Alpine Skiing

Outdoor Adventures

Ronald W. Kipp

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To my daughter, Shalaya, who is my role model
and constantly reminds me that hard work
makes play that much more fun.

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Preface

Welcome to *Alpine Skiing*. By opening this book you have shown that you have an interest in Alpine skiing. You may be a total novice or possess some skiing skills already. If current demographics are correct, you may even be a snowboarder, and there is a chance you may be a cross-country skier also. Even if you have only seen a ski movie or the Winter Olympics, you probably have some idea of the excitement Alpine skiing can bring. For those of you who have slid down a mountain or even down the backyard on a sled, you have an idea of the exhilaration that downhill movement on snow can bring.

Skiing is a unique activity. It started as a tool for hunting and vehicle for traveling. Today it is a sport, and more than that, it is a community. Even today when you meet people and discover they are skiers, you have a connection with them. So be warned: Skiing can alter your identity and change your life.

Skiing challenges balance and rewards proficiency in a beautiful mountain environment. Whether you're skiing a groomed run or knee-deep powder, the skills needed contain common fundamentals. The degree to which these fundamentals are understood and mastered will determine if a person is challenged on a groomed beginner run or skis with confidence and control on a double black diamond.

Skills are the building blocks of ski performance and the stumbling block to technique. When the basics are understood and the accompanying motor skills are realized, the skier is rewarded with an open door. Skillful skiing creates efficient movements, which translate into less energy expenditure. When the skier has increased energy reserves, the day's skiing is more enjoyable and the prospect for injury is decreased.

Skills are something a beginner learns and an expert perfects. Although this book will provide the theory and guide your practice, it is not a substitute for on-snow skiing. How to practice as well as where to practice are important and will be discussed. In addition to practice, feedback is also necessary for the student. This book is not a substitute for a ski instructor, but it will provide cues for dealing with the changing environment of skiing. The changing environment includes the obvious, such as groomed versus powder slopes. Other changes the skier must deal with include the ski turn. Every moment of the ski turn, something changes. The interface of the ski's edge to the slope is altered with every centimeter the ski moves. At one moment the ski is across the hill, and in a fraction of a second it is pointed straight down the hill. Balance is an obvious consideration in this slippery arena. With this in mind, we will break down balance into three planes. When the planes are understood, balance cues can be directed so the skier does not fall backward, as is a normal case, and also will not fall sideways or rotate out of control. The need for balance is obvious but rarely understood.

While balance is a goal, skills are the way we move. Skills are indigenous to the stage of skill development. For example, it is essential that the skier learn whole-foot balance. When this is mastered, the skier can learn lateral balance, or balance between the left and right foot. Finally, fore–aft balance can be cultivated. Although these are similar skills,

the refinement must be learned in succession. Readers are advised to evaluate where they are in their personal skill progression. From there, find the appropriate chapter to concentrate on. Meanwhile, more experienced students having difficulties or finding themselves stuck at a learning plateau will be wise to seek out the rudimentary exercises to search for elementary building blocks with which to refine their basics.

This book will introduce never-ever skiers to the basic skiing skills and direct intermediate skiers in their quest to refine of their skills. This book also contains information that the seasoned professional may find valuable for further elucidation or as a reference.

The two parts of this book divide the off-snow from the on-snow information. The first half of the book, Preparing for the Skiing Adventure, covers a multitude of subjects. These could have been presented in almost any order and need not be read in any specific order, although they do present the most logical sequence for the topics chosen. Getting fit and understanding the ramifications of high-altitude ski resorts logically could be a prerequisite before planning a ski vacation.

Chapter 1 starts with skiing history. With this grandiose history as a background, it will explain why skiing has so many variations, such as Nordic, telemark, and backcountry.

Chapter 2 can be read before the snow falls; that is its purpose. It covers getting fit for skiing, which ultimately makes the skiing adventure more enjoyable. Having the endurance to sustain an entire day and the strength to endure the demands of a tough ski run takes planning. This will lead us to the physiological ramifications of skiing. Skiing and even just being at a high elevation in the cold alters physiology, and these changes will be discussed.

Chapter 3 on equipment points out that there used to be just one length of ski that was based on a skier's height, while ski width and sidecut were inconsequential. Today length is not a set value, while ski width and sidecut are essential to the desired turn radius and conditions. Since skiing is an equipment-oriented sport and the choices are varied, this chapter is devoted to the many options available. While not a buyer's guide, the reader should walk away understanding the language and appreciating the idiosyncrasies of skis, boots, bindings, poles, helmets, and eyewear.

Chapter 4 discusses the skiing environment, which is not only beautiful but has a plethora of options. While groomed slopes are the desired place to learn a new skill, moguls and powder create challenges that eventually all skiers will seek and desire. Ski areas rate the slopes by their difficulty. This chapter will tell you what the signs mean and how to interpret them. Other types of slopes are also presented, including ones that might present an avalanche hazard, and how to be prepared.

Chapter 5 should arouse the attention of readers who are passionate about learning. How skiers learn and practice, as well as the importance of feedback, will be unveiled. Why, how, and when to take a ski lesson and the types of lessons available are covered. Last, ski ability levels and what they mean will no longer be a secret.

Chapter 6 realizes that skiing is not usually close to home, and with all the equipment required, there needs to be an element of planning. This is not a travel guide but will unveil types of trips, methods of travel, and ideas for packing. With this information, a travel guide will yield larger dividends.

Part II, On the Slopes, is the instructional section, and the content is progressive. It assumes you are fit and have arrived at the ski area. This part covers everything from skills for the never-ever skier to the dynamic parallel turns of the expert. It is not meant to be carried in your back pocket on the ski slopes. The purpose is to equip you with tools so that you can evaluate, analyze, and improve your skiing.

Chapter 7 begins with how to carry and put on this new equipment. This chapter contains strategies for getting used to the ski equipment that at first can be quite awkward. Putting on boots and even skis prior to arriving at the ski hill can assist in the first part of the learning curve. Your first introduction to stance and the first movements on the snow are followed by how to ascend your first slope. With this newfound skill, your first slide down the hill on skis will be followed by your first wedge. Just in case you ever fall down, getting up is also covered.

Chapter 8 assumes you can make a rudimentary wedge and move in and out of it. The wedge turn is outlined along with some new sensations for the upper body. Angulation is introduced, which is one of those sections you will probably come back to as you progress. With these skills, you will link left and right turns. A quick sojourn into how a ski turns before heading to the chairlift concludes the chapter.

Chapter 9 will take you from the *V* of the wedge to parallel skiing. Weight transfer with an emphasis on balance will open the door to edging skills. With these under your belt, you will be ready to officially make your first complete parallel turn.

Chapter 10, Parallel Turns, means you have arrived at the penultimate benchmark in skiing. This chapter is devoted to enhancing already-acquired skills and learning how to coordinate them into a more harmonious movement.

Chapter 11 covers dynamic parallel skiing. Just the name sounds exciting. You will learn to move in three-dimensional space with one motion. By separating the seemingly complicated movements of skiing and arranging their timing, you will be prepared to start your turn on a dime. This will be the key to carving and is essential in the moguls, racecourse, trees, and any other skiing area that requires precision.

The book concludes with web resources that will help further satiate your interests, a Success Checks section with questions on the chapter contents, and references from each chapter.

Skiing is a wonderful sport for all ages. The more the enthusiast understands, the more the ski environment has to offer. This book is an introduction to the adventure of skiing. It can be read from start to finish or used as a reference. Technical areas can be used to refresh the basics or to advance the present level. In the end, it is the goal of all skiers to have a safe and enjoyable skiing experience. Welcome to the fraternity of skiers. See you on the slopes!

Acknowledgments

This book is a guide for aspiring skiers and those who already ski. Guidance is also important in the writing of a book. I was fortunate to have Gayle Kassing as my guide, or, as it is known in publishing, my acquisitions editor. She led me from the wedge turn of writing to the black diamond slopes of authorship. I am deeply indebted. Thank you, Gayle.

While Gayle guided me on my journey of composition, Melissa Feld directed me on making that journey with style. Like a skier figuring out the finer points of the ski turn, Melissa made sense of the points I was attempting to make and turned them into a book. Skiing is performed in a beautiful environment. Rachel Brito made sure the book's artwork displayed that beauty. Thank you, Melissa and Rachel.

A major part of the artwork in this book is in the form of photography. For this I was fortunate to have my good friend Ron LeMaster behind the lens. Ron is not only one of the finest ski photographers, but he is also a skiing expert. He kept me on task in the constant search for not just the best photos but those that depicted the critical points.

An artist will tell you a sculpture is no better than the stone from which it was carved. The same is true of ski photography. Michael Rogan, captain of the PSIA Alpine team, was the main demonstrator for the book. Not only is Michael the best image on skis, but he provided us with expertise in adjusting the photo shoots to capture the intended message. Thank you, Michael, for sharing your many talents.

Harry Caston shot the cover photo and many other photos in the book. A formidable photographer, Harry comes equipped with offspring capable of doing anything on skis. That is his daughter, U.S. ski team member Rose, on the cover; his son Marcus is pictured in the interior of the book. Thanks to a great skiing family.

Thanks to Katie Perhai at U.S. Ski and Snowboard Association and Zach Littlepage at Nordica for their help with acquisition of fantastic photography.

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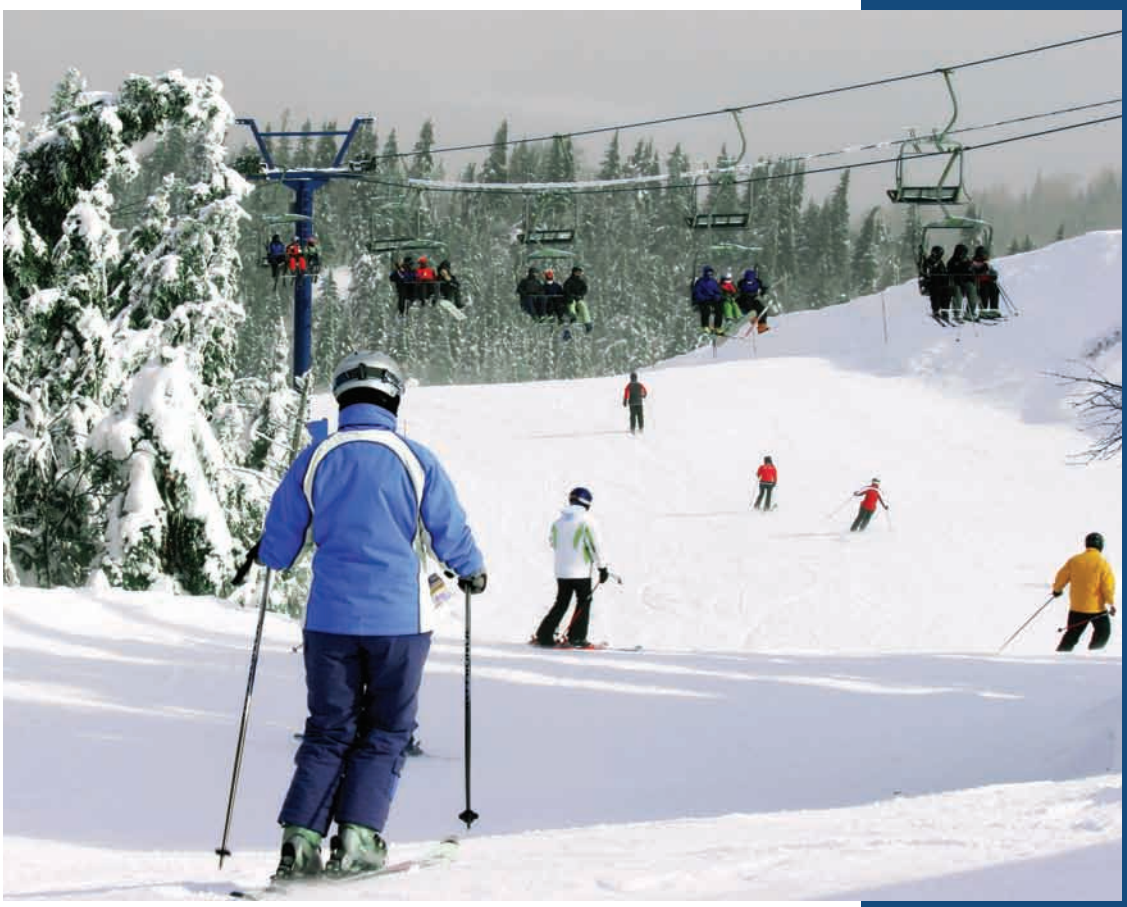
PART I

Preparing for the Skiing Adventure



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CHAPTER 1

Introduction to Alpine Skiing

Let's go skiing right now!

Roald Amundsen (first person to reach the South Pole and first person to reach both poles)

Skiing comes in many varieties, and Alpine skiing, also called *downhill skiing*, may be the most exciting. As with a roller-coaster ride, the thrill is in the movement. Gliding over the snow with the wind in your face creates a thrill that every level of skier can cherish. With the sun overhead or the snow heavily falling, each day is an experience that will find its way into the skier's memory banks.

Whether skiing with a group of friends or by oneself, skiing creates excitement. The ways to enjoy oneself as a skier are endless. The size of the mountains, the variety of terrain, and the varying snow conditions make it impossible to have the same experience twice. Each day is different because the slopes change as the sun moves across the sky—all are unique experiences and all are exciting. Skiers are drawn to the snow, the hill, the run, and the turn.

The mountain is the ballroom and the slope the dance floor. The dance can change in rhythm by the pitch of the hill or the depth of the snow. The beat has any tempo that the skier wishes, or the skier may want to find the dance in the terrain, surrendering to gravity while controlling the path that gravity allows.

When a turn or two are mastered, when the chill of the cold has been replaced with the warmth of the lodge, skiers reflect back on the mountain and share their memories of the day. It is then that they know they have joined a special group, a family called *skiers*. Skiing is a lifestyle and skiers bond with each other via their unique love of the sport.

Brief History

Skiing is older than the wheel and has more history than any other sport. Prehistoric rock carvings displaying skiing in northern Norway and Russia can be traced back 6,000 years. A rock carving found in Rødøy, Norway, dating back to 2,500 BC shows a skier equipped for hunting. A very short, wide ski was found in a peat bog near Hoting, Sweden. Skis nearly twice the length of modern skis were used by the Finns, while in Østerdal, Norway, it appears a long and a short ski were used, likely with a technique similar to pushing a scooter. In Russia, a ski called the *artach*, similar to the Bloke ski, was found over 2,000 kilometers away on Slovenia's Bloke Plateau.

Lengths of these evolutionary skis were quite varied. The common element was not much different from the wheel: No matter what the size, skis provided an important means of transportation. Just like the wheel, this equipment had an effect on many events throughout history. The survival of humankind, and unfortunately, the ability to wage war were critical in the evolution of skiing. It took the less serious activity of play to further evolve skiing from its basic transportation roots, or cross-country skiing, to the present-day downhill activity enjoyed by millions.

Skiing to Survive

The first skiers donned skis to help endure nature. Skis allowed the Norseman unlimited access to hunting and fishing in northern Scandinavia. With snow covering the brush, game could be more easily tracked and seen during the hunt. The snow also permitted hunters unlimited travel options in which to pursue their dinner. The reindeer, which followed the ice lines, proved to be the ideal source of food, clothing, and material for tools. Without roads, it was natural that the transportation advantages provided by the ski would make it an indispensable tool.

Skiing and War

The first reference to skis and war occurred in 1,200 AD. King Sverre of Norway ordered Pal Belte to lead a band of citizens on skis to reconnoiter his Swedish enemy near Ryenbergene, Norway.

Just six years later, two Birkebeiners, so named because they used the bark from birch trees as footwear, rescued baby Haakon Haakonssøn from his deceased father's political rivals. The Birkebeiners saw the infant prince as the heir to the Norwegian throne. On skis they carried the royal successor 54 kilometers from Lillehammer to Østerdalen. Skiing as a method of winter travel was in the process of creating a nationalistic pride and identity for Norway.

In 1932 the Birkebeiner cross-country race was established to celebrate this historic event. Today 13,000 skiers participate in the annual race, tracing the Birkebeiners' rescue route while carrying a 3.5-kilogram pack representing the infant prince.

Warfare prompted the publishing of the first ski book. In 1733 Colonel Jen Henrik Emahusen, a Norwegian ski troop commander, wrote a book on skis and skiing for the ski troops. Included in the book is a 72-step military rifle drill on skis. He even designated proper ski length. According to Emahusen, the left ski should be 270 centimeters long and the right ski should be 210 centimeters, not unlike the ancient ones found in Østerdal, Norway.

