). This historical controversy refers to the moment in which, after the European discovery of the "New world", the Spanish conquerors were faced with a new and not easily comprehensible intercultural encounter. The so-called Indians, in fact, appeared to have peculiar habits and customs, which had provoked a real "culture shock" in the newcomers, such that several of them had occasion to wonder whether the Indians were

human beings or not. Of course, the problem had non negligible consequences: in case the Indians were human beings, they ought to be treated as such – which meant, for the Catholic Spain of that time, that they were God's creatures equal in dignity with the Spanish people. If not, their territories could be conquered, and the Indians could be enslaved. At least three aspects have to be pointed out in facing this controversy, in order not to oversimplify its perception in our modern appreciation of the facts. First of all, the impact that such an intercultural encounter had on the Spanish conquerors should not be underestimated. Witnesses of that time speak of human sacrifices and ceremonies which could really appear as feral to the Spanish eyes.[3] Secondly, such a controversy did in fact take place in the Spanish culture – though of course not precisely in the fictive reconstruction we have given of it – and constituted a real advance for the Spanish culture of that time.[4] Such a controversy, in particular, developed in the context of a debate held in 1550 in Valladolid, in which Bartolomeo de Las Casas, a Seville conqueror who had converted to Christendom and had become the first priest to celebrate a Mess in the new world, defended the Indians' cause against Juan Ginés de Sepúlveda, a humanist and the Cordoba canon, who sustained that they were inferior beings and suggested that they should be enslaved. The phenomena of mixed marriages and of mixed race people, which were nearly absent in the North American colonization but have been present in South America since the beginning of the European conquest, are sometimes evoked as a sign of such a cultural evolution, as it witnesses the acknowledgment of the Indians' human nature. The third aspects concerns the relevance that such a controversy could have nowadays. It is rather clear that nobody would now doubt that South America's pre-Columbian populations were indeed constituted of human beings. However, the problem of facing diversity in intercultural encounters still remains an important issue in our modern culture (Rocci 2006); furthermore, debates concerning the definition of the human nature are still present in other contexts, as suggested, for instance, by E. Schiappa (2002), who analyses a case of discussion about the definition of *person* and *human life* in

[3] Hernán Cortés describes the astonishment of the Spanish conquerors faced with the Indians' practice of making human sacrifices in his first relation (Primera Relación o Carta de Veracruz, 1519) sent to the Emperor Charles V. After having reported the ritual associated to this practice, which some of his men had reported, Cortés also relates their opinion according to which it is the most crude and dreadful thing that they have ever seen ("Esto habemos visto algunos de nosotros, y los que lo han visto dicen que es la más cruda y más espantosa cosa de ver que jamás han visto").

[4] Many interventions contributed to such a debate. It is worth mentioning that, in 1537, Pope Paul III promulgated the Bull "Veritas ipsa", also known as "Sublimis Deus", in which he clearly condemned the slavery of the Indians, and declared that they were human beings "capable of faith", whose freedom had to be respected by the Catholics ("…predictos Indos et omnes alias gentes ad notitiam christianorum in posterum deventuras, licet extra fidem christianam existant, sua libertate ac rerum suarum dominio huiusmodi uti et potiri et gaudere libere et licite posse, nec in servitutem redigi debere, ac quidquid secus fieri contigerit irritum et inane, ipsosque Indos et alias gentes verbi Dei praedicatione et exemplo bonae vitae ad dictam fidem Christi invitandos fore, auctoritate Apostolica per praesentes litteras decernimus et declaramus, non obstantibus praemissis caeterisque contrariis quibuscumque").

debates over abortion in the United States. The choice of the controversy of Valladolid, thus, is not a mere rhetorical exercise; it somehow forces one to reflect on issues that are still contemporary. On the other hand, the relative temporal distance from the events constitutes a pedagogical advantage, since it allows discussing the issue with a more detached and free attitude.

In our didactical scenario, the controversy recalls – though with a significant extent of freedom and imagination – the debate held in 1550 in Valladolid. We imagine that three parties have to present their position in front of a Pontifical envoy, assumed to be the arbitrator who will make the final decision on this cause: a representative of the Spaniards declaring that Indians are not human beings; a representative of the Spaniards arguing that Indians are human beings; and a representative of the Indians themselves (expressly arrived in Spain to defend their cause). As a first step, students were required to choose one of these three roles, for which they were asked to prepare a written text to be read in front of the Pontifical envoy. They were given some preparatory texts in order to understand the three roles' positions and reasons.[5]

5 How the Learning Activity Developed

In accordance with the principle of learning argumentation by arguing, the methodology followed for this learning experience has allowed students approach the construction and evaluation of an argumentative text following subsequent steps that correspond to deeper cognitive acquisitions on its argumentative structure. In particular, the production of the argumentative text referring to the Valladolid debate was collocated quite at the beginning of the argumentation course. In a following phase, after the introduction of a model for analyzing the inferential structure of arguments (the Argumentum Model of Topics, described in chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource" of this volume by Rigotti and Greco Morasso), each student had the possibility to return to his/her production and evaluate its logical strength and persuasiveness with a theoretically more solid appreciation.