In the United States, World War II resulted in a group of unique outdoor troops and ski equipment in quantities and quality never seen before. The famous 10th Mountain Division of the U.S. Army was charged with training ski troops in the advent of a mountain attack, and it was the 10th Mountain Division that participated in a crucial mountain battle near the end of the war. When the war was over, the men trained in skiing brought back experience, knowledge, and surplus equipment that started the ski industry in the United States.

Young Haakon Haakonssøn being transported by the Birkebeiners to safety from his enemies, as imagined by 19th-century painter Knud Bergslien (1869).

Special Collections Dept., J. Willard Marriott Library, University of Utah

Many countries learned to ski through the wartime experience. Prior to World War I, Italy had the Alpini, and France had the Chasseurs Alpins, also called *Blauen Teufel* (Blue Devils), as the Germans nicknamed them. At the start of World War II, the Russians invaded Finland on three fronts. The Soviet troops had read the *Russian Manual of Ski-Fighting*, which was quickly printed the previous autumn. Riddled with elementary errors, the manual did not seem to help the 45 Russian divisions, some with armor and artillery, which were annihilated by Finnish soldiers camouflaged with white uniforms.

From Cross-Country to Downhill Skiing

Skiing remained primarily a cross-country endeavor of utilitarian purpose until the 1800s. It took sport and competition to morph cross-country skiing into a downhill or Alpine version.

In Norway, the birthplace of skiing, the first cross-country ski races were held. The first, in 1843, was accompanied by ski jumping exhibitions. By 1868 ski jumping was popular in its own right. This popularity inspired people from the Telemark region of Norway to design a more maneuverable ski. Credit is usually given to Sondre Norheim for this ski, which had a wider tip and tail. An old method was resurrected to attach the foot to the ski. Using osier willows, which were used in basket weaving, a strap was woven to go around the skier's heel. With the heel more secured in the improved ski, the Norwegians from Telemark had a distinct equipment advantage. They were already the best skiers, and with this improved equipment they maintained their dominance in ski jumping for the next 20 years. Part of their success was a new landing technique called the *telemark position*. This landing style had been tried previously, but success was limited with the old equipment. With the new ski and binding, the skiers from Telemark not only landed their jumps effortlessly but also demonstrated the first downhill technique: the telemark turn.

It took the Austrian Mathias Zdarsky to evolve the downhill technique. Zdarsky abhorred speed and was highly critical of the Norwegian method of skiing, which he thought was useless in the steeper Alps. He introduced the *V* position for his grooveless short skis. With tips together, the tails of the skis could be pushed out for speed control. When one ski was pushed out at an acute angle to the hill, a turn could be initiated. This was aided by a single pole that could be harpooned into the snow, acting as a pivot around which to turn. With his Lilienfeld method, Zdarsky founded the first downhill-only ski school. Many today consider Zdarsky to be the father of Alpine skiing.

Zdarsky influenced many Austrian ski instructors. One instructor, Hannes Schneider, was an outstanding student of the sport and started teaching in St. Anton in 1907. With so few pupils and a lot of time to experiment with technique, Schneider resurrected the 40-year-old Norwegian stem Christiania and further improved on the stem or *V* position with the ski tips together. Using two ski poles, he created a teaching system that started with a snowplow, progressed to the stem turn, and culminated with the stem christie, a progression not unlike those used today.

In North America, the California gold rush of the 1850s saw miners, who were unable to mine due to the deep Sierra snows, formulate their own form of skiing. Miners from rival mines would race for large amounts of money. They were pitted head to head in straight, no-turning races that were 900 to 2,000 feet (274-610 m) long. On skis that were two and half times the length of today's skis (14 ft or 427 cm), they reached speeds of 80 mph (130 kph) with the courage only hardworking miners could possess.

It was only natural that going downhill would evolve into its own activity. The thrill and excitement of going downhill was there; it just needed a few freethinking people to show the way. One can imagine those skiers near Rødøy or Hoting thousands of years ago experiencing the thrill of going down a hill while hunting for dinner.

Types of Skiing

Skiing is performed on snow with two planks (as they used to be called) attached to your feet. What you do with them describes the type of skiing. Also important is the design of the ski. Sondre Norheim in 1868 and Mathias Zdarsky in the 1890s recognized that the design of the ski and how the binding attached the boot to the ski were essential if their ski techniques were to be accepted.

The many types of skiing that have evolved only add to the assortment on the ski menu. They all have a historical connection. In essence, they are all branches of the same tree, connected by sliding somehow on snow; however, people may identify with one type of skiing over the others.

Nordic

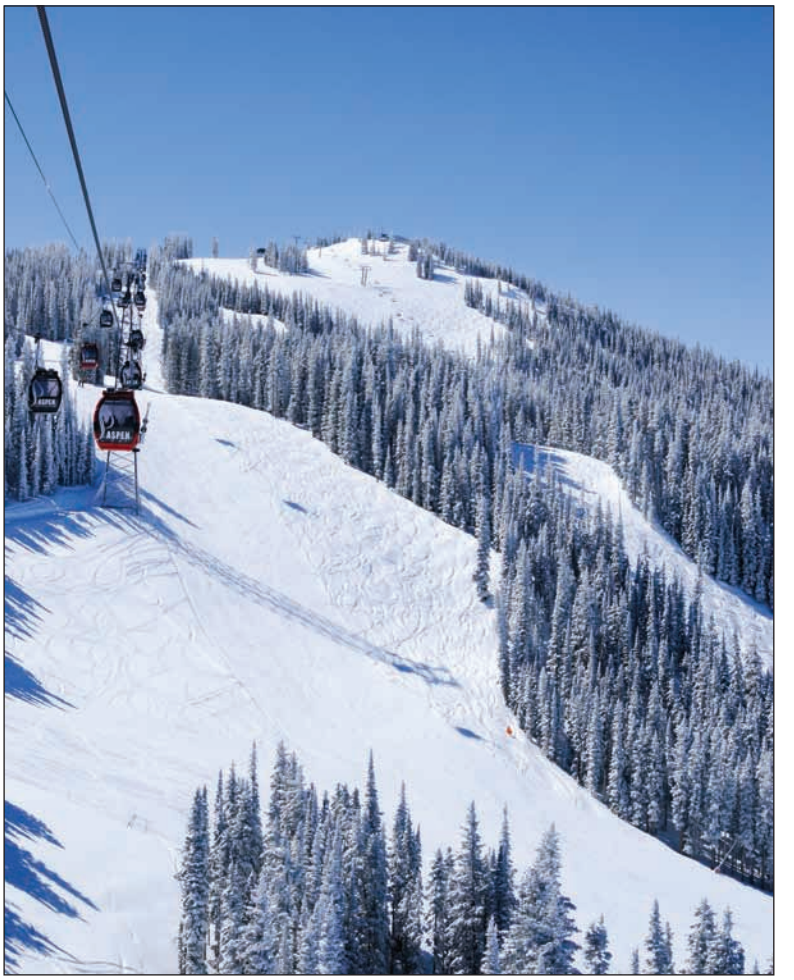
Nordic skiing, also called *cross-country skiing*, is the original ski endeavor. It can be as casual as hiking or as strenuous as running a marathon. Classic or diagonal stride movements, not unlike walking or running, are performed in tracks imprinted in the snow. Skating is ideal on the smooth, packed snow. Either way, the terrain is mostly flat with small undulations.

Nordic or cross-country skiing is the original skiing endeavor.

Alpine

Alpine skiing is performed in the Alpine environment or mountains. *Alpine*, a derivation of the European mountain range, refers to the downhill variation of skiing and is often called *downhill skiing*. It can be thought of as the adrenaline activity. While cross-country gets your heart rate up with physical exertion, Alpine skiing accelerates your heart with the excitement of going downhill. Although that is an oversimplification, as we will see in chapter 2 on getting fit for skiing, the point is that the adrenaline-ridden exhilaration of going downhill is its major draw.

Originally all skiing had some component of cross-country skiing. If you wanted to go down the hill, you first had to climb up the hill. As the downhill component of skiing became more popular, skiers figured out alternative methods to ascend the mountain. Since 1870, a train in Switzerland has been ascending the slope above Lake Lucerne to the town of Rigi for views from 1,800 meters. Before 1930, trains were the only choice



Alpine skiing takes place in the mountains and ski lifts take skiers to the top of the ski run.

for those skiers solely interested in the downhill portion of the ski adventure. Trains were also used in Zermatt and Davos, Switzerland. The Jungfrauhochbahn took aspiring skiers from Wengen and Grindelwald up to Kleine Scheidegg and beyond.

In the late 1920s, engineering student Gerhard Mueller used a 2.5-centimeter hemp rope and some old motorcycle parts to create the first rope tow. This rope tow was not unlike an old-fashioned laundry line that wraps around two wheels. Mueller had created a way to keep this contraption moving while skiers grabbed on and were pulled uphill on their skis. With skiers complaining of sore hands from his rope tow, Mueller later constructed the first T-bar lift. The T-bar was designed as an upside down *T*. Two skiers would each place their rear ends on their respective half of the *T*, which would then pull them up the hill by an overhead rope-tow device.

Today, skiers have the luxury of sitting on a chairlift or even inside a gondola or tram to accelerate up the slope. Surface lifts that pull the skier up the hill, such as rope tows and T-bars, are still prevalent in Europe but rare in the United States and Canada. However Alpine skiers get up the hill, it is going downhill that strikes their fancy. With gravity as the propellant, the skier makes turns back and forth across the hill. This is the primary goal of recreational skiers. Skiers often talk about moguls and deep powder. These types of terrains and conditions add spice to skiing.

Park and Pipe

A park is a designated area for performing tricks off manmade features such as boxes and rails in a variety of shapes and sizes. The pipe, or more specifically the halfpipe, is just that, half of a pipe cut down its length, resulting in a snow trough 100 to 120 meters long

The design of the ski pipe lets skiers perform many different kinds of tricks.

by 13 to 17 meters wide built on a 15- to 20-degree gradient. The walls are 3 to 4 meters high, terminating in a vertical section. Tricks are performed in the air off the vertical walls of the halfpipe. Tricks are a combination of flips, twists, and ski grabs. Takeoffs and landings are often switch or fakie, meaning the takeoff or landing is performed facing backward. Many park and pipe enthusiasts skip the lift, preferring to walk up the flank or side of the pipe so they can watch others perform tricks.

Snowboarding

Snowboarding is not technically a type of skiing, but with so many similar attributes, it deserves mention. Sliding downhill and the exhilaration of movement make snowboarding more than a distant cousin to skiing. Snowboarders ride the same lifts and use the same slopes. The only difference is the equipment. Snowboarders do not use poles, and instead of two skis, they ride a snowboard. A snowboard is wider and slightly shorter than skis. Also, recreational snowboard boots are mostly soft as opposed to the stiffer plastic versions found on Alpine skiers.

Snowboarding can trace its roots back to the 1920s in France, but snowboarding as we know it today got started in the mid-1960s. The United States has half of the world's eight million riders.

While their equipment is different than skiers, snowboarders share the same slopes and lifts as skiers.

Telemark

Telemark is a hybrid of downhill and Nordic skiing. The skier goes downhill on equipment that resembles Nordic equipment. The ski binding, the equipment that attaches the boot to the ski, hinges at the toe with the heel free. Thus it is sometimes called *free heeling*, but it is more officially termed *telemark*. Named after the county in southern Norway famous as the birthplace of skiing, the telemark position is similar to a genuflection in worship, where one knee is flexed toward the ground. It was first used as the desired position in which to land a ski jump and later evolved into a telemark turn, a rigorous form of going downhill due to the balance demands and the extreme knee bend during each turn.

Backcountry or Randonnée

Those who prefer nature on its wild side end up in the backcountry, feral area not served by ski lifts or ski patrol. This variety is not unlike skiing in its developing years. Travel is uphill with ski bindings that hinge at the toe so the skier can walk up the hill, and skins are attached to the base of the ski in lieu of sticky wax to assist in uphill travel. Today's skins are synthetic and have short hairs that allow forward travel while retarding backward movement. The ski hiker is rewarded with a downhill run that is either performed in the telemark style or with the heel locked down in a conventional Alpine method.

Adaptive

Skiing can be for almost everyone regardless of physical or mental limitations. Equipment modifications and teaching methods have been devised for people with physical disabilities such as loss of sight and single or multiple amputations. Programs have been

Equipment modifications and teaching methods allow people with disabilities to participate in skiing.

developed for people with common disabilities such as cerebral palsy, muscular dystrophy, traumatic brain injury, spinal cord injury, stroke, spina bifida, multiple sclerosis, autism, Down syndrome, attention deficit/hyperactivity disorder, intellectual disabilities, and learning disabilities. Many snowsport areas have instructors and guides with special training for specific adaptive situations. Ask the ski school or adaptive program for specifics.

Where to Ski

With more than 2,000 ski areas in 57 countries, you can ski almost anywhere in the world, from Algeria to Venezuela. The United States has 481 ski areas in 37 states and Canada has ski areas in all 10 provinces. You can ski in every European country.

Skiing can literally take your breath away when you ski from an elevation of 5,421 meters at Chacaltaya, Bolivia. Or you could have your breath taken away by the views from sea level in Norway. Stepping off the Aiguille du Midi in France at 3,842 meters will also take your breath away—the run to the valley is over 26 kilometers long.

You could ascend the ski hill on a platter lift by yourself, being pulled with a dinner-plate disk between your legs. Or you could take the Vanoise Express, a double-decker cable car between La Plagne and Les Arcs in France, with over 200 of your friends. Skiers are not limited to runs accessed by lifts on the ground. Heli-skiing has definitely been developed and refined by Canadian operators to become a legitimate means of uphill travel. With this exciting transportation method, skiers can reach remote powder stashes that would otherwise be inaccessible.

Ski areas come in every size. They range from the mom-and-pop ski hill that has one surface lift to the famous White Ring in Austria (Lech, Zürs, St. Anton, and St. Christoph) with 86 lifts and 276 kilometers of prepared runs able to accommodate 123,000 skiers per hour—the ultimate in destination ski resorts.

TECHNIQUE TIP

Ski areas are measured by acreage and vertical drop. Acreage refers to the amount of skiable terrain, while vertical drop indicates how many meters (or feet) separate the highest lift from the resort base.

Day-Use Areas

Day-use areas are usually small and are always located close to larger metropolitan centers. Their draw is proximity. Many skiers use these areas as their primary source of entertainment, while others use the convenient location for training or warming up before their big ski vacation.

A homier atmosphere is found at the smaller area. It is not uncommon to run into people you know or who will soon become acquaintances. Frequent visitors may have

a locker to store their skis and may know the idiosyncrasies of the lunch menu. It is this down-home atmosphere that many find attractive.

Although called *day areas*, many also offer night skiing. Skiing under the lights affords the busy metropolitan day worker with an opportunity to take in a few runs and enjoy the benefits of skiing after a hard day at work. Many skiing aficionados hold season passes to their local day area and find their after-work identity as a skier of their local hill.

Day areas may or may not have overnight housing. With today's superhighways and ease of transportation, overnight facilities are becoming a thing of the past. Members of ski clubs, which are sometimes nothing more than a large bunkhouse purchased by several families, are still fortunate to enjoy a night away from home, even if home is only an hour or two away.

Destination Ski Resorts

These are the resorts such as Vail, Whistler, and Chamonix that proliferate the ski magazines and travel networks. They are big and pride themselves on their glamour. It is difficult to miss the screen stars who have skied at Sun Valley, the rock stars who have walked the streets of Aspen, or even real princes like Prince Charles skiing at Klosters, Switzerland.

Destination areas have the largest skiing acreage and vertical drop, with lift-ticket prices to match. But before you hang up on the travel agent, it may be worth reassessing the value. Amusement dollar-for-dollar skiing is comparable to if not better than a day ticket at Disneyland or similar amusement facility. To top it off, it would be difficult to compare the amusement park hot dog to the Wagyu corned beef and Emmentaler cheese at Deer Valley, Utah.

A large ski resort has many amenities and is a destination in and of itself.

Skiers go to destination areas for a vacation. The brochure will tempt the reader with pictures of large expanses of snow and romantic couples in hot tubs. Though these pictures are the product of the marketing department, visitors will probably find themselves in similar scenarios. Dining, shopping, and even spa facilities are common accoutrements to the destination ski resorts.

With Norway as the birthplace of skiing and Austria claiming to be its cradle, skiing is a European invention and design. Since skiing originated across the Atlantic, Europe still holds much skiing mystique. From Norwegian sweaters with reindeer buttons to tanned and accented Austrian ski instructors, Europe indeed is a place for a ski experience to be remembered for life. The Alpine countries of Europe hold skiing in high regard. Ski racers in Europe are comparable to football, basketball, and baseball stars all wrapped up into one superhero.

In Europe you can expect to ski a new run after every ride if this is your preference. Some skiers follow the sun around the mountain to take advantage of its warmth and snow-softening ability, never skiing the same run twice. Although this benefit, and the glitter, is an attraction of large resorts, don't sell the smaller ski areas short. No matter how many ski runs and lifts, the skier can only be in one place at a time. There have been many world champions who grew up on ski hills with only one or two lifts. The fun is in the descent, and that is what is important to the skier.

Conclusion

Starting out as a utilitarian form of transportation, skiing has a rich and long history. With snow covering the countryside, cross-country skiing was the functional method of travel and the perfect vehicle to carry out the basic needs of living. Unfortunately, it took warfare to add to the growth and understanding of skiing among nations.

Changing skiing from an overland endeavor to a downhill activity was a result of sport. Norwegian ski jumpers modified the skis and bindings so travel and turns downhill were not only possible but fun. Downhill travel in the steeper Alps required further refinement and the stem was introduced. Technique kept evolving as another Austrian added a seemingly forgotten Norwegian element—the Christiania. Meanwhile, in the United States, the California gold miners were not interested in turns, only speed.

With a common theme of sliding over snow in some form, skiing has many branches on its genealogical tree. Today there are many types of skiing to choose from. By any method, the allure of Alpine skiing can be found in going down big or small mountains. It was the process of going up that required some new inventions to help popularize the downhill sport to what it is today.

CHAPTER 2

Getting Fit for Skiing

But I'm not afraid. I prepared myself well this summer.

Giorgio Rocca

Skiing is an enjoyable, exciting activity performed in a stunning outdoor environment. While the views incite the mind, gliding on the snow stimulates the body. The senses are rewarded and the muscles are stimulated. That may explain part of the draw to the slopes. Add the health and fitness benefits, and it is hard to stay away.

It might seem that going downhill does not require much energy, but exactly the opposite is true. The environmental concerns alone—elevation and cold—are substantial. Skiing also takes cardiorespiratory endurance, muscular strength and endurance, flexibility, appropriate body composition, and motor skills. Combine the environmental and physical demands, and it makes sense to get fit for skiing.

Fitness Benefits of Alpine Skiing

People of all fitness levels can ski. Skiing will burn calories, give an increased feeling of well-being, increase cardiorespiratory endurance, and enhance balance. These and more are the benefits of a day out in a beautiful environment while participating in an exciting activity.

Burning Calories

Every opportunity to burn additional calories is a benefit in today's sedentary life. Although it may not be a weight-loss option, Alpine skiing burns between 300 and 400 calories per hour and may burn as many as 600 calories per hour. This is equivalent to running 12-minute miles or biking at 20 kilometers per hour. Since skiing is performed in a cold environment, there is a 2 to 5 percent increase in metabolism, which turns up the thermostat, resulting in even more calories burned. Compare these results with the average office worker burning 75 calories per hour and the benefits are obvious.

Sense of Well-Being

Just being in the outdoors with fantastic views and fresh air can be an invigorating and stimulating experience. Skiing in this setting will further contribute to one's sense of well-being. One reason is due to endorphins, a morphine-like hormone. Endorphins are released from the brain as a natural part of Alpine skiing. This release and accompanying excitement contribute to the universal draw of skiing. There may even be an addicting quality to these mood-enhancing hormones, which may explain why we get the urge to go skiing.

Other benefits from endorphins may include their ability to improve the body's insulin action, thereby reversing or decreasing insulin resistance. Some scientists claim that endorphins enhance the immune system and block lesions in blood vessels, thereby lowering blood pressure. Furthermore, endorphins may play a role in removing free radicals, thereby having an antiaging effect.

Increased Cardiorespiratory Endurance

Cardiorespiratory refers to the ability of the heart and lungs to deliver oxygen to the skiing muscles. Often referred to as *aerobic endurance*, cardiorespiratory endurance provides the

energy to ski a long run or to ski with energy the entire day. During a difficult ski run, the demands for oxygen are usually greater than the delivery system. This is why we breathe so hard at the end of a long run and feel a heavy, burning sensation in the legs. One way to reduce these reactions is to increase cardiorespiratory endurance through bouts of high-intensity activity. A ski run can provide this intensity. Through repeated bouts, or ski runs, the body will adapt to the stress and become more efficient. Although a weekend skiing or even a weeklong ski vacation will not provide a noticeable improvement in cardiorespiratory endurance, it will contribute to other previously performed aerobic activity.

Enhanced Balance

Balance and the associated full-body coordination is present in every daily activity. Whether it is shuffling through a crowded parking lot or walking up a flight of stairs, the body moves through space while staying upright. Spend some time with the elderly and it is easy to see how balance and coordination slip away with time. Though some of these losses are age related, a large degree of degeneration can be slowed through balance and coordination challenges, such as skiing. For safety's sake, people must have a fairly competent balance level when they start skiing. Gained is what the farmer would call "hay in the barn" or the economist "money in the bank." Through practice and training, balance becomes more refined. The higher the level, the longer it will take to diminish.

Fitness Demands

Alpine skiing requires all-around conditioning. All components of fitness are required, and training these will result in a better day on the slopes. The amount of training before skiing is at the skier's discretion. Optimal conditioning that contains a balance of the following elements will show the greatest dividends when the skier hits the slopes.

Cardiorespiratory Endurance

A 9:00 a.m. start with a 4:00 p.m. finish and only a short lunch break can make a long ski day. The ability to stay at the top of your game is not just a matter of making it to the end of the day but possessing the requisite endurance to meet unexpected situations. Cardiorespiratory endurance is essential if skiers want to get maximum hours out of their ski pass. This fitness component is also necessary for recovery between runs and to have the ability for repetitive motions such as linking turns down a long run. As a health issue, a high level of cardiorespiratory fitness reduces the chances of coronary heart disease.

Muscular Strength and Endurance

Muscular strength and endurance are both necessary for skiing. Making turns can generate the same forces (and thrills) found on a roller coaster. To resist these high forces, skiers need muscular strength, and muscular endurance is needed to link turns during a ski run. Though strength and endurance are sometimes viewed at opposing ends of the training spectrum, they are both needed in Alpine skiing.

Flexibility

The ability to move through a large range of motion is important for general health and for efficient skiing. Advanced skiing taxes the range of motion of the hip flexors and back muscles. If these are tight, the body tends to work against itself.

A seemingly perilous fall can be no more than an inconvenience if skiers have conditioned themselves with flexibility training. This will reduce the likelihood of overstretched or torn muscles and tendons as the result of a fall.

Skiing can require extreme hip flexibility.

Body Composition

Your percentage of body fat defines your body composition. There is no ideal percentage for Alpine skiing, but less is usually better for general health. Excess body weight and obesity are serious health concerns that are linked with hypercholesterolemia, hypertension, diabetes, and coronary heart disease. In skiing, it makes sense to stay on the leaner side since skiing is a balance sport and it is more difficult to balance a heavier weight. It is possible to err on the too-lean side, and women need to beware of the female athlete triad: disordered eating, osteoporosis, and amenorrhea or oligomenorrhea.

Motor Skills

Skiing relies heavily on indigenous motor skill activity, specifically coordination, agility, and balance. Knowing where your limbs and body are in space while moving are

central aspects of skiing. Being able to adapt and adjust movements either in a proactive or reactive state is mandatory. Balance is the end result of the skier's coordination and agility. Lacking balance leads to falling. While this is a part of the learning process, it can be the humiliation of the expert.

Coordination

Watching a baby's first attempt to put food in her mouth and a street dancer rotating his entire body demonstrates the continuum of coordination. Lacking finger dexterity, the baby palms her food and uses a full-arm motion to smear it in the vicinity of her mouth, which may or may not be open. The street dancer can balance on one hand while his body rotates, arms flexing and extending while the legs twist, all in time to the music. Coordination is how body parts move in relation to each other to achieve a goal. Skill acquisition relies on coordination—most improvements in skill are the result of coordinating movements.

Agility

Having the capability to move the body against gravity, against external forces, and relative to itself is essential for skiing. This agility depends on quickness appropriate for the situation; moving just fast enough for the desired outcome is essential. Moving too fast for a given situation may even be detrimental, such as in slalom ski racing where turning quickly around a gate or pole is the goal. World Cup and top Olympic ski racers spend eight-tenths of a second for every gate or turn. This is more than one turn per second! Although the ability to make these quick movements may seem an end unto itself, many slalom racers turn too soon, catching a ski tip on the gate and disqualifying themselves. They have made the turning movement, but not at the appropriate tempo

Skiing requires precise, skilled movements.

for the setting. What they are lacking is agility, the ability to move and change directions effectively. Some specific components of agility are muscular power, reaction time, coordination, and dynamic flexibility.

Balance

Balance is the result of movements in space. It is sometimes defined as the center of mass in line or over the base of support. If the center of mass is too far out of line with the base of support, the body falls in that direction. The body has several balancing strategies, including vision, vestibular apparatus in the inner ear, and muscles and joints. Without vision to inform us of where we are relative to other structures, our coordination is diminished and agility reduced, compromising balance. The inner ear has sensors that provide information at the movement of the head. Located in the ear are three fluid-filled half circles called *semicircular canals*. These canals are oriented in the three major body planes (frontal, sagittal, horizontal). As each semicircular canal relays information concerning its specific orientation, the brain receives three-dimensional information about where the head is in space. With this information, the body can maintain balance or adjust to regain balance. We will see later on how balance in the three planes is essential for skiing.

Getting Fit for Skiing

Cardiorespiratory endurance, muscular strength, and muscular endurance are the three physiological components needed for skiing. Cardiorespiratory endurance creates the stamina to keep going all day and assists in run-to-run recovery. Increasing muscle strength permits the body to resist high turn forces that want to pull the skier out of the turn. Coming full circle, this strength is tempered with an endurance component so that ski turns can be linked and the length of a ski run is not a limiting factor. With a balance of these three components, skiers will not be limited by their physical capabilities.

Figuring Out Your Strengths and Weaknesses

Many people who are drawn to Alpine skiing already exercise, from the do-or-die gym rat to the occasional weekender hardly working up a sweat. Even if your closest relationship to exercise is stumbling upon and immediately passing by an exercise infomercial on TV, do not fret. If you can walk a couple flights of stairs without major medical consequences, you are probably okay, although it is never a bad idea to get a thumbs-up from your doctor before undertaking any physical training program.

Your strong points are what you do now. Do you run, play tennis, or lift weights? Maybe you have an exercise video of some sort that you use? Skiing requires many attributes and whatever you are doing now to exercise will not be wasted effort. Your strong points should be maintained while you work on your weak points.

Many times fitness enthusiasts do what is easy or comfortable. If you are a runner, lifting weights can be out of your comfort zone, and the novelty of running intervals or fartlek training might also be awkward. This is to be expected. The fact that this unique routine is uncomfortable could reveal something about your general conditioning. If the body is unaccustomed to lifting weights, it rebels with disagreeable sensations. This message is in response to the newness of the physical action, not to the action itself.

The body is wired to protect itself while being a magnificent adapter. If you lift a weight, your central nervous system (CNS) will not allow you to lift too much. Your muscles are probably a lot stronger than you might think. Remember the story of the mother lifting the car off her child? The muscles are there, but it is the wiring or CNS that is protecting the system. The initial phases of training do no more than convince the CNS to allow it to perform the action. Through training, the body gradually is allowed to perform to higher and higher standards.

Cardiorespiratory Endurance

If you run, bike, swim, cross-country ski, participate in orienteering, or do anything that makes you breathe hard for over 20 minutes, you are performing cardiorespiratory endurance exercises. The key is that you can maintain the activity for 20 minutes or more. Breathing hard does not mean you have to be blue in the face and bent over with exhaustion. Rather, it implies that it would be difficult, although not impossible, to hold a conversation. Breathing is coupled with heart rate and is a consequence of the heart beating faster or more often. The body is reacting to the stress of the activity and needs additional oxygen to accomplish whatever you are doing. As training progresses, your body adapts with physiologic alterations so that you are more efficient at using oxygen. In time you will breathe less for a given amount of exercise, and consequently the volume or intensity of your training can be increased.

When you watch Olympic marathon runners, they are breathing no harder than good recreational runners. The difference is that their bodies are efficient from years of training so they end up running at a much faster pace. It would seem natural that the Olympic runner's heart is beating faster, but in reality the maximum heart rate is probably lower than that of the average couch sitter. This is because the Olympic runner's heart is stronger. With each beat it pumps a large bolus of blood, thereby not having to beat as often. Resting heart rates of elite endurance athletes can be 40 beats per minute or less. As skiers, we don't need this elite level of endurance. What we need is a fitness level that provides the stamina to maintain an energy level throughout the day. Endurance training also enhances the ability to recover from short explosive bouts such as a demanding mogul run or any situation in which the muscles are taxed.

Muscular Strength

Some people are genetically more blessed with the ability to build muscle. They have a broader, thicker morphology. If you were a track athlete and were more successful in the sprints as opposed to the distance events, you probably trend this strength direction.

Muscular strength is not acquired by accident. Performing any strenuous activity will stimulate skeletal muscle, but there are better methods. Lifting weights is the primary method for gaining strength. The key is that the weight needs to be heavy. Moving a light weight does little to stimulate muscle. Even if you lift it many times to failure, you will not be building muscle to an appreciable extent. If you find yourself in the weight room a couple times per week lifting heavy weights that you probably couldn't lift more than 10 to 15 times without failure, give yourself a check mark in this category.

Muscular Endurance

Muscular endurance is a combination of strength and endurance. This may seem to be an oxymoron, because strength and endurance are on opposite ends of an exercise continuum. Strength is something you can do only a few times whereas endurance is

something you can do many times. However, the key to building muscular endurance is performing a difficult task many times, which requires both strength and endurance. This is not a normal activity. Some sports, such as hockey, have inherent endurance-building qualities. Players stay on the ice performing at maximal capacity until there is the opportunity for a line change. Exhausted players are replaced by a new group. Due to the sprinting and jogging aspect of soccer, it can also fall in this category. Again, the key is bursts of high-intensity activity followed by short recovery periods. The ability to keep producing high-intensity bouts is the desired result.

Training for Cardiorespiratory Endurance

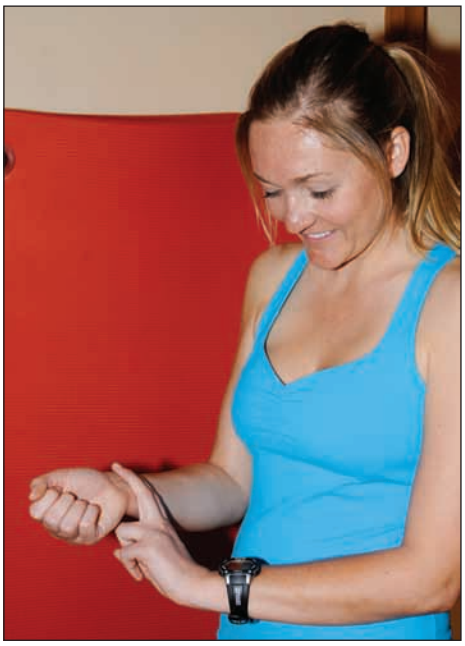
Cardiorespiratory exercise from running, biking, swimming, cross-country skiing, and so on should be sustained for at least 20 minutes. A good starting point is to shoot for exercise that will raise your heart rate to 70 percent of its predicted maximum. As you gain endurance from training, this percentage can be raised or time spent performing the exercise can be increased. Do not try to increase both at the same time. The following sections will discuss measuring your heart rate and determining training zones.

How to Determine Your Maximum Heart Rate

Maximum heart rate is not an exercise value or even a goal; rather, it is a ceiling for calculating exercise intensity. The simplest rule of thumb is to subtract your age in years from 220. For example, a 40-year-old would have an estimated maximum heart rate at 180 (220 – 40 = 180). That estimate is a prediction of the person's maximum heart rate in beats per minute (bpm). This approximation does not imply that the person would be able to maintain that heart rate for an entire minute; it is only the instantaneous value of the heart rate. It is similar to driving at 100 kilometers per hour—you are not necessarily driving for an entire hour, but that is your speed at the moment you view the speedometer.