[5] These texts, originally provided by the Neuchâtel group, and recently translated from French into Italian within the Argumentum project (Rigotti et al. 2006b), are a collection of historical documents representing the different positions at stake in the controversy (Bourdin et al. 2001). The Indians' representative, of course, did not in reality participate in the debate in Valladolid, but the collected texts try to briefly resume the reasons of the Indians' practices and celebrations. The Spanish positions in favour of and against the Indians only partially reflect De Las Casas' and Sepulveda's positions; students are given freedom of constructing their own argumentative discourses for defending these positions.

Lesson sin class (with the support of Argumentum)	Group-work in class	Personal online activity
Presentation of the model of canonical argumentation		
Presentation of the controversy of Valladolid		
		Reading of the materials
	Group discussion about the different positions (Spaniards in favour and against the Indians; Indians)	
	Analysis of the issues and standpoints of the discussion (guided by the teachers)	
		Personal production of an argumentative text
Presentation of the Argumentum Model of Topics		
	Presentation of the student's "best-practices" and analysis of the inferential structure of some of their argumentations	

Fig. 1 Main phases of the learning activity

The main phases of this learning activity are represented in Fig. 1 in a chronological perspective. The different types of interaction foreseen within the blended learning context of this activity (lesson in class, group-work, personal online activity) are also indicated.

A brief description and discussion of the salient moments of this learning activity is presented in what follows.

5.1 The Classical Model of Canonical Argumentation as a Starting Point

The model of argumentative intervention we have developed within Argumentum is rather complex, considering that it aims at taking into account all relevant factors of the argumentative intervention within the communication context (see Rigotti and Greco Morasso, chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource" for a description of this model, which has been named "Fishbone"). Before introducing this model to students, we are used to proposing them, after about one third of the course development, an exercise of argument construction based on an inspiring model inherited from the classical tradition of ancient rhetoric, to which argumentation theory is largely indebted. In particular, the fundamental elements of this model can be retrieved from the very clear expounding given in the ancient handbook named *Rhetorica ad Herennium* (first century BC, see Cancelli 1992), an anonymous text which some scholars attribute to the young Cicero. The book presents a very precise and refined technique for elaborating an argumentative intervention, which includes both argumentative and rhetorical suggestions. It is foreseen that the intervention takes place in one of the typical application contexts of argumentation for ancient rhetoric: a court.[6] In this model, it is presupposed that each arguer will hold his or her own discourse, which will be followed by the counterpart's discourse; the dialogical exchange of turns, with its unforeseeable dynamics, is not focused on. Despite this limitation, in our didactical experience, the model has proved to be a useful tool for introducing students to the reflection on how to construct argumentative interventions. Indeed, the model presents a series of precise suggestions that help elaborate one's argumentative intervention in a consistent and persuasive fashion.

Two dimensions can be envisaged in the ancient model of canonical argumentation which is described in the Rhetorica ad Herennium; the following matrix (see Fig. 2), out of which a software application has specifically been elaborated for Argumentum by the eLab competence centre, intends to show the combination of these two dimensions. The software has been conceived for helping students in writing their argumentative texts.

On the vertical axis, the different *partes orationis*, i.e. the temporal "segments" of discourse or "text constituents" are listed; each of these constituents is associated with its *officium*, i.e. with the task that it has to accomplish within the complex design of argumentation. Here, it is worth briefly mentioning the respective *officia* attributed to these segments, as they are presented in the Rhetorica ad Herennium.[7]

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[6] Aristotle, in the first book of his Rhetoric, identifies three main genres of argumentative texts. The first two genres foresee the application of argumentation in two specific contexts: the deliberative assembly (*ecclesia*) and the court; the third genre, termed the *epideictic discourse*, concerns the appraisal or blame of a person and of his actions and behaviours. The typical context of application of this third genre was the celebration of a city festivity.

[7] For a more detailed description of the classical model, see Mortara Garavelli (1997: 55 ff.).

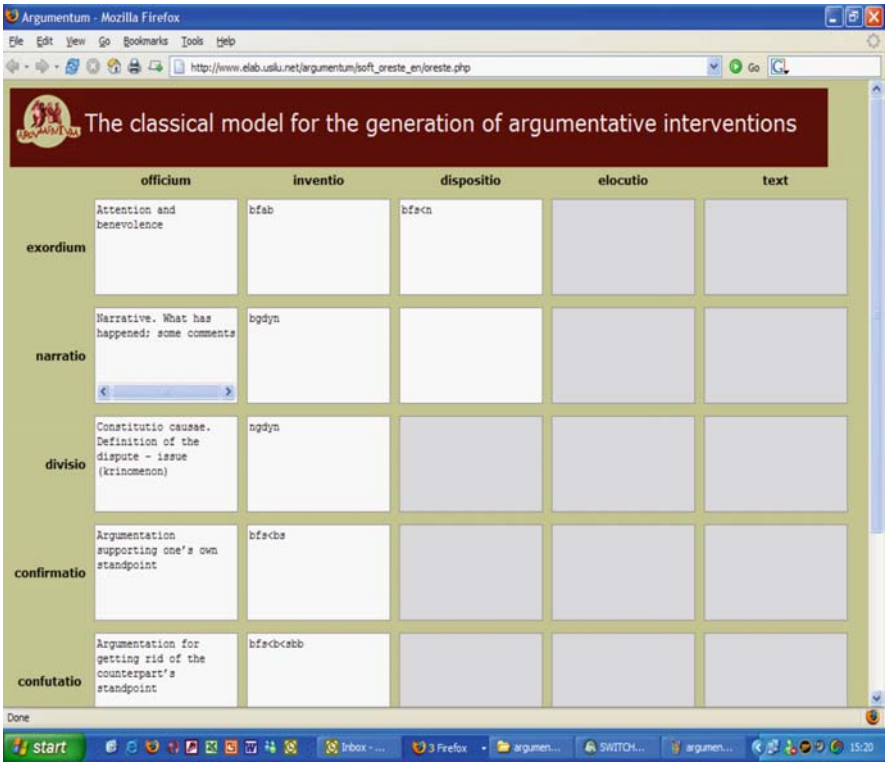

Fig. 2 A screenshot of the tool for building canonical argumentative discourse based on the Rhetorica ad Herennium

The *exordium* is conceived of as the arguer's introduction of the topic to the decision makers; by means of this text constituent, the decision makers' disposition towards the discourse is created (*Exordium est principium orationis, per quod animus auditoris constitutur ad audiendum*, I, 4). As such, it has the task of raising the decision makers' attention, including their willingness to listen and reasonably decide and their positive attitude towards the arguer's cause (*Principium est, cum statim auditoris animum nobis idoneum reddimus ad audiendum. Id ita sumitur, ut attentos, ut dociles, ut benivolos auditores facere possimus*, I, 6). The Rhetorica ad Herennium proposes a wide range of possible moves to make an effective exordium, which include the strategic choice of whether to start by relying on the arguer's authoritative person, by celebrating the decision makers' impartiality and wisdom or again by highlighting how the matter at issue is urgent and relevant. Such a choice depends, of course, on one's position within the communicative context and on the strength of one's reasons.

The *narratio* consists in the presentation of the relevant facts,[8] whereby, through the selection of the narrated events, the arguer's position is implicitly supported. Sometimes, the narratio can also recur to analogies or to fictive facts (II, 13); nevertheless, it should keep the requisites of being synthetic, clear, and verisimilar (*brevis*, *dilucida*, *veri similis*, II, 14).

The *divisio* is a crucial point of the discourse, as it represents the elicitation of the issue(s) to be discussed, and on the parties' relative standpoints with regards to the issue(s); these are elicited on the backdrop of the shared *common ground* of the decision makers, from which the premises for the development of the argumentative discourse can be extracted.

Confirmatio and *confutatio* comprise the real argumentative discourse aimed at persuading the decision makers (*tota spes vincendi ratioque persuadendi posita est in confirmatione et in confutatione*, I, 18). In particular, in the confirmatio the arguer presents arguments in favour of his or her standpoint, whereas in the confutatio he tries to show the weakness of the counterparty's reasons.

Finally, the *conclusio* is the final part of the argumentative intervention, whereby the arguer briefly recalls the structure of his discourse in order to revive it; the arguer must also stress the importance of the cause, and move the decision makers' attitude towards the decision he/she wants to suggest.

On the horizontal axis, the *phases of elaboration* of the discourse are represented, which concern the process of finding out arguments (*inventio*), arranging them into an effective order (*dispositio*), and finding the right communicative tools to express them (*elocutio*). Two further dimensions were considered in the ancient rhetoric model, corresponding to memory and non-verbal communication (*memoria* and *actio*); these dimensions have not been represented in the software, which has been designed for the production of written rather than oral argumentative interventions.

The classical model and the software based on it have been presented to students in class (see Fig. 1). The controversy of Valladolid was introduced just after this presentation and students were asked to identify in one of the three possible positions (Spaniards "pro Indians", Spaniards "against the Indians" or Indians).