How to Calculate Your Heart Rate

Your heart rate is determined from your pulse. Two convenient places to feel the pulse are the radial and carotid arteries. The radial pulse can be found by holding one hand straight out with elbow bent and palm relaxed and facing up. Raise your thumb upward as if you were holding a tennis ball. This will create a small pocket under your thumb at the top of your wrist. With your other hand, place the tips of your index and middle fingers on the pocket under your thumb. Your fingers are now lying across the tendon running down your arm. Adjust your fingertips until you can sense a steady beat under the skin of your wrist.



Radial pulse palpation.

The carotid artery is easier for some people because it is a stronger beat. The carotid is located on either side of the windpipe just below the jaw in the groove where the head and neck meet. Use your index and middle fingertips to palpate the groove for the pulse.

Using either the radial or carotid artery, count the number of beats for 10, 15, 20, 30, or 60 seconds (all are divisible by 60). Multiply by 6, 4, 3, 2, or 1 to arrive at the number of beats per 60 seconds. You can use any number of seconds if you want to do the math. This will be your heart rate in beats per minute, or bpm.

A high-tech method is to use a heart rate monitor. A band is worn around the chest and a readout is worn like a watch. Some heart rate monitors download into a computer. There are beep options that can inform you if your heart rate is too high and you need to decrease your intensity or if you need to step it up a notch because your heart rate is lower than programmed. A heart rate monitor is convenient because you can get information while you are exercising.

Carotid pulse palpation.

How to Determine Your Heart Rate Training Zone

A percentage of your predicted maximum heart rate can be used to train for cardiorespiratory endurance. For example, a 40-year-old skier would have a predicted maximal heart rate of 180 (remember, 220 – 40 = 180) bpm. If this skier wanted to train at 75 percent of the predicted maximum heart rate, she would train at 135 bpm (180 × .75 = 135).

The intensity level or percentage in this example is 75 percent. This is not a magic number, but it is a value that will stimulate the magic of training. If it is too high, the training becomes too intense and the skier is unable to proceed for a proper duration. If it is too low, the adaptive physiologic responses will not occur. So the key is finding the percentage of maximum heart rate in which to create a heart rate training zone. Here are some general guidelines:

Beginner or low fitness level	**50 to 60 percent**
Average fitness level	**60 to 75 percent**
High fitness level	**75 to 85 percent**

These rules of thumb are a good place to start. A more accurate test is to work backward through a bit of trial and error. Perform your given endurance task at as high of an intensity as you can maintain for 20 to 30 minutes. This will generate a heart rate that is indicative of your threshold. Add and subtract 5 bpm to create a target zone in which to train. The 40-year-old wishing to train at 75 percent of her predicted maximum would train at 130 to 140 bpm (135 ± 5).

Over time your body will respond with endurance-related physiologic changes. The less fit you are at the beginning of the training, the quicker these changes will manifest. If you are totally new to training, you may need to alter your training after a couple of weeks. Conversely, a well-trained endurance athlete may not even see a noticeable change and may be training only to maintain his current level.

How much endurance is enough? One rule of thumb is the point when you can perform your chosen task for 60 minutes at 75 to 80 percent of maximum heart rate. More training will improve your endurance further; however, the point is not to become a marathoner but to meet a necessary prerequisite for Alpine skiing. When only one type of training is practiced, the body adapts primarily in that direction. Although marathon training is good if the goal is to run marathons, focusing exclusively on cardiorespiratory endurance will leave the skier shorthanded when other physical components are needed on the slope.

Cardiorespiratory endurance is the base of the training program. Gaining and maintaining this endurance will set the stage for strength training. Endurance will not only enable the skier to ski long runs all day but also to endure the other components of training that are needed.

Rating of Perceived Exertion

Another way to determine training intensity is with a Likert scale. The scale can be thought of as a number line in which harder exercise intensity corresponds with higher numbers (see table 2.1). It can be used in conjunction with taking your pulse or by itself. It can be the primary means of measuring exercise intensity if you do not have a heart rate monitor or a typical heart rate response to graded exercise. People on beta-blocking medications, some cardiac and diabetic patients, pregnant women, and others may have an altered heart rate response and can use the scale in lieu of taking their heart rate.

Table 2.1 Rating of Perceived Exertion Scale

1	2	3	4	5
Easy	Moderate	Intense	Extreme	Exhaustive

Training for Muscular Strength

As in many sports, skiing requires a prerequisite amount of strength. Strength can be defined as the amount of weight that can be lifted when a joint goes through a range of motion, or it could be just holding a weight, opposing a force. This type of action is present during a ski turn when the skier is attempting to resist the external forces.

Getting stronger for skiing involves high-intensity efforts. Weight lifted is counted in repetitions, and multiples of these are termed *sets*. Recovery between sets is important, and of course the weight lifted needs to be carefully chosen.

Repetitions

The number of times an exercise can be performed before rest is needed is called *repetitions* or *reps*. To build strength, reps need to be low enough to result in serious stress on the skeletal and muscular systems. For most recreational skiers this will be between 4 and 15 repetitions.

Skiers need strength to resist the high forces in the turn.

Sets

A series of repetitions constitutes a set. After performing an exercise for 10 reps, for example, the exerciser has performed one set. After a short rest interval, another set may be attempted. Strength training for Alpine skiing will involve two to five sets per exercise; with the law of diminishing returns, more sets may not be in the best interest of time. For the recreational lifter, other exercises and muscle groups may be targeted when a limited amount of time is available.

Rest Period

The time between sets is used for recovery. This rest period or interset rest is necessary to give the muscle sufficient time recover so another stressful set may be attempted. The amount of rest between sets will be between 1 and 5 minutes, with 2 to 3 minutes used most frequently. A general rule of thumb is that the heavier the weight or greater the absolute stress, the longer the rest. Shorter rest periods are also used during the first few weeks of training, with longer rest periods coming later.

Picking a Weight

Weight and repetition maximum (RM) are inversely related. As one goes up, the other goes down. At the initiation of training, strive for repetition numbers on the higher side in order to give the body time to learn good technique. This would imply 12 to 15 reps and the accompanying weight that would lead to failure after 12 to 15 reps. After about three weeks of training (assuming two to three sessions per week), the weight can be increased and reps decreased. Another three weeks and it is time to change again.

CONCEPT OF REPETITION MAXIMUM

Repetition maximum, or RM, refers to a weight that can be lifted a certain number of times with proper form. For example, 1RM is a weight that can only be lifted once, while 10RM is a weight that can be lifted 10 times (with the assumption that the 11th attempt would not be possible).

Lifting 1RM is a serious endeavor and should only be attempted by experienced weightlifters. For this reason, converting to a multiple RM such as 10RM may be desirable. This calculated weight can then be used as the benchmark for training. Looking at table 2.2, it is easy to visualize how a higher number of repetitions is inversely related to weight.

Table 2.2 Percent of 1RM and Repetitions Possible

% of 1RM	Number of reps possible
100	1
95	2
93	3
90	4
87	5
85	6
83	7
80	8
77	9
75	10
70	11
67	12
65	15

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Safety

Weights are divided into free weights and weight machines. Free weights include barbells with plates attached and dumbbells. Weight machines are designed to take the lifter through a range of motion to stress the targeted muscles. Free weights require the lifter to not only lift the weight but to remain balanced during the exercise. This effort to maintain balance recruits auxiliary muscles to stabilize the body. Since skiing requires superb balance skills, it is clear that free weights are more beneficial than the weight

SAFETY TIP

Never lift beyond your ability to maintain good technique. Technique should always be the number one goal. Constantly monitor yourself during exercise so that you can quit a minimum of one repetition before failure of technique.

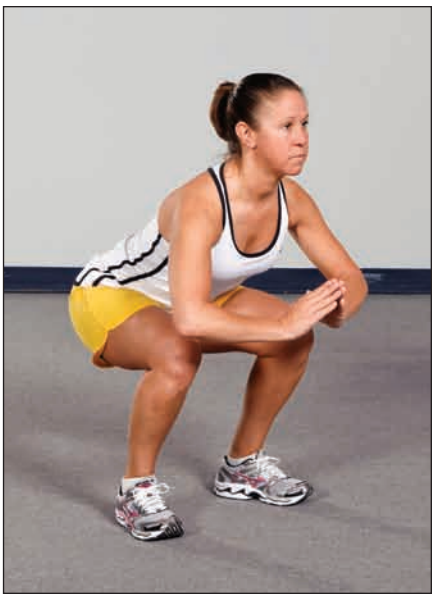
machines that guide the user. The trade-off is that free weights are more dangerous compared with weight machines. Either way, the user should seek instruction, and even experienced lifters are advised to maintain a coaching relationship so technique may be continually monitored. When searching for instructors or coaches, find out their credentials. Ask if they have schooling or any certifications to assist you in obtaining the best possible tutelage. Finally, before starting any portion of an exercise plan, consult your physician.

Strength Training Exercises

Muscle strength is important for skiing. This training is traditionally performed in the weight room, but with a little background knowledge of what is needed along with some imagination, you can perform strength training with a variety of means. Weights involve customarily barbells and dumbbells, but you can substitute household items. To replace a barbell, a sack of sugar will suffice, and to replace a dumbbell, a large can of soup will work. The strength training exercises that follow are only a partial list. A brief description of each exercise is provided. For a more in-depth explanation, consult a certified trainer.

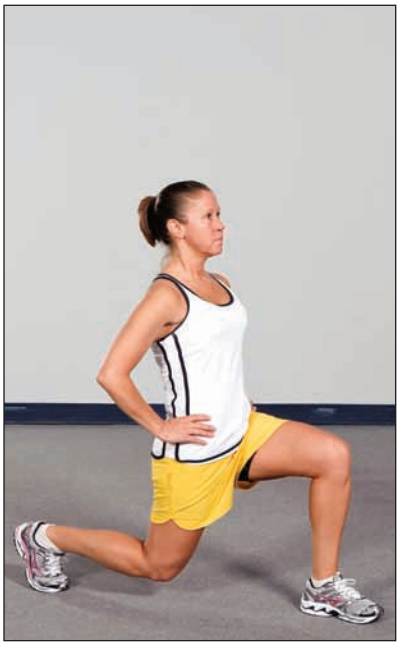
SQUAT

Flexion and extension of the legs along with general leg strength are important in skiing. The squat is a key exercise for skiers. Assume an athletic stance with your feet about hip-width apart. Without any weight, flex at the knee, hip, and ankle until your thighs are almost parallel with the floor. Make sure your knees stay directly over your feet. Point your toes anywhere from straight ahead to 45 degrees out. Your feet should stay flat on the floor during the whole squat movement while your back stays straight. After you have mastered the technique, it is time to add weight. Holding the weight in front targets the quadriceps, whereas putting the weight on your shoulders taxes the gluteus maximus and lower back muscles.



LUNGE

The lunge is just as it sounds—a giant step forward so that the striding knee ends up directly above the striding foot. Keep your back upright and reverse the movement or stride forward with the other leg. Weight is added with a barbell on your shoulders or dumbbells in extended arms at your sides. This is an eccentric muscular action, so expect delayed muscular soreness in a couple of days. The muscles targeted are the quadriceps and adductors (groin muscles), which are used in flexing the hips and steering the skis.

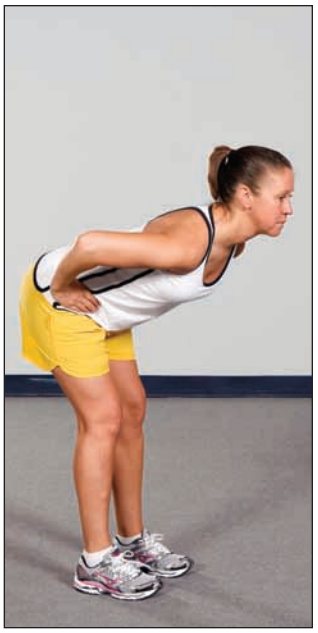


HEEL WALK

The heel walk is simply walking on your heels. This flexed position at the ankle will strengthen the muscles that keep you out of the backseat when skiing, specifically the tibialis anterior, an underused muscle on the lateral portion of the front part of the lower leg. Start with about 100 steps the first day and build gradually to 1,000.

GOOD MORNING

Stand with your feet approximately hip-width apart and knees slightly flexed. Bend forward at the waist until your chest is parallel with the floor. Start with hands on the waist and progress to hands behind the head. You can add a barbell or dumbbell to increase resistance. Add weight slowly with this exercise. It uses the lower back muscles, gluteus maximus, and hamstrings, which all contribute to fore–aft stability in changing snow conditions.



HIP RAISER

Lie on the floor with one heel on a chair or stability ball and the leg bent 90 degrees. The other leg is pointed toward the ceiling. Raise your hips off the floor with the hamstring muscles of the leg that is supported by the chair (or stability ball). This is an excellent exercise for the hamstring muscles, which will help protect those knees. Using a stability ball increases the balance challenge for more advanced users.

SIT-UP

Keeping the upper body stable for balance is essential, and core exercises are the key. Target your sit-ups to three areas. First, the upper abdominal muscles are strengthened by crunches. A crunch is not a full sit-up but rather lifting the shoulders off the floor while keeping the back and neck relatively straight. Second, you can best target the lower abdomen by keeping your back on the floor and lifting your feet in the air. Bend your knees at first, then add resistance by straightening your legs or putting your ski boots on. Third, the obliques are used for any countering movement. With your knees bent, direct your shoulder to the alternating knee. Start with 25 repetitions of each exercise and progress to 100.

Volume

How much should you do? Unless mentioned otherwise, start with three sets of 12 to 15 repetitions. Increase resistance or weight after the third week so that 10 to 12 repetitions are still difficult. Ideally do the exercises every other day. Continue the exercises into ski season, performing them two to three times per week for maintenance.

Training for Muscular Endurance

Muscular endurance is a product of strength and the ability to perform the action many times. For example, a ski run of 25 demanding turns would require muscular endurance. The result of that run would leave the skier out of breath. This is an indication that the skier has performed an activity that is not aerobic but anaerobic, meaning without oxygen, or more precisely, without enough oxygen. That doesn't mean the skier didn't

breathe. It just means that the energy demand was so great that it required more oxygen than the system could immediately deliver.

Training the anaerobic system requires a demand similar to what happens on a difficult ski run. It involves a hard bout of exercise, followed by a rest interval, followed by another hard bout of exercise, and so on. With interval training the body learns to adapt to this type of physical stress (see figure 2.1).

- **Interval variables.** Intervals consist of exercise and rest. Measured in time, these two variables can be viewed as a ratio. An interval of 4:4 would be four minutes of high-intensity exercise followed by four minutes of active rest, such as walking. Duration of exercise intervals for skiing will be between 30 seconds and 4 minutes. Rest intervals will be similar although not always equivalent to the exercise duration.
- **Interval intensity.** Since the purpose of interval training is to stimulate the body to better deal with the high physical stress of skiing, the interval training intensity must also be high. Intensity or effort of 90 to 95 percent of maximum is desired. This can be monitored with heart rate or rating of perceived exertion. Motivation and commitment are essential to gain the benefits from this type of training.
- **Interval recovery protocol.** Recovery that involves active movement as opposed to just sitting or standing has been shown to be superior. If running intervals are being performed, then a light jog or even a walk will suffice.

Interval Examples

30-Minute Run Interval

- Warm up 5-10 minutes
- Light stretch of hip flexors, hamstrings, and calves
- 4 × 400 meter sprint with 90 seconds rest between each interval
- Cool down with 400-meter jog, then 400-meter walk
- 10 minutes of stretching

30-Minute Bike Interval

- Warm up 5-15 minutes
- 2 × 1-minute sprint
- 2-minute easy-spin rest interval
- 2 × 2-minute sprint
- 2-minute easy-spin rest interval
- 2 × 1-minute sprint
- 2-minute easy-spin rest interval
- Spin until able to carry on a verbal conversation
- Stretch hamstrings, quadriceps, and shoulders

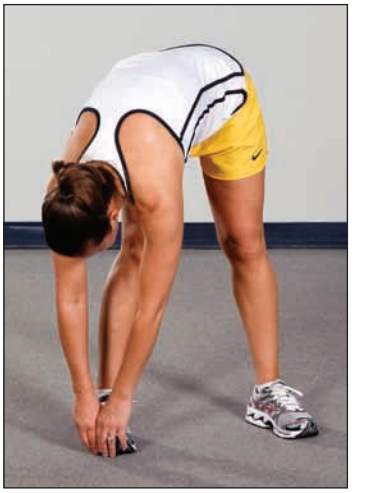
Figure 2.1 Examples of interval training for biking or running.

Stretching

After skiing, the muscles can feel tight. Stretching can help reduce this feeling by increasing blood flow. Since stretching can also tear muscle fibers, a general warm-up that includes range-of-motion exercise is recommended. The protocol for stretching after skiing will be different than stretching for increased range of motion. The idea with postskiing stretching is to relengthen the muscle, not increase the length of the muscle. With this in mind, go only slightly beyond the initial stopping point and hold for 15 to 30 seconds. Stretching deeper will only exacerbate microtears in the muscle.