5.2 Analysis of the Issues and Standpoints in the Discussion

After having assumed the positions they were going to defend, and having read all the documents concerning the controversy of Valladolid taken from Bourdin et al. (2001), students met in class to have a first discussion on the case in groups, whereby our aim was to elicit the different issues and standpoints emerging from their understanding of the controversy. In argumentative terms, issues can be defined as the matters on which there is a difference of opinion, whereas standpoints are the different positions on a given issue or, more precisely, are statements

[8] The narratio shares the form of indirect argumentativity that is proper of news reporting in journalism. The selection of facts, indeed, is argumentative in itself, because it presupposes the relevance of the selected facts.

(simple of complex) for whose acceptance by the addressee the arguers intend to argue (Rigotti and Greco 2006). In this phase, students worked together in groups, assuming their role of opposing parties in the discussion, thus confronting their respective standpoints and identifying the issues they discovered as relevant.

The parties identified two main – distinct but related – issues of the controversy: the main one concerned the definition of the Indians' human nature, whereas the second one posed a question on the moral legitimacy of the Spanish occupation of Indian territories. Of course, the evaluation of the second issue depends on the evaluation of the first one.

On the first issue, the positions of the two Spanish parties were respectively in favour of and against the Indians' human nature. Interestingly, the Indians' party was subdivided into two groups with regards to this point. Some of them assumed the standpoint "we are human beings", thus conforming their position to that of the Spanish party supporting them. Others protested against them not by opposing another standpoint on this issue, but by questioning the legitimacy of the issue itself. They claimed, in fact, that no human being has the right to evaluate other human beings' humanity. From the point of view of the argumentative analysis, the Indians' position can be distinguished from the Spanish ones in that it identifies a different boundary between what is in the realm of ascertained facts and what is still to be discussed. In terms of the ancient doctrine of *status causae* (Greek *stasis*), the Spanish parties and a group of Indians interpret the dispute as a *definitory* one, whereas other Indians question the adequacy of the "court" that should judge them (the analysis of these standpoints is discussed in more detail in Greco Morasso 2006).

Concerning the second issue, the Spanish representatives who considered Indians not to be human consequently considered the occupation of their territories licit; on the opposite, those who thought that Indians were human beings also found that the occupation was decisively immoral; and the Indians themselves viewed it as an act of aggression.

The following table represents issues and respective standpoints emerged from the students' discussion[9]:

Table 1 Issues and standpoints in the controversy

Issues	Standpoints
1. The Indians' human nature	(a) Indians are not human beings and, for this reason, can be treated as slaves
	(b) Indians are human beings
	(c) The issue is illicit: you Spanish people do not even have the right to question our human nature
2. Moral character of the Spanish occupation of Indians' territories	(a) The Spanish occupation is licit
	(b) The Spanish occupation is decisively immoral
	(c) The Spanish occupation is an act of aggression

[9] It is interesting to compare the results of the discussion with the results of the same phase of this exercise which was proposed also in the summer semester 2007. In 2007, many more issues emerged, whereas the discussion on the legitimacy of the first issue was not raised by the Indians, who accepted it.

5.3 Construction of an Argumentative Text Through the Help of a Software Application

Students were requested to write their own argumentative text in an online modality, using the software application based on the Rhetorica ad Herennium. The text had to be conceived of as if it were to be read in front of the Pontifical envoy in Valladolid. The software application has been structured in such a way that it somehow forces the users to go through all the passages of the elaboration of argumentative texts foreseen in the model. In fact, first students have to fill in all boxes concerning the *inventio* in the different segments of the discourse, from the exordium to the *conclusio*, by writing down their notes in the respective textboxes; successively, they go through the *dispositio* and *elocutio*; only in the end they can access the textboxes reserved to the composition of the real text. Once all textboxes have been completed, the software allows generating a unique text from the different segments. When they have gone through all the requested passages, students can always go back and refine, modify, or correct preceding elaborations.[10]

The relative rigidity of the model has the pedagogical aim of forcing students to take into account all relevant questions the arguer has to think about when designing an argumentative intervention, and to distinguish the different phases of elaboration in the design.

In the case of the exercise about Valladolid, students have been given about two weeks to complete their texts, which were expected to be between one and two pages long.

5.4 Presentation of "Best Practices": An Effective Way of Learning from Students' Exercises

In our didactical experience in the argumentation classes in Lugano, we have progressively elaborated a methodology for correcting students' exercises that, in our experience, turns out to favour their engagement and to facilitate their reflection on possible improvements of their argumentative practice. We are used to presenting, in class, a collection of *best practices*, which are taken from their works and which go through the different phases of elaboration and segments of discourse. In this way, rather than pointing at imperfections, misunderstandings, or unhappy moves, we focus the attention on happy experiences of argumentation, with which students can compare their work.