TOE TOUCH

Standing with the feet hip-width apart or wider and with straight legs, slowly bend toward the floor. Relax the back and exhale, letting the weight of the back lower you. Rotate toward the right or left foot and hold. If you are tight in the upper back, you should feel this in the opposite side also.



QUAD STRETCH

Standing tall on one leg, flex the knee of the other leg. With the hand of the same side of the body, pull it toward your buttocks. Push your hips forward (without arching your back) until you feel the muscles in the front of your leg. If you feel any discomfort in the knee, discontinue the exercise.

CALF STRETCH

Start in a tall lunge position, with your head, neck, spine, pelvis, rear leg, and ankle in line. Lean forward with your rear foot flat on the ground, gradually straightening the rear leg until you feel your calf. While balancing without aid is a good exercise in itself, the more advance stretcher will need something in front to lean against. The calf stretch is a great exercise if you spend a lot of time in high heels.

CORKSCREW

This stretch is also known as a piriformis stretch. Lying on the floor, bring one leg up (slightly bent at a 45-degree angle) toward the chest while crossing the other leg with the ankle on the knee. This position will be similar to sitting with a crossed leg in a chair, which is an alternative method for this stretch. Place your hands behind the knee of the leg that is up and slightly pull the leg toward the chest. You should feel a stretch in the buttocks and hip of the crossed leg. Hold this position.

Conclusion

People of all ages and fitness levels can enjoy the excitement of skiing. Once you start skiing, the fitness benefits gained can keep you skiing into your 80s or more. There are even ski instructors who are well into their 70s.

Besides enjoying a beautiful day in the mountains, you will also improve your general health and well-being. Skiing burns calories, increases cardiorespiratory endurance, and

enhances balance. All are needed to enjoy an active life no matter what you plan to do in your golden years.

To take full advantage of the many skiing options and to enjoy skiing to its fullest, you need a certain level of fitness. Skiing is a multifaceted sport and preparation involves general all-around conditioning.

CHAPTER 3

Equipment and Gear

There is no such thing as bad weather, only bad clothing.

Old Norwegian saying

From the wooden barrel staves of the 1800s to the titanium- and fiberglass-laminated layups of today's skis, equipment can help explain why skiing is what it is today. Our ability to ski with ease and effortless beauty is a product of our equipment. Skis, boots, bindings, and peripheral items all contribute to the ski experience.

Skis

What was initially a utilitarian mode of transportation has evolved into more choices than a boutique coffee house. The most recent revolution occurred in the early 1990s with the amplification of the sidecut. The sidecut is the hourglass or bow-tie shape of the ski when viewed from the top. It has been around since 1868, but it took some creative thinking and influence from the snowboard industry to alter it radically. Manufacturers started to make it more extreme with very wide tips and tails. This super-sidecut ski is also called a *carving ski*. Carving is not only the type of ski but also a technique. Tipping the ski on edge, it is capable of carving a single line in the snow. Although this has always been theoretically possible, it is now a technique most skiers can use.

The super sidecut changed the ski industry—so much so that if you are using older straight skis, you are in essence driving a Model T. Other changes have experimented with sidecut and consequences of altered width dimensions. Skis are wider underfoot and called *fat* or *phat*. This permits greater flotation in soft snow, although with some loss of edging ability.

Anatomy of a Ski

At first glance, a ski is a simple item, but with closer inspection we find features that give each type of ski its own performance characteristics. These essential elements of a ski are important even if you are not considering buying. Awareness of these features will allow users to make better decisions in their ski selection whether buying or renting for the day.

base—The bottom side of the ski. Bases are typically made of polyethylene, P-tex for short. The base is waxed to make it slippery against the snow.

bottom camber—The curve in the ski noticeable when skis are put base to base. When standing in the middle of the ski, this camber allows even pressure throughout the length of the ski.

edge—The steel corner that separates the base from the sidewall, originally attached to the ski to eliminate wear. Today the edge is crucial, especially on hard skiing surfaces. A sharp edge will facilitate cutting or carving into the snow, thereby allowing the ski to grip.

longitudinal stiffness or flex—The ability of the ski to flex (bend) along its length.

overall length—The length from the tip to the tail of the ski in centimeters (2.54 cm = 1 in.).

shovel—The widest part of the ski, located near the tip.

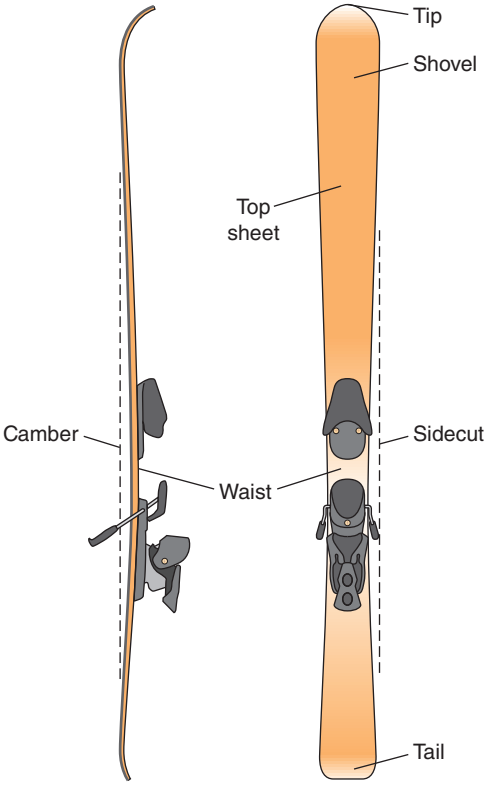
sidecut radius—When the ski is laid flat and viewed from the top, it has a shape similar to an hourglass. If one side of this hourglass is extended, it will make an arc or circle. The radius of this arc is the sidecut radius.

tail—The aft portion of the ski opposite the normal tip or front of the ski.

tip—The most forward part of the ski, pointing in the same direction as the toe of the ski boot.

torsional stiffness or flex—The ability of the ski to flex (bend) from one side to the other around its longitudinal axis.

waist—The narrowest part of the ski, not counting its thickness.



Users should look for these essential elements of a ski whether buying or just renting for the day.

Reprinted, by permission, from C. Fellows, 2011, *Total skiing* (Champaign, IL: Human Kinetics), 87.

CONSUMER TIP

The hourglass or bow-tie shape of a ski is its sidecut. Sidecut is the result of three dimensions: tip width, waist width, and tail width. When the ski is laid flat, these dimensions compose a portion of a circle. The radius of this circle is the sidecut radius of the ski and is commonly given in meters. The smaller the radius, the tighter the turn the ski will make for a given edge angle. The tip width, waist width, and tail width along with the sidecut radius are usually printed somewhere on the ski.

Types of Skis

Modern skis differ by where they were designed to be used. This creates unique features that accentuate ski performance in differing terrain and snow conditions. Skis can be further defined by the type of user. A beginner ski is shorter and more forgiving while an advanced ski is engineered for higher demands. See table 3.1 for help in deciding whether to purchase or rent skis.

Table 3.1 Purchase or Rent Skis?

Questions to ask	If you answer yes, then . . .	
	Rent	Buy
How many times per year will you ski? Will you ski fewer than five times per year?	X	
Advancing from a beginner level is a relatively quick progression; therefore, you may grow out of a beginner ski quicker than an expert ski. Are you a beginner?	X	
Do you want to keep up with the newest ski technology?	X	
Do you want to be able to change your skis based on snow conditions, such as powder skis for powder days, or do you want to experiment with differing ski lengths?	X	
Do you mind the hassle and extra cost of traveling with your own skis?	X	
Do you dislike the idea of starting your vacation by filling out forms and standing in the rental line, which could be up to an hour during busy times?		X
Is it hard for you to get used to a different pair of skis each ski trip?		X
Do you have more confidence in a pair of skis after getting to know its idiosyncrasies and limitations?		X
Do you want to maintain your own skis either by doing the work yourself or taking them to a shop?		X
Do you want to have control of the tune on your skis?		X

All **mountain skis** are designed to be good everywhere but not great at any one place. They are a good choice for the skier who only has one ski. The width will be enough (74-88 mm) for support in powder yet able to seize the snow for carving on the groomers.

Carving skis perform best on hard or packed snow. These skis are stiff, so they may carve into the snow. Sidecut is under 70 millimeters, although some manufacturers have carvers up to 74 millimeters.

A specialized ski built for the hard snow in the racecourse is the **race ski**. These are the narrowest (63-67 mm) of all skis and are similar to carving skis. The narrow waist is needed to transfer pressure from the skier to the edges. If a skier is racing in USSA (United States Ski and Snowboard Association) or FIS (Fédération Internationale de Ski) races, they must ensure that the skis are within legal limits for width, radius, and length.

Mogul skis are soft for a couple of reasons. First, if the tip is too stiff, it will not flex when it contacts the steep upslope of the mogul. Since the backsides of the moguls are convex, the midbody should be fairly soft so it can maintain snow contact. The tail also needs to be soft so it can flex when leaving a trough or else it will jet forward quickly, leaving the skier in the backseat. Because mogul backsides are steep, the ski should have a narrow waist (65 mm) so the edge can maintain contact as it skids down the backside. With mogul spacing that is close together, you want a ski with a tight turning radius, although if the ski has too much sidecut, it will overturn, not leaving enough backside for speed control. Look for a turning radius of 16 to 20 meters.

Wide powder skis, which are the fattest of all skis, can be skied in a longer length.

Park and pipe skis are specialty skis for the jumps, rails, and halfpipe. The skis look similar in the front and back, and some are called *twin tips*. This is because they are designed not only to go forward but also backward. The tail curves upward like the normal tip, and the binding is mounted center, with as much distance from the toe of the boot to the tip as from the heel of the boot to the tail. They are wide (85-105 mm) and have a 19- to 23-meter sidecut radius.

Powder skis are the fattest of all skis. Sometimes called *wide body*, they have a waist from 100 to 140 mm. Turning radius is of less consequence (20-30 m); it is the surface area that distinguishes these skis. Soft flex is important so the ski will have more leverage to buoy up in the deep snow. The ski can also be skied in a slightly longer length, which will also contribute to its soft flex.

CONSUMER TIP

Questions for Ski Buyers

1. What is your ability, or what type of run are you comfortable on (green, blue, black) (see page 57)?
2. How many days do you ski per season?
3. Are you growing into this gear (either maturing physically, such as a child, or radically improving in the future)?
4. What is your preferred terrain (groomed runs, powder, moguls, racing)?
5. Do you require versatility from your ski?

A **rocker ski** is a unique soft-snow ski that has a reversed camber. Instead of the skier's weight and turning force bending the ski, the rocker is preflexed into what is traditionally termed *reverse camber*. This bent shape then defines some of the arc or turning radius for the skier.

Ski Length

Length is a personal choice, but certain factors influence the decision.

Beginner	*Expert*
Shorter	**Longer**
Softer flex	**Stiffer flex**
Softer torsional flex	**Stiffer torsional flex**

The following are rules of thumb for ski length:

Beginner: from the ground to the armpits or collarbone
Intermediate: from the ground to the chin
Advanced: from the ground to the chin or nose
Expert: from the ground to the chin or above the head

If your body is heavier, then go longer, and if it is lighter, you can go shorter. The type of ski also makes a difference. Powder skis can go longer to give them more bend and surface area. Carving skis can be shorter or longer depending on the radius of turn desired.

Caring for Your Skis

No matter how good they report to be, skis are no better than their tune. The tune refers to the maintenance of the base and edges. New skis come tuned and usually do not need much attention. Bases should be flat, and edges are tuned according to the type of skiing.

Edges have two aspects: the base edge and the side edge. The base edge is the part of the edge that contacts the ski base. This part of the edge needs to be angled slightly

SKI RENTAL TIPS

- Ask for package deals. These include skis, boots, and poles and usually are cheaper than individually renting each piece of equipment.
- Ask about weeklong pricing.
- Ask your hotel, resort, or ski school if they have any deals.
- If you are an advanced skier, ask about demo skis, which are for higher skill levels.
- Ask if you can exchange the skis during your stay. For the advanced skier, this will mean swapping for powder skis when it snows. For the beginner skier, this means graduating to a longer pair when skills are gained.
- It is a good idea to reserve the rental ahead of time, especially during holidays. If possible, know your desired ski length in centimeters.
- At many resorts it is possible to rent online prior to arrival. This will reserve your sizes during busy times.
- For convenience, check to see if the rental shop can deliver to your hotel room.
- Ask about seasonal prices. These are sometimes available for children's packages with a lower per-day price.

away from the base in order for the ski to rotate into the new direction of travel when flat against the snow. This base-edge angle is often termed the *base bevel*. If the edge is too flat, or not beveled enough, it will get hung up on the snow, inhibiting the skier from properly rotating the ski. As a result, the skier must unduly unweight or come away from the snow to turn the ski. The amount of base beveling ranges from 0.5 to 4.0 degrees, with the normal amount being 1 to 2 degrees.

The side edge contacts the side of the ski. Its influence on the ski is not as great as the base bevel, but it does determine the sharpness of the ski. Sharp edges are important in harder snow and icy conditions so that the ski can penetrate the skiing surface. Side-edge beveling is used in conjunction with base-edge beveling (figure 3.1). If the base-edge bevel is 1.0 degree, the side-edge bevel would be 1.0 degree to maintain a

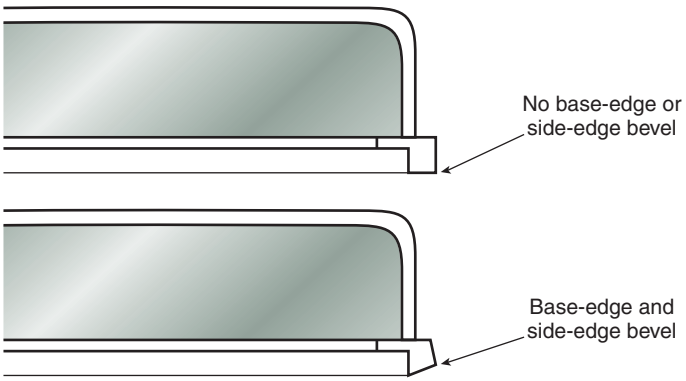
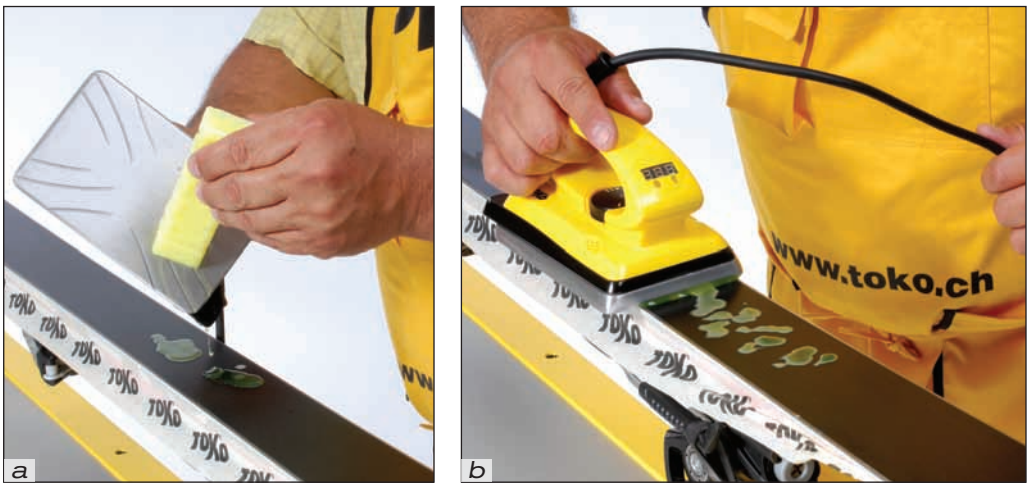


Figure 3.1 Base-edge and side-edge bevels. The degree of bevel refers to how much the bevel or angle deviates from 90 degrees.

90-degree edge angle. A sharper ski can be achieved by making the edge more acute to 89 or even 88 degrees. Always determine the base-edge angle first. Then the side edge is determined by the degree of sharpness desired. Sharper edge angles less than 90 degrees will be more susceptible to damage due to their thinner profile.

Tuning should be performed anytime you start to feel burrs on your skis or a change in the skis' performance. To get the ski base flat, have the ski ground at a reputable ski shop. They can also fill in gouges in the base. For the pesky little burrs left by rocks, use a coarse (150 grit) diamond stone and rub at the angle of the side or base edge. A diamond stone or whetstone needs to be used prior to filing. This is because contact with the rock has hardened the edge, making it tougher than a normal file. If a file is used first, it will do little to the work-hardened edge and will only end up damaging the file. Stones can be purchased at any specialty ski or snowboard shop.

Waxing is also vital. Many novices use the logic that they don't wax because they don't want to ski fast. Though wax does make the ski slide faster, this logic is backward. To control speed, the skier either turns the ski more across the fall line or tips the ski on its edge to create friction between the edge and the snow. Both of these methods involve moving the ski on the snow, and doing that requires a ski base that is slippery. Finally, failure to wax will result in the base oxidizing, decreasing the life of the ski base.



Waxing the ski with an iron. Wax is dripped onto the base and then ironed.

Waxing can be easy. All you need is ski wax, an iron, and a plastic scraper. Wax and scrapers can be purchased at most specialty ski or snowboard shops. Wax is specific to the temperature of the snow, but for starters a universal wax will usually suffice. The iron can either be one designed for waxing or a household iron without steam holes.

1. Set the iron to a low temperature and hold it over the ski base. Touching the wax to the iron, let the wax drip in small drops onto the base. A drop every few centimeters is sufficient.
2. Iron the wax in as if you were ironing a pair of pants.

TECHNIQUE TIP

When traveling with your skis, leave the wax on the base and edges. This will give them a protective coat against the elements. When you are ready to ski, use the scraper to scrape off the wax.

3. If the wax doesn't melt against the iron, turn up the temperature. If it starts to smoke, the temperature is too hot and needs to be lowered. Overheating will alter the chemical nature of the wax and it will not perform as well as designed.
4. After the wax has been evenly melted on the base, let it sit, the longer the better.
5. When the wax has solidified, use the scraper by tilting it against the base and peeling or scraping the wax away.

Don't fret that by scraping you are reversing the work you just performed. The wax on the base is not the wax desired. It is the wax *in* the base that provides the slip. If you look at a ski base through a microscope, you will see amorphous spaces that capture the wax, making the ski base impermeable. When a ski runs over the snow, it melts the snow. That is why you can see shine coming from a ski track in the snow when the sun is just right. This melting produces minute water droplets that work like small ball bearings, reducing friction with the snow. Without sufficient wax in the base, the water will sheet along the base of the ski and produce suction, which is uncomfortable for the skier.

Expert skiers wax every day, and the more often, the better. If the ski base starts to look dry with small splinters, get wax in it right away. You can also have your skis waxed by a ski shop or ski storage facility, although many of these services merely roll your ski over a waxed roller and do not heat the base sufficiently to capture the wax in the amorphous spaces.

The condition of the ski base can also be a factor in ski performance. Nicks and gouges should be repaired. Small scratches can be ignored by the recreational skier, although any gouge that contacts the ski edge or is deep enough to go all the way through the base material should be repaired. This can be done at home or at most ski or snowboard shops.

Though nicks and gouges are detrimental to skis and make skiing more difficult, ski bases should not be perfectly smooth. Up close you should be able to see a structure in the base—the small scores that are etched into the base. These small rills abrade the snow as the ski travels over the crystals, resulting in friction. This friction melts the snow, and the resultant water creates a hydroplane effect that makes the ski slide easily. If the ski base were perfectly smooth, there would be surface tension between the snow, or more specifically the water, and the ski base. In other words, the ski would attach itself to the snow. Structure in the base creates a conduit that allows the resultant water to be moved. If the structure is too linear, the water is removed but there will be a lack of friction on the new snow. Structures therefore are usually crisscross patterns, which result in friction and also create a water exit route. Most new skis come with structure. Taking a close look at the ski, you should be able to see the uniform pattern of the original structure.

TECHNIQUE TIP

To get a good glide, finish by buffing the ski with a Scotch-Brite or Fibertex pad. The pros use fine brushes made of nylon, brass, or horsehair.

If the structure has been abraded by skier mileage, take the skis to a reputable ski shop that provides this tuning service.

Ski Boots

Your boots are the most important decision you will make. You can have the best ski in the world, but if the connection to it is less than optimal, the transfer of movement and force will be wasted effort.

Fit and performance are the two most important factors in boot choice. Fit is the first item to consider. It is usually associated with comfort, but performance and even warmth are also affected by it.

Each foot contains 28 bones, 19 muscles, 33 joints, 31 tendons, and 107 ligaments. Accommodating all of these in a workable plastic shell is as much an art as it is a science. Boot fitters are well trained in theory and understand how the foot must work in conjunction with the ski boot and ultimately with the ski.

For a ski boot to transmit the action of the skier to the ski, it must be tight, meaning the boot is snug everywhere around the foot. Like a firm handshake, the boot must encase the foot with equal pressure around the entire foot. All skiers can point to places where they like their boots tight and where they say snugness does not matter. In general, the tighter the boot, the better.

Pressure points and hot spots are the nemeses of skiers. These are spots where the boot does not conform with the foot and creates an uncomfortable situation. The reaction of the skier, and the unskilled boot fitter, is to get a larger boot. This boot may be comfortable, but it will be a low performer, even if the boot is in a high-performance category.

Ski socks should be considered part of the ski boot. Socks are the interface between the skier's foot and the boot liner, and they actually become part of the liner in the fitting process. Always use socks designed for skiing. They are made of materials that wick, pad, don't rub, and are well thought out for skiing. The sock thickness is irrelevant because it depends on the rest of the fit. New boots should be fitted with thin socks. As the liner packs out, a thicker sock can be worn. Here is a list with definitions of the main features of a ski boot:

bail—The hook at the end of the buckle that fits into the ladder.

boot board or zeppa—The platform inside the boot shell on which the liner rests.

buckle—The lever that closes and tightens the shell.

cant adjustment—An upper-cuff lateral adjustment used to align the leg with the bottom of the boot. Not present on all ski boots.

cuff—The upper plastic part of the boot shell.

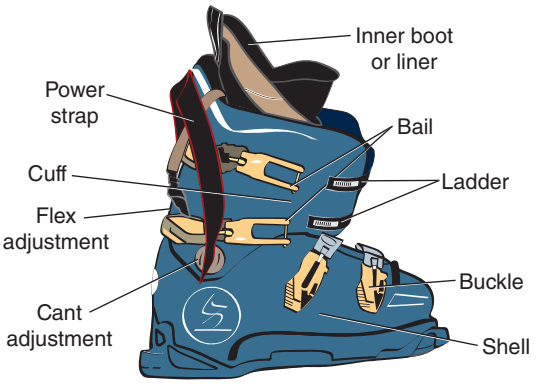
flex adjustment—A device used to adjust the forward tension, making the boot stiffer or softer. Not present on all ski boots.

footbed—The part of the inner boot that the foot stands on.

forward-lean adjustment—Changes the angle that the lower leg is pitched forward relative to the foot. Not present on all ski boots.

inner boot or liner—The soft inside of the boot.

ladder—The graduated rung attached to the opposite side of the shell that the bail fits into.



The features of a ski boot. Look for these things when choosing your own ski boots.

power strap—A band that wraps around the top part of the cuff.

ramp angle—The incline of the boot board.

shell—The plastic outer portion of the ski boot.

ski–walk adjustment—An adjustment that permits the ski boot to have its forward lean for skiing and then allows for a more upright shaft to make walking easier. Not available on all ski boots.

Boot Stiffness

Ski boots are made of fairly stiff plastic. Stiffness is conventionally thought of as the forward-flex resistance. The more resistance encountered, the greater the stiffness. As a general rule, stiffer ski boots yield higher performance skiing. The stiffer ski boot will transmit the actions of the skier without excess movement. Finding the optimal amount of boot stiffness is a give-and-take proposition. If the boot is overly stiff, the skier's ankle movement will be inhibited, which can impede balance. Though the softer boot enhances balance by increasing ankle range of motion, it lacks the support of the stiffer boot, which can then diminish balance. Ideal stiffness is unrealistic, but being in the right range of stiffness is paramount. Look for a stiffness that allows ankle range of motion while providing support for your body size and skiing ability.

Boot stiffness is numerically described in durometers; the higher the number, the stiffer the boot. Each company seems to measure stiffness a bit differently, which makes comparison between companies difficult. As a guide, however, the number does give the consumer an idea as to the relative stiffness. You will often see these numbers on the side of the boot. Beginner boots are in the 50 to 100 range, intermediate in the 80 to 130 range, and expert in the 100 to 150 range.

It would seem that in order to ski to a higher level, one should just get a boot that is stiffer. This fallacy has led many skiers down the wrong path. The ability to flex at the ankle and be intimate with the ski is of primary importance for balance and control. If the boot is too stiff, then this essential hinge is not free to contribute to the skiing process.

Since ski boots are made of plastic, they are temperature dependent, so flexing them in a warm ski shop will not produce the same stiffness as being on the slopes during a cold

spell. Flexing forward in the ski shop can only be used as a relative indicator between boots while in the shop.

Boot Sizing

Most ski boots use the Mondopoint system, the international metric sizing system used by most boot manufacturers. Although this is not meant to be confusing to the skier, it tends to add to the frustration of trying on ski boots. Fortunately, there are size conversion charts that make it easy to compare sizes with the system you are familiar with.

A U.S. size 8 equals a Mondo size 26, but don't feel obligated to ski in the 26 if your U.S. dress shoe is a size 8. This association should only be used as a starting point. Remember, the snug fit is essential for performance. The biggest mistake is getting a boot that is too large.

Boot liners are made with material that conforms to the foot over time. Eventually, time and body heat will move and adjust the flow material from tight places to voids that need filling. Custom liners are available that do this job better for the hard-to-fit foot.

Finger fit or shell fit is a method to dial in the fit. With the inner boot or liner out of the shell, place the footbed in the raw shell. Slip your foot into the shell and slide your foot forward until it contacts the front of the boot. Insert your hand into the shell behind your heel and measure the distance from your heel to the heel of the boot with your fingers. Depending on performance needs, two fingers is a good starting point. If you can fit three fingers in the space, you should drop down a shell size.

Pressure points and hot spots do not necessarily mean you should move up a size. These intolerable places can be ground or punched by a specialty ski shop. Grinding is not unlike the grinding a dentist performs. The boot plastic is marked at the pressure point and a grinding tool takes away plastic from the inside of the ski boot,

A shell fitting is a method to dial in the fit.

Ski boot being punched.

making room for the shape of the foot. Another method is stretching or punching the plastic after it is heated in order to re-form the shell to match the intended foot.

It could be argued that the fit of the ski boot is more important than even the model of boot. A well-fitting boot will at least transmit the actions of the skier even if the boot is a bit too soft or stiff. The world's best ski boot will be useless if the fit is such that the skier is skiing inside the boot. To get the best advice, work with a shop that employs a certified boot fitter. To find a certified shop, go to www.bootfitters.com and click on Find a Bootfitter.

Canting

Not everybody stands with their feet perfectly flat on the floor. Bowlegs and knock-knees are part of the natural diversity that makes us human. When the interface between our feet and the ground is not perfectly flat, an intervention is required.

Canting of the ski boot adjusts the lower leg and foot so that it will be flat against the ground. When canted, skiers are able to move on and off an edge with efficient movements. Between turns they are able to achieve a flat ski that is easily rotated or steered into the desired direction.

Skier being measured for canting.

Footbed or Orthotics?

An often-overlooked piece of ski equipment is that part that most intimately connects the skier to the ski boot—the footbed. A crude footbed comes inside every liner, but it mainly takes up space for the fitting process. The better the ski boot, the less you get with the footbed. This is because most good skiers replace the manufacturer's footbed with their own footbed or orthotic.

Balancing requires an ankle that is in its strongest position. Footbeds support the feet in their neutral position. This allows the subtalar joint to be neither cocked to the left nor right and the forefoot neither pronated (varus) nor supinated (valgus)—in other words, neutral.

While footbeds support the foot, orthotics support and provide correction so the foot remains in its neutral position. If you have a normal foot, a footbed may work just fine. If you have any irregularities, you might want to consider orthotics, which are available from podiatrists and specialty ski shops.

Women's Ski Boots

The female lower leg and foot have slightly different dimensions than their male counterparts. Women have smaller ankles that are narrower in the heel. They are higher at the instep and wider in the forefoot, and they generally have lower calves. With these proportions in mind, many ski boot manufacturers have designed boots specifically for

SAFETY TIP

To create a balanced position, ski boots place skiers in a flexed (or more correctly, dorsiflexed) position at the ankle. This is easy for some, but those who have spent time in high heels or who are genetically predetermined may have shortened Achilles tendons. This predicament can be solved with Achilles tendon stretches. See the calf stretch on page 33.

women. These dimensional criteria, along with buckles that are easier to close and softer flexes, make women's boots a possibility for women to consider.

Although women's boots may have a more feminine feel, don't think that just because you are a woman, you have to ski in them. If the shoe fits—or rather, if the boot fits—wear it. Women's boots simply create more options for the female foot.

Bindings

Bindings secure the boots to the skis. When their tension is adjusted correctly, they will release during a fall, reducing the chance of injury. Many bindings sit atop a plate that is attached to the ski. Besides lifting the skier, the plate allows the ski to flex more naturally to create an arc in the snow when turning.

Skis and bindings are almost always purchased as a system. That means when you buy the ski, the binding is included. Mounting the binding to the ski in these cases is much easier and can often be performed in minutes. Even though this is a seemingly easy process, it is important to have the bindings adjusted by a certified binding technician. The technician will use your weight, age, and skiing ability to arrive at a DIN or release setting (see the following section). This setting along with your boot sole length (don't confuse this with boot size) will determine how your bindings will release in a mishap.

Ski binding with lift.

Ski bindings have a toepiece and a heelpiece. Often the heelpiece is higher off the ski than the toepiece. When a skier with a small boot uses such a binding setup, the ski boot is at a greater angle than it is for the skier with a larger boot size. Since this angle varies with boot length, it is termed the *delta angle*. The consequence is that it will change the way a skier stands or balances on the ski. With this in mind, it would seem prudent to experiment with balance and stance while standing in the boot and binding.

Bindings come with brakes. These will not slow you down

SAFETY TIP

If you ever see a runaway ski, the universal alarm is to yell, "Ski!" If you hear this signal, pass on the alarm in the same manner while avoiding your own disaster.

when skiing, but they are essential in the event of a fall in which your ski or skis come off. A loose ski on its base many times will seek the fall line by itself and start tracking down the hill. This runaway ski can gain speed quickly and can cause serious injury if it comes in contact with another skier. For this reason ski brakes are required at all ski areas around the world.

DIN Setting

DIN is an acronym for Deutsches Institut für Normung. It is an industry standard. For bindings, it sets a scale for release tension. The scale ranges from .5 to 12 and sometimes up to 14 for recreational bindings (racers have higher release values), and it is standardized for all makes of bindings. When you buy a child's ski that has the binding included, you will get a binding that covers the lower end of this scale. The other end of the DIN scale is found on bindings that come with high-performance skis, while intermediate skis cover the middle of the scale. Make sure the DIN scale will cover your range. There are charts at reputable ski shops and online, or you could consult a salesperson. You can also calculate your anticipated improvement in skill level and see if the binding will continue to cover you.

Binding Mounting

Bindings are traditionally mounted with the ball of the foot over the midline of the ski. However, twin-tip skis require special considerations. With the differing demands of twin-tip skis, this mounting point has been moved forward such that the middle of the foot is over the midline of the ski. This provides increased control when riding switch (backward) and better balance rotating on and off axis. However, moving the binding too far forward can cause a ski to lose stability at higher speeds.

The research and development team of K2, a ski company, has developed a scale that can help skiers determine their own mounting point based on their skiing style. This scale can be adapted to many twin tips on the market today.

0 to 2 centimeters forward: All mountain. If you plan on skiing mostly outside the park and want the ski to behave like a traditional ski, you should stay on the conservative side and mount traditionally.

3 to 5 centimeters forward: 50 percent all mountain, 50 percent terrain park. When mounting beyond 3 centimeters, you will lose a little of the traditional feel of length in front of the binding, but with more tail, you gain the control in the air and riding switch.

6 to 7.5 centimeters forward: If you bought the skis primarily for the terrain park or are focused on riding switch in powder or backcountry, you might consider mounting your skis this far forward. Though you may sacrifice forward directional float and stability, it's made up for in the switch riding, landing stability, and balance in the air.

Generally the specialty twin-tip skis are mounted with flat bindings, or bindings without lift in the heel. This reportedly enhances balance in the air and on the rails.