We have remarked, for instance, that students often "slip" on intercultural communication, as they avoid situating their roles in the adequate cultural context and using appropriate cultural categories. The exercise, indeed, is not a trivial one from this

[10] The process can be done in a single session, but it can be also saved and continued in different sessions. In the end, users can decide to print their work in PDF format, and submit it to the teachers using the online platform.

point of view, because it requires a sort of diachronic intercultural sensibility that alone can help understand some positions that, as said, turn out to be unacceptable and even quite exotic nowadays. As mentioned above, nobody would doubt now that Indians were human beings. Therefore, understanding the position of the Spaniards who were of this opinion requires intercultural empathy, reflection on the historical context and the cognitive capacity not to consider one's position and categories as the unique possible (which Muller-Mirza et al. consider one of the cognitive pre-requisites for argumentation, see chapter "Psychosocial Processes in Argumentation" of this volume). Rather than pointing at problems related to such an issue of intercultural sensibility, we have presented some good solutions extracted from the students' elaborations. The discussion of the selected examples brought all students to reflect on this issue.

5.5 Selection of a Particularly Relevant Argument Proposed by a Student: Analysis and Evaluation of the Argument Based on the AMT

The controversy of Valladolid has also provided the occasion to move a step forward in the acquisition of theoretical tools for the analysis and evaluation of arguments. In fact, while presenting best practices "spontaneously" produced by students, we had the occasion of showing how the inferential structure of arguments can be analysed and evaluated through the Argumentum Model of *topics* (henceforth: AMT, see Rigotti and Greco 2006; Rigotti 2006, 2007; Rigotti and Greco Morasso, chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource" of this volume), deliberately introduced to students only after the writing of their text. The AMT allows classifying arguments by eliciting their inferential structure[11]; in this sense, it is part of the stream of studies focusing on *argumentation schemes* underlying actual argumentative moves (see in this relation van Eemeren and Grootendorst 2004). The identification of the inferential structure of arguments allows proceeding to an evaluative phase, where the strength of the reasoning and of the premises is considered.

Now, as the presuppositions and functions of the Argumentum model of topics (AMT model) have been discussed and illustrated before in this volume (see and Greco Morasso, chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource"), my aim here is simply to show, by means of one example, how this model can be applied for analysing argumentative interactions, and how it may be explicative in understanding the inferential structure of arguments.

[11] The system of *topics* has been conceived of, since antiquity, as a tool for generating all relevant arguments in support of a given standpoint and for analysing and evaluating their reciprocal strength in terms of logical validity and persuasiveness (see Rigotti 2007). The model of topics proposed within Argumentum "inherits" the studies stemming from the ancient rhetorical tradition, but it aims at proposing a more consistent and coherent framework, integrated with the recent developments of Argumentation theory and pragmatics; moreover, it considers the modern argumentative practices and the social context in which the argument construction is embedded (Rigotti 2007).

As mentioned, the AMT has been presented to students after completing their written text on the Valladolid controversy; the presentation of the theoretical aspects had been initiated after the presentation of the exercise, and concluded before the discussion in class. Now, the discussion of best practices in class has equally offered the possibility of applying the AMT to some arguments previously produced by students in the *confirmatio* and *confutatio* of their argumentative texts. As a consequence, students had the possibility of becoming analysts of their own text and eliciting its inferential structure.

I will here focus on a single argument proposed in the *confirmatio* phase by one of our students, who acted as the Indians' representative. The analysis of this passage has been also proposed in class not only for its significance with regards to the context of the dispute – it is bound to the first issue, i.e. to the problem of definition of the Indians' humanity – but mainly because it offers a happy example of a good argumentative strategy:

> "Indeed, our society has been evolving through the centuries: we have built roads, waterworks, boats, temples where our cult is practiced… If human beings differentiate from beasts because of reason, why should such works of our minds not be considered a proof of our human nature?"[12]

As a first step in the analysis, it is possible to identify the standpoint and argument that constitute this reasoning. The standpoint, which remains implicit, but is evoked by the final rhetorical question, can be formulated as "We (the Indians) are human beings"; the student is thus one of the Indians who accept the issue of evaluating their own nature, and supports the position according to which their identity as human beings can be demonstrated. Concerning the argumentation in support of this standpoint, it is constituted by an unexpectedly complex structure, which is based on the crossing of different syllogistic reasoning.

As a first step, two parts of the argumentation can be envisaged:

Part A. The rationality of the Indians' works demonstrates that there is some rationality in the Indians themselves; in other words, it is possible to reason out the presence of rationality in the efficient cause (agent) from the rational effect it has produced.

Part B. If Indians are rational creatures, according to the definition of human being, they can be labelled as human beings. This second part of the procedure, which assumes as a premise the conclusion of the former part, is based on the one hand on the Aristotelian notions of *genus*, *species,* and *specific difference*; on the other hand, it presupposed a shared ontology of the human being as "rational animated being".

Let us first focus on Part A, analysed in Tables 2 and 3 and graphically represented in Fig. 3 in the transparent textboxes. The inferential strength of the argument

[12] The author of this argument, Sara Montanari, wrote her text in Italian. Here, I quote the original passage: "…La nostra civiltà infatti si è evoluta nei secoli: abbiamo costruito strade, città, acquedotti, barche, luoghi in cui praticare il nostro culto… Se gli uomini si differenziano dalle bestie per via della ragione, come possono tali opere dei nostri intelletti non essere considerate prova della nostra umanità?".

Table 2 First syllogistic procedure, Part A

Maxim (major premise):	*If there is rationality in the product, there must be rationality in the producer*
Minor premise:	*We (the Indians) are producers of intelligent works*
First conclusion:	*There is rationality in us (We are rational beings)*

Table 3 Second syllogistic procedure, Part A

Endoxon (major premise):	*Roads, towns, waterworks, boats, temples are intelligent works*
Minor premise:	*In pre-Columbian America there are many of such works made by our people*
Final conclusion:	*We (the Indians) are producers of intelligent works*

is based on the principle – named the *maxim*[13] – that allows reasoning out the rationality of the efficient cause from the rationality of the effect produced, as "If there is rationality in the product, there must be rationality in the producer". In terms of topical analysis, such a principle is a particular application stemming from the argumentative *locus from the effects*.[14]

The maxim gives rise to a syllogistic reasoning (see Table 3) which carries the logical strength of the argumentative move we are examining. Such syllogistic reasoning brings to conclude the rationality of the producers of intelligent works, namely the rationality of the Indians; the conclusion can be expressed as *"There is rationality in us"* or *"We are rational beings"*. In order to reach this conclusion the following minor premise is necessary that guarantees the rationality of the Indians' products: *"We are producers of intelligent works"*. This first syllogistic procedure, so constructed, can be resumed as represented in Table 3).

Yet, the minor premise of this syllogistic reasoning still needs to be argued for, because it is not evident in itself: in fact, who guarantees for the intelligence of the Indians' work? Some form of backing is necessary for supporting this statement. It is thus possible to discover, within this apparently simple argumentative move, the presence of another syllogistic reasoning, which is intertwined with the former; in particular, the minor premise of the first syllogism is supported by the second syllogism, i.e. it becomes the conclusion of the latter (see the graphical representation in Fig. 3).

Now, the major and minor premises of this second reasoning can be directly taken from the observation of the Indians' works made by Spanish observers;

[13] In the AMT, maxims are defined as implications establishing a connection between the truth value of a hooking point and a standpoint of the form $p \rightarrow q$, which generate inferential processes; each inferential process defines, within the locus, the form of a subclass of arguments (see Rigotti and Greco Morasso chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource,"). All the maxims of the same locus share the same hooking point to the standpoint.

[14] According to the AMT, argumentative discourses are always constructed on the basis of *loci*, which can be classified according to their *hooking point*, i.e., to the particular aspect of the standpoint they refer to. For a complete account on possible hooking points giving rise to the system of *loci*, see Rigotti 2007).