Ski Poles

Ski poles assist with balance and can be used to ambulate on flat terrain. When used correctly, they can help in timing key elements of the turn.

A grip, shaft, and basket are the key features of a ski pole. Most grips are made from a nonslip hard rubber, with a strap usually attached at the top. Straps are useful for adding support during pole plants and providing a leash in case the pole is accidentally dropped.

Buckles and Velcro have added to the choices, but the basic pole strap has remained unchanged since the days of bamboo shafts. The break in tradition is the breakaway strap, which is designed to release when it encounters a certain force. This can be advantageous in a bad fall or when skiing the trees. With the traditional strap, many skiers just remove their hand from the strap and hang onto the grip when safety is a concern. It may be a good idea to remove the pole strap prior to backcountry, off-piste, or tree skiing.

Shafts have evolved from their bamboo beginnings. Today they vary from large, heavy, round aluminum to light, small, flat, or even wing-shaped aerodynamic designs. These composite materials are appealing but come with a price tag that reflects the increased engineering. Though they add performance benefits, these space-age materials are more fragile.

The basket is the bottom part of the ski pole that prohibits the pole from sinking significantly into the snow. Baskets are included when purchasing poles. The general rule of thumb is to use a small basket for hard or groomed snow and a large basket for off-piste or powder skiing.

Skier being measured for pole length.

Pole Sizing

Pole length is important because it will assist or hinder skiing technique. Table 3.2 can aid

Table 3.2 Pole Sizing Guide

Height (ft and in.)	Height (cm)	Pole length (in.)	Pole length (cm)
6'7" and up	201 and up	56"	140
6'4"-6'6"	193-198	54"	135
6'1"-6'3"	185-191	52"	130
5'10"-6'0"	178-183	50"	125
5'7"-5'9"	170-175	48"	120
5'4"-5'6"	163-168	46"	115
5'1"-5'3"	155-160	44"	110
4'9"-5'0"	145-152	42"	105
4'5"-4'8"	135-142	40"	100
4'1"-4'4"	125-132	38"	95
3'9"-4'0"	114-122	36"	90
3'5"-3'8"	104-112	34"	85

in finding the ballpark size. A more precise method is to stand with your forearm parallel with the floor and your elbow at a 90-degree angle. Making a fist with your hand, measure from the top of the fist to the floor. This distance will be your pole length. Ski poles are sized by 5-centimeter or 2-inch increments. Always round up—ski poles can be cut down but not lengthened.

Pole length is based on the skier's physical dimensions, but skiing style can also influence length. Bump and park skiers use a shorter pole, while powder hounds use a longer pole due to the penetration depth of soft snow. Conversely, ice does not permit much penetration and a shorter pole may be in order.

Children and Ski Poles

The general rule about ski poles for children is that they usually get in the way. A good rule of thumb is to wait until children can make a wedge christie (see page 143), they are about six to seven years of age, or they beg for poles. Children ski fine without poles. Peer pressure is usually the motivating factor for children desiring ski poles.

Helmets

More than half (55 percent) of advanced skiers wear a helmet, and 70 percent of children aged 9 and under wear a helmet (www.ski-injury.com). A Norwegian study found that wearing a helmet was associated with a 60 percent reduction in risk for head injuries. ThinkFirst Canada has been involved in research showing that traumatic brain injury is the leading cause of death and catastrophic injury in the skiing populations of 10

countries. This and more evidence has led the U.S. Consumer Product Safety Commission to recommend the use of a helmet when skiing.

Full-shell, short-shell, competition, and youth styles are available. Each has advantages. Sizing is one of the most important criteria. Fit should be performed by a knowledgeable sales assistant. In an accident, a helmet that is too loose may come off or readjust, making it impossible for it to do its job. This is important to remember for children because it is customary to buy many children's apparel items in a larger size.

The warmth of a helmet can be a selling point, but many helmet models have ventilation ports to let off heat during those warm spring skiing days. These can be closed if the weather turns cold or foul.

Due to the importance of helmet fit, goggles should be taken into consideration at the time of fitting.

Helmet Sizing

Take a tape measure and measure the circumference of the head just above the eyebrows. That will be the helmet size. Correct sizing should be performed in a qualified ski shop, where the helmet will be tried on. With this in mind, helmets purchased as gifts should be able to be exchanged or brought back to the store to ensure proper fitting.

Helmet Standards

There are standards for helmets. The norms for Alpine helmets are Snell RS-98, CE-EN 1077, and ASTM F2040. They vary according to the methodology of their impact tests and how they perceive an impact.

The Canadian Standards Association (CSA) has a multi-impact standard. If a helmet passes the standard, it can then display the CSA seal.

In Europe, to conform to the EPI (individual protection equipment), Alpine helmets must be validated according to CE-EN 1077 by an accredited European laboratory.

The standard of ASTM International is ASTM F-2040. It differs from CE-EN 1077 in that it uses a different impact energy and requirement. It applies a hemispherical anvil and an edge anvil and does not apply a penetration test.

Helmet Limitations

Helmets will continue to be controversial as to their safety, what aspects of injury they should protect, and even how their competency can be quantified. Some politicians would

like to make ski helmets mandatory, while others want the public to decide themselves. One school of thought is that helmet wearers have a perceived sense of safety and actually ski in a more dangerous fashion. Even the research is mixed: The *British Medical Journal* reported a Canadian study of 19 ski areas in Quebec suggesting that children wearing helmets may be at greater risk of neck injuries. This was based on 1,082 cases during the 2001-2002 ski season. In the end, helmet use should be a consideration for all skiers. The more information consumers have, the more equipped they will be to weigh the pros and cons of this personal decision.

Eyewear

Covering the eyes is essential in skiing. Eyewear provides wind blockage, but more important, it protects against harmful solar radiation. There are two choices for eyewear: goggles and glasses. Goggles cover more of the face and have a seal so wind and spindrift snow cannot enter. Most modern goggles have double lenses, which significantly reduce fogging. Glasses may be cooler in hot weather, but environmental protection is reduced. Both come in a variety of lens colors that can be used in a variety of lighting conditions.

Lenses should provide 99 to 100 percent ultraviolet (UV) protection. Some manufacturers' labels say "UV absorption up to 400 nm." This is the same thing as 100 percent UV absorption. Polycarbonate plastic lenses are preferable for action sports such as skiing. They are thinner and lighter, and they offer more impact resistance. CR-39 plastic is more impact resistant than glass but not as shatterproof as polycarbonate. It is recommended over glass for prescription eyewear.

Polarization is used in lenses to cut reflected glare, the sunlight that bounces off smooth surfaces such as snow. Polarization has nothing to do with UV light absorption, but many polarized lenses are now combined with a UV-blocking substance.

Conclusion

Alpine skiing is dependent on equipment. From the skis on your feet to the gear on your head, there are many choices. Understanding the advantages and limitations of this gear can sometimes be more challenging than getting down the slope itself. Recognizing the questions to ask and understanding the vocabulary are the keys to acquiring satisfying equipment.

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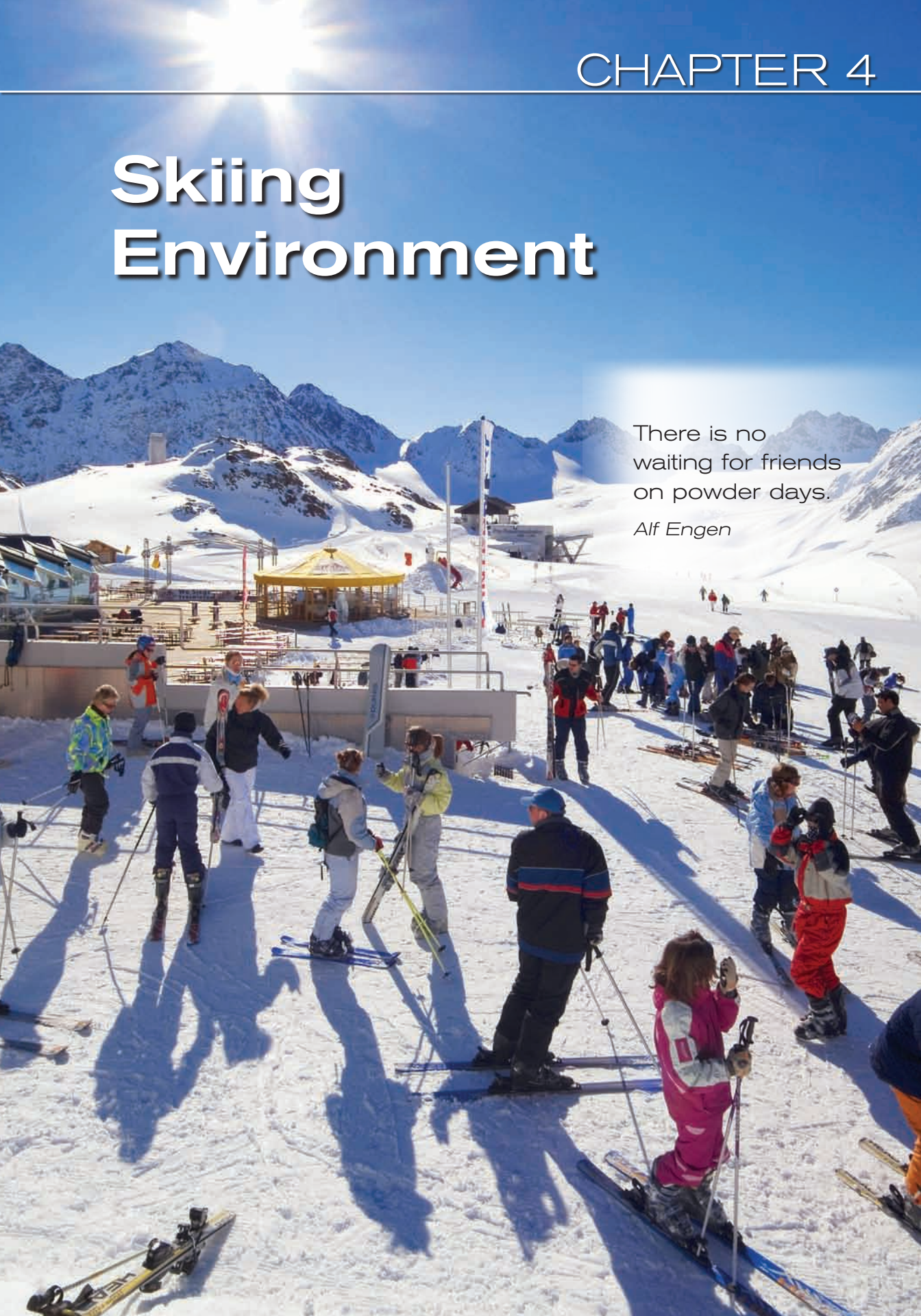
CHAPTER 4

Skiing Environment



There is no waiting for friends on powder days.

Alf Engen

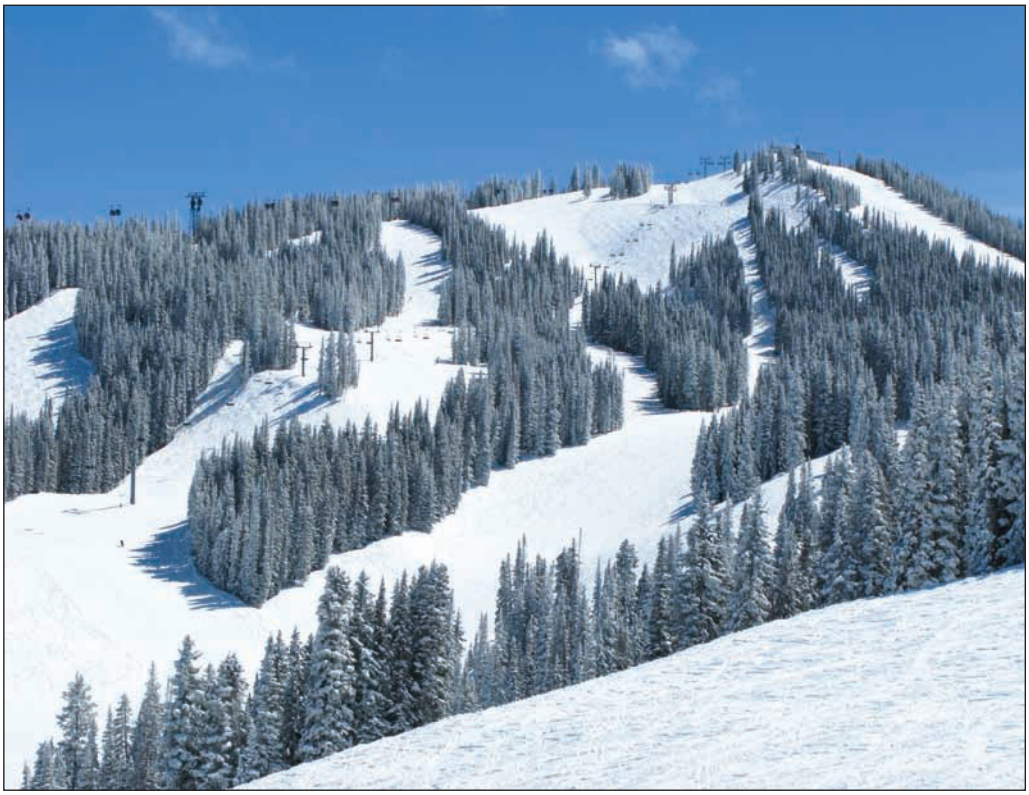
The skiing environment includes many dimensions. The slopes and the mountains may come to mind first; these obvious features are what the ski area has been built around. The first ski areas were just that, skiing areas or hills. Over time came lifts, followed by amenities to support the skiers. Ski shops and food services sprang up as needed. Today boutiques and après-ski activities surround the base of the ski area.

The most important feature is the skiable area or terrain. This encompasses the trails, slopes, and glades, which contain many idiosyncrasies that can be explained by their difficulty and admired for their beauty. The area where skiing takes place is the draw. It is what attracts skiers to come and what skiers most like to talk about when they leave. Some of the mystique of ski areas is that no two are the same.

The slope and mountains are just one portion of the ski area. As we will see, ski areas have an ambiance that is created by many factors.

Slopes

Ski areas contain slopes, also called *runs*, *trails*, *courses*, or *piste*. They may also contain open bowls and tree-filled glades. Ski areas boast about their number of runs and amount of acreage. These runs may be prepared with expensive grooming machines or left natural, only to be altered by new snow and skier traffic.



A destination ski area will have many ski runs meandering toward the base area.

Slope Difficulty

Ski areas rate the skiing slopes by their relative difficulty. Beginner, intermediate, and expert slopes are identified on the map along with the hill trail markings. Many ski areas also list the percentage of each difficulty level, which is useful when choosing a ski area.

Difficulty is expressed by a system that was originally developed by the theme-park guru Walt Disney. It has evolved into a system that is used in the United States and Canada and endorsed by the National Ski Areas Association (NSAA). By law, ski areas in most U.S. states have to display the difficulty at the start of every ski slope. Europe, New Zealand, and Japan have similar systems.

The system in the United States and Canada uses color and shape to define the difficulty of the ski run (see figure 4.1). The easiest slopes are designated with a green circle. Intermediate slopes are marked with blue squares. The black diamond indicates the most difficult slopes. Very difficult slopes may even add another diamond, creating the double black diamond.

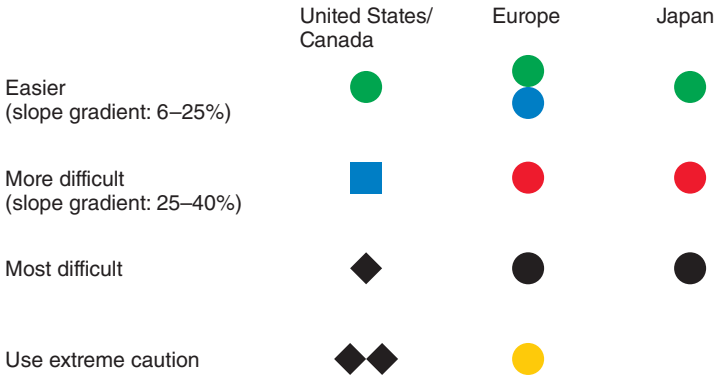


Figure 4.1 Trail difficulty symbols using shapes and colors.

Slope steepness is generally the most influential factor in determining difficulty of a ski run. Its designation depends on the overall difficulty of the ski area. If a ski area is generally easy, its black diamonds may be equivalent to the blue squares at a more difficult ski area.

The relative designation of the marking classification has even evolved some hybrid designations, such as double blues or a black diamond superimposed over a blue square for a run that is a bit tougher than a blue but not quite as difficult as a black. It works and skiers are informed, which is all that can be asked of the system.