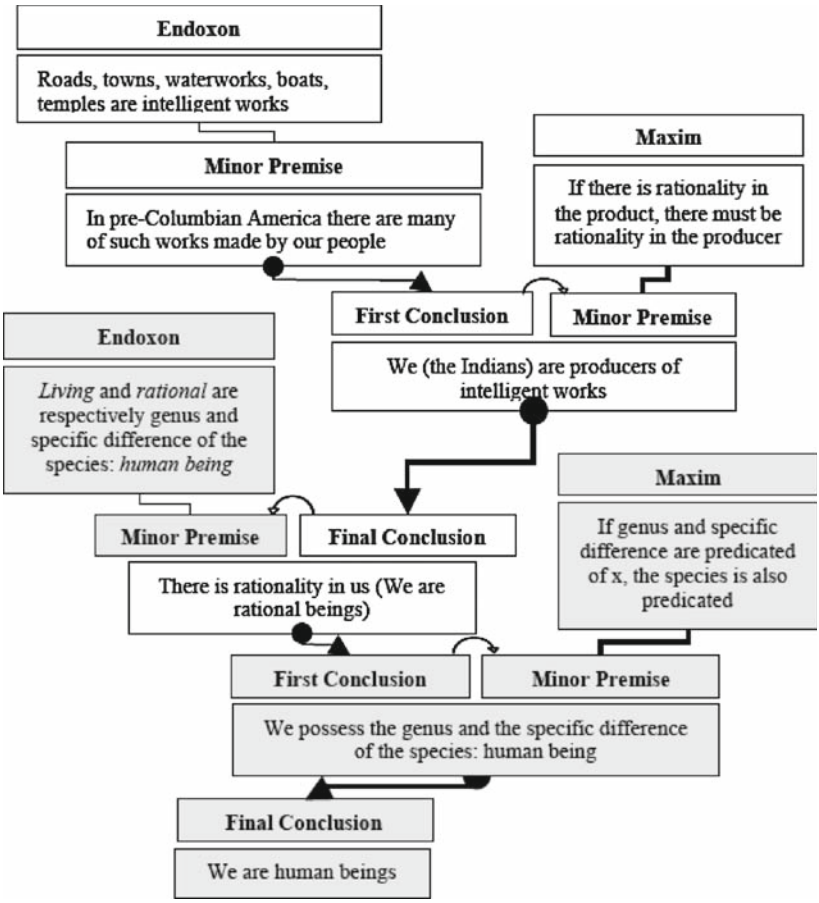

Fig. 3 Synergic representation of the whole argumentation (Part A and Part B)

documents of the time, in fact, witnessed the Spanish wonder in front of a form of civilization that, though different, appeared to have evident traits of humanity: cities, buildings, which witnessed a form of social civilization and communal living (as it is also described in Cortés' second report to the Emperor Charles V[15]).

[15] Cortés (1520), when describing the city of Temixtitán (also known as Tenochtitlán), highlights some of the traits that had touched the Spanish observers. He comments that this city is as big as Seville and Cordoba; many flourishing markets are present in the streets and squares, and every day several thousands of people buy and sell all kinds of wares. The city also foresees temples and places where the Indians' cult can be practices, and which are guarded by religious figures. The architecture of many building is also impressive; Cortés describes in detail the biggest house of the city, which is such a big and decorated building that no human words can describe it ("No hay lengua humana que sepa explicar la grandeza e particularidades de ella").

Technically, the major premise of this reasoning is constituted by an *endoxon*, an Aristotelian notion defined as "an opinion that is accepted by the relevant public or by the opinion leaders of the relevant public" (Rigotti 2007). Even when an argumentative move is based on a strong logical connection, as in our case, its persuasive force holds only if its logical structure (represented by the first syllogistic procedure) is founded on an appropriate backing, namely the endoxon of the second syllogistic procedure. In this case, if the presence of intelligent works in pre-Columbian America had not been accepted by the decision makers, the argument would have had no persuasive force.

I will now focus on the second argumentative move (Part 2), analysed in Tables 4 and 5 and represented in Fig. 3 in the shaded textboxes. Such a move aims at bringing to the conclusion that represented the original standpoint: "We (the Indians) are human beings". This reasoning is, in turn, constituted by two combined syllogistic procedures; the first one is still based on a maxim, this time referring to the *locus from definition*, which in particular exploits the relation between *species* and *genus* (see Rigotti 2007). The maxim at work in this passage recalls an Aristotelian principle: "If genus and specific difference are predicated of x, the species is also predicated". This maxim can generate the desired conclusion "We (the Indians) are human beings" if it is associated to the minor premise "We (the Indians) possess the genus and the specific difference of the species: human being", as showed in Table 4:

It is clear that, also in this case, the minor premise needs in turn to supported by another reasoning, which could be represented as follows:

It is easy now to realize that the minor premise involved in the syllogism in Table 4 ("There is rationality in us/We are rational beings") is directly assumed from the final conclusion of Part A of the argumentation, based, as shown, on the locus from the effects. The two complex reasonings constituting Part A and Part B are thus sequentially connected in a sort of argumentative chain.

In order to clarify the reciprocal relations between the different components of the argumentation analysed up to now, it is possible to synergically represent the

Table 4 First syllogistic procedure, Part B

Maxim (major premise):	*If genus and specific difference are predicated of x, the species is also predicated*
Minor premise:	*We (the Indians) possess the genus and the specific difference of the species: human being*
First conclusion:	*We (the Indians) are human beings*

Table 5 Second syllogistic procedure, Part B

Endoxon (major premise):	Living *and* rational *are respectively genus and specific difference of the species:* human being
Minor premise:	*There is rationality in us (We are rational beings)*
Final conclusion:	*We possess the genus and the specific difference of the species: human being*

inferential structure of the whole argumentation (see Fig. 3).[16] The combination of transparent textboxes, referring to Part 1 of the reasoning, and shaded textboxes, referring to Part B, visually helps represent the point of intersection constituting the argumentative chain.

Such a representation is very much centred on the syllogistic process of the reasoning (major premise, minor premise, conclusion), and allows highlighting the crossing between the topical procedure, founded on the maxim, and the procedure founded on the endoxon.[17]

In argumentation, the maxim guarantees the inferential strength, whereas the endoxon provides the embodiment in the shared premises of the community. Argumentation, indeed, is always hovering on these two dimensions: the logical strength of the reasoning and the foundation on the common ground of a cultural community. The abstract logical procedure is not persuasive in itself, even if it is consistent, if its premises are not really rooted in the community to which the decision-maker belongs. The foundation in the community is of cultural nature. Not coincidentally, both endoxa emerging from the complex reasoning we have considered constitute the critical aspects of our argumentation, which must be considered when evaluating its soundness and persuasiveness. The first endoxon, as said, derives from an observation made by some Spanish conquerors themselves, struck by the civilization of the Indians' communities; the fact of being founded on a premise that is certainly shared also by the counterpart constitutes the strength of this part of the reasoning. The second endoxon, in turn, recalls a definition of human being as "rational living being" which was largely shared at the time of the facts, being an Aristotelian definition also assumed in the Christian ontology. From an evaluative perspective, thus, the reasoning results well-founded also for this second passage, if we consider the context proper of the dispute. It is worth noticing, however, that if we should transfer this argument to the modern times, such an endoxon would result much less solid, as the current cultural debate lacks a shared definition of the notion of human being. The indication of reason as the specific difference of the human species would probably not be so easily acknowledged nowadays.

6 Some Remarks on the Lessons Learned

Several observations about the method adopted during this experience and about its pedagogical implications have already been presented in the motivation and description of the four phases of the exercise. However, some final aspects can be

[16] This kind of synergic representation has been proposed in Rigotti and Greco (2006).

[17] It is important, however, to shed light on an aspect of the representation that may be misleading: in conformity with the syllogistic structure, minor premises are associated to the maxim or to the endoxon respectively (i.e. to major premises) by means of a *logical conjunction*. This means that they do not derive from the major premise, although the representation might suggest this interpretation. On the opposite, the conclusion is *derived* from the logical conjunction of major and minor premise.

focused on, in order to reflect on the lessons learned from this exercise and possible future openings and enrichments.

First of all, we have remarked that, for students, the temporal development of the exercise has proven important. The classical model of canonical argumentation, which we have introduced at first, has served the purpose of introducing them to the challenge of assuming a standpoint and of producing argumentation in support to this standpoint. Applying the AMT to examples of argumentation "intuitively" produced by students (as the example described in this paper) has had the advantage of showing the relevance of this model in relation to the elicitation of the inferential structure of the argumentation, and to its evaluation. This temporal development leads to considerations with regards to respecting the *chronogenesis* (Chevallard 1985) of the community of students and teachers constituting the class: the introduction of new theoretical contents and notions should always respect the development of the classes learning process.

In chapter "Argumentative Interactions and the Social Construction of Knowledge" of this volume, Michael Baker presents some cognitive acquisitions that students can gain from their engagement in argumentative discussion. In this relation, the notion of "space of debate" is particularly relevant to understanding the value of the controversy of Valladolid. In fact, the first phase of this exercise consisted in the elicitation of issues and standpoints, achieved through a discussion in class. Indeed, the inability of identifying the issue(s) in the debate is often at the origin of misunderstandings, blocks in conversations, or, more in general, of the lack of an authentic dialogue between the parties. The phase of identification of issues and standpoints had the aim of clarifying the respective parties' positions and the questions that had to be debated. Such a process has showed to be particularly important for students, who often, at the beginning, find it difficult to distinguish between the question – issue – around which the debate is developed (e.g. "Do the Indians have a human nature?") and their respective standpoints on the issue. This is, indeed, a crucial phase of the argumentative discussion, which, according to the model proposed by van Eemeren and Grootendorst (2004), consists in the *confrontation stage* of a critical discussion.[18]

Another important acquisition in this respect is the capacity of developing arguments in support of one's standpoint (to which phase 2 of our exercise was devoted). Baker highlights the cognitive importance of the *expression of arguments* in students' learning processes (see chapter "Argumentative Interactions and the Social Construction of Knowledge" of this volume). It should not be neglected that, in some contexts, debates turn out not to be really argumentative because they are configured as a mere contraposition of standpoints without any party assuming the burden of proof of his or her standpoint (political TV debates sometimes represent an example of this scarcely argumentative practice). In relation to this, the argument evaluation process, involving the verification of the logical validity and of the

[18] For a brief description of the model of a critical discussion, see also Rigotti and Greco Morasso, chapter "Argumentation as an Object of Interest and as a Social and Cultural Resource," of this volume.

persuasiveness of arguments for the decision makers, has shown to be a crucial point in the acquisition of skills for reasonable argumentation.

Finally, a valuable possibility of further developing this exercise would foresee a phase in which students confront their respective argumentations in the context of a synchronic discussion. In this way, the process for the reciprocal evaluation of arguments and the ability of responding to one another's arguments in synchronic argumentative practices would be certainly enhanced. In this relation, the use of a software like the one elaborated within the European project DUNES, which helps managing argumentative discussions by regulating the exchange of turns and forcing the argumentative structuring of one's intervention, would prove a precious support (Andriessen et al. 2004 and Muller-Mirza et al. 2007 describe its use in relation to the controversy of Valladolid).

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