European slopes, or pistes, use a similar color-coded classification, although the shape designations are not used. Circles are used for all labels, so don't think you are on the beginner terrain just because the sign is a circle—you could end up plummeting down an expert couloir.

Instead of the double blue or black on blue for an intermediary designation, red is inserted into the equation. In recent years, many European resorts reclassified some black slopes to yellow slopes, signifying a ski route that is ungroomed and unpatrolled—basically off-piste skiing. In Austria and Switzerland, these difficult routes are usually marked with orange squares.

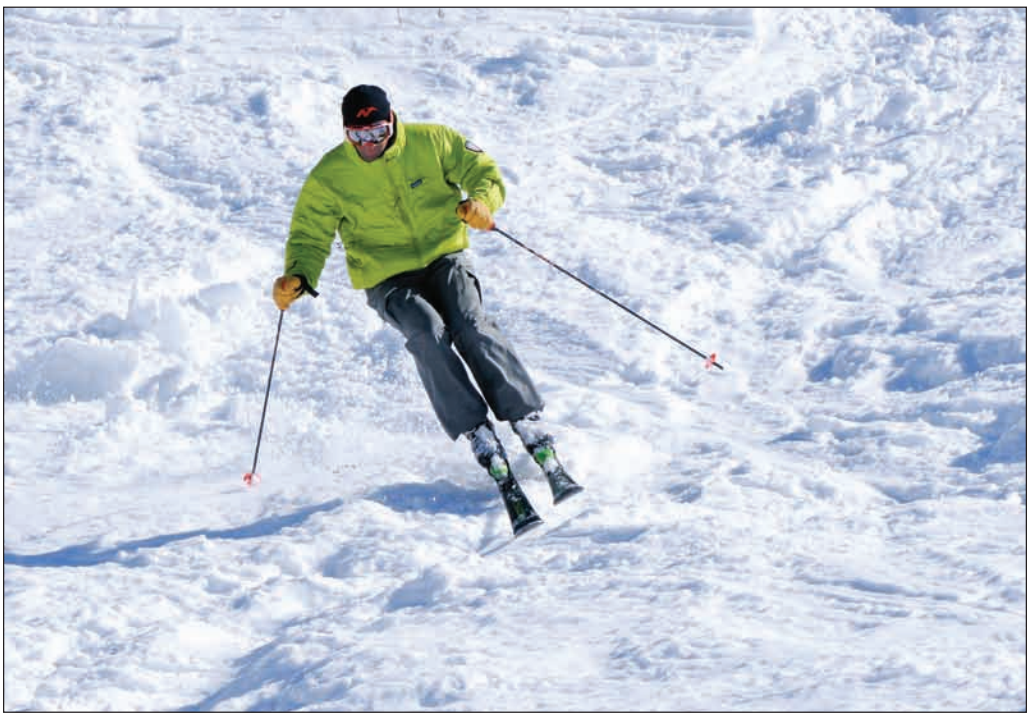
The European classification may be less attached to slope angle than its North American counterpart. A low-angle cat track may carry a blue or even a red classification due to the narrowness or off-camber exposure.

The system in Japan is the most confusing. They have only three colors, and like the Europeans, they are not into the shape game. Japan has more than 600 ski areas. Many are small and family owned, so comparisons among systems is difficult at best. To add to the confusion, some of the larger areas also incorporate the North American and European systems. The colors do follow the same general pattern: Green describes beginner slopes, red is intermediate, and black is expert.

What should be a simple system is made more complex since skiing is performed outdoors in the snow. Snow and weather conditions are variables that can make the ski slope easier or more difficult in spite of the trail-marking system. One day a slope might ski like a blue run after it is groomed. Add some new wet snow, skiing traffic, and flat light and it may ski harder than some black runs.

Though changeable conditions can blur the rating system, they can also lead to some of the beauties of skiing. Every run is different than the one before. The sun will have changed the shadows and the density of the snow will have changed. Every slope has its own personality.

The skiing environment most likely changes more than any other sport environment. In basketball the hoop is always exactly 10 feet (3 m) above those smooth wooden floors. Even the lighting is similar. The free-throw line doesn't change, and the ball bounces the same each time. Whereas the basketball court is flat and has standard dimensions,



Conditions can alter the difficulty of the ski run.

the skiing surface could have hundreds of variations. It is not only tipped up but can change angle in the middle of a turn. Whereas the basketball court resembles a kitchen table, the skiing environment could be said to resemble a large pile of laundry.

The ski hill doesn't just go straight downhill like a ramp but may have a sidehill also. In other words, if you were to roll a ball down the slope, it would not just go downhill but would trail to the right or left, or maybe to the right and then to the left. As if that weren't enough, the hill might be smooth in the mornings after the grooming machines, or it might be covered with moguls as large as VW Beetles spaced as if they were parked in a New York City parking lot. On top of that, the snow has limitless texture variations. It might be smooth like a velvet skirt, or it might have a texture more resembling a stone chimney. Was it mentioned that no two snowflakes are the same?

From the largest features on a slope right down to the snowflakes, the skiing environment is distinctive from one moment to another. A skier will never ski the same turn twice. This is part of the charm of the skiing environment.

Groomed Slopes

Groomed slopes are the ballroom of the skiing environment, smooth slopes that leave their challenge to the angle of the hill only. Surface texture is as smooth as 600-thread-count

Perfectly groomed slopes allow for the perfect skiing environment—the skier can focus on the angle of the hill only.

sheets, allowing every skier to feel like an Olympic champion. Add some sun and blue sky, and you have the makings of a holiday card or at least a perfect day.

Groomed slopes are possible due to late nights and expensive machines. Like their nocturnal counterpart, these snow cats come out at night. This is for obvious safety reasons, plus it coincides with the melt–freeze diurnal cycle during warm weather. With quarter-million-dollar machines in formation like the Blue Angels, they smooth and till up the snow to a perfect skiing surface.

Mogul Runs

If groomed slopes are the ballrooms of skiing environment, then moguls are the rowdy clubs across the way. Bumps are formed by skiers making repetitive passes and pushing snow away from the same places. After enough skiers, the moguls start to grow and reveal themselves. Moguls can appear in a variety of shapes. They can be round, egg shaped, or half circle. One thing you can count on is that they will never have the rhythm you are looking for. Good mogul skiers will ski the fall line, which keeps their speed in control by skidding the backsides of the moguls. Good vision and planning to see the potential pitfalls are essential to the successful mogul run.

Powder Slopes

Powder is new snow. It can be a couple of inches deep or the bottomless powder seen in ski movies and on postcards. Powder is the crème de la crème of all snow types, the champagne of the ski slope. Its beauty lies in the sensations the skier experiences. Skiing is no longer just right and left turns. Powder offers the opportunity to be in the snow, to ski in and out like a dolphin swimming in and out of the water. Powder skiers talk as if they were high, describing sensations of weightlessness, floating, and even flying. Due to the snow holding you back, time even seems to move slower.

First tracks are the goal of the powder skier, a special gift from Mother Nature. As surfers talk about the tube of the Banzai Pipeline in Hawaii, skiers speak of facing shots down Alf's High Rustler at Alta, Utah.

Gate or Racecourses

These courses are made of poles or gates placed strategically on a ski run. Skiers ski around each one, alternating left and right. Ski racing can be as casual as racing a friend or the clock at a recreational area or as serious as the ski racers in the Olympics. The ability to make turns on a given slope is critical. The ski race begins when a small wand is moved by the skier's shins as the skier leaves the start. After all the gates have been correctly negotiated, the skier skis through the finish, which stops the clock when the skier's shins break a light beam aimed across the finish line. It is okay to touch or hit the gates, although they can inflict a bit of pain since they are secured to the snow with a base that is similar to a giant wooden screw.

Gate skiing and race training is not only exciting but one of the best training exercises available. The discipline required to stay on line in the course is difficult. Feedback is immediate when a mistake leads the skier off line. Elite ski racers are the best skiers in the world, and their skill comes from skiing gates or racecourses.

TECHNIQUE TIP

You don't have to be an Olympic racer to experience the thrill of the racecourse. Many ski areas have coin-op (coin-operated) or recreational racecourses available to the public. Intermediate skiers and better can negotiate the gates for a small fee. In the United States, the NASTAR (NAtional STAndard Race) is available in 25 states and 120 ski areas. This program calculates a handicap that allows you to compare yourself with others who have achieved a NASTAR handicap.

Tree Skiing

The neighborhood would not be complete without the crowded cocktail party and you trying to thread your way through the action. Exchange the partygoers for trees and you have tree skiing. As with parties in college, these glades are not always on the map. With the advice of a ski instructor or a tip from a local, these areas can be found. Trees add a new dimension to skiing. Obviously there is an added dimension of danger, but if the skill level and confidence are appropriate, tree skiing can be rewarding.

After appropriate skiing skills, the next most important skill is tactics. Some of the best advice in the trees is to look ahead at the snow. Don't look at the trees; instead, look at the spaces between the trees. The skis will follow the path of your vision.

Tree skiing can add challenges and increase adventure to a ski trip.

EQUIPMENT TIP

Here are a couple of equipment hints. Trees are a good excuse to wear a helmet, and taking off your pole straps may save a shoulder if your pole gets stuck on something.

Steep Slopes

These slopes are the double or triple black diamonds. Snowbird, Utah, has a yellow triangle with an exclamation mark in the center. Whatever way the slope is marked, you should be aware that it is steep. Some out-of-bounds areas are only marked with a warning that it is dangerous and you are on your own because the area is not patrolled.

Compared with Europe, more steep slopes are listed on North American trail maps. This is because Americans tend to name everything. In Europe there is less of a tendency to give a name for every option available.

Avalanches

Avalanches occur when snow moves downhill. Two things are needed for an avalanche: snow and a slope. Any amount of snow can avalanche, but the more snow, the greater the hazard. Survival and rescue more than 2 meters deep is rare (about 4 percent). Slopes that are less steep hold the snow while steep slopes slough off snow as it accumulates, neutralizing the drama of release. The most likely slope for snow release is in the 35- to 50-degree range.

Since 1980, less than 1 percent of avalanche fatalities in North America have occurred within the boundaries of ski areas. Most incidents occur in the backcountry where avalanche control is nonexistent except in areas that may avalanche onto roadways. The risk areas are different in Europe, where a great deal of terrain within resort boundaries is without avalanche control.

The number of avalanche fatalities in North America has risen through the years. This is attributed to the greater number of backcountry enthusiasts. Meanwhile, in spite of the increased traffic in Switzerland, it has seen a decrease in accidents. This is attributed to greater education of backcountry travelers.

Avalanche Safety

The first rule of avalanche safety is to not get caught in an avalanche. To reduce this possibility, it is advantageous to know the warning signs:

- **Snow.** Most avalanches occur during or shortly after new snowfall.
- **Slope angle.** Most avalanches are on slopes between 35 and 50 degrees.
- **Past history.** Avalanches slide where they have in the past. This can be seen in

WHITEOUT

Also called *milky weather*, a whiteout is an atmospheric optical phenomenon in which the light coming in from above is approximately equal to the light reflected from the snow. The end result is that the skier cannot distinguish up from down. Shadows, horizon, and clouds are not discernible. The skier has no sense of depth, and orientation in space is limited at best. Fog and blowing snow contribute to this difficult situation. Vertigo can result and skiing can be dangerous, if not impossible. Tree skiing or skiing close to the side of the ski run can be helpful. The dark trees can break up the constant white, providing a small visual reference.

catch zones, where snow is deposited by wind, and chutes cleaned free of trees from previous avalanches.

- **Slope shape.** Terrain that is convex is less likely to hold the snow compared with a concave shape.
- **Slope aspect.** Leeward or wind-loaded slopes gather more snow as well as create cornices that can break off, triggering an avalanche. Intense sun weakens the bonds between grains of snow as well as lubricates the base layer, causing instability.
- **Weather.** A sudden temperature rise is dangerous. The closer the temperature gets to 0 degrees Celsius (32 degrees F), the greater the hazard. Wind direction indicates where snow will be deposited; for example, a southwest wind will deposit snow on a northeast exposure.

Avalanche Equipment

When traveling into potential avalanche areas, it is wise to carry equipment that will assist in the event of an avalanche. It is tragic enough to be involved in an avalanche, but without the proper tools, the situation becomes even worse.

Avalanche cords. This is the oldest and least expensive piece of avalanche equipment, originally constructed out of 10 meters of parachute cord and dyed red. It is attached to the skier and left to follow on the snow while skiing. The idea is that when the skier is buried, the cord will stay on the snow surface, making the buried skier easier to find. Store-bought cords have markings every meter or so indicating direction and distance to the skier.

Transceivers. Also called *beacons*, *beepers*, and *PIEPS*, transceivers are the most efficient method to locate a buried victim. The transceiver emits a beep by way of a 457 kHz radio signal while in normal use but may be switched to receive mode to locate a buried victim. The rescuer's transceiver is in receive mode, and the rescuer will hear audible beeps that are used to estimate the distance to the buried victim. These are usually required at many ski areas for skiers who want to go alone into the backcountry. They should be worn close to the body and not in the backpack because they could become dislodged from the skier during an avalanche.

Probe. This is a rod used to poke into the snow to attempt to feel for a buried victim. Most ski areas have these on hand in the event of an emergency. Additionally, some backcountry ski poles convert into probes. Probing is time consuming and should not be the primary rescue strategy.

Skiers prepare for a possible avalanche search by practicing with a probe and transceiver.

Shovels. Shovels are essential equipment in an avalanche rescue. Finding victims is one thing, but being able to dig them out of the packed snow is vital. There are many backcountry shovels that break down into pieces that fit into or attach to a skier's day pack. Even with the wide tip on modern powder skis, the skis are useless when trying to dig in the snow. Carry a shovel when entering any terrain with avalanche concerns.

Physiological Considerations

In spite of its beauty, the skiing environment is harsh. Elevation and cold make for difficult living conditions. The body reacts to these extremes in differing ways. Some reactions can be uncomfortable while others can be outright dangerous. Understanding how to modify your behavior in response to these considerations can lead to a more enjoyable adventure.

Nutrition

To perform any movement, the body needs food. Food energy is measured in calories, and though it seems most people are trying to reduce caloric intake, it takes calories to provide energy for movement. Due to the physical demands and environmental stress, skiing is not a good time to diet. First, if you are dieting, your energy will be reduced while skiing and you will be tired. Second, skiing is a sport that tears down muscle

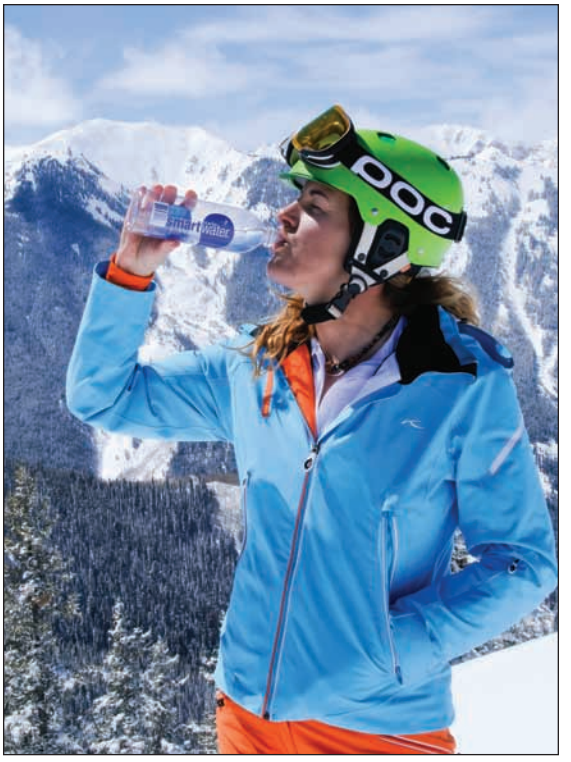
tissue, so recovery takes longer. Even if you are not overly tired at the end of the day, the following day you will be drained.

This is not the forum for a nutrition tutorial, but needless to say, a well-balanced diet is in order. This is sometimes difficult at posh ski resorts. Those incredible meals served under candlelight can be packing an inordinate amount of undesirable calories. The high-fat meal is not only bad for general health, it can be detrimental for the skier who desires to go right back out or wants to ski the following day. You can only get so much on one plate—add the fat and away go the carbohydrate and protein. Carbohydrate is used as blood glucose, and skiing is an intense activity fueled by this glucose. Without a sufficient balance of carbohydrate in the diet, energy will decrease. Additionally, skiing takes a lot of strength, and it tears down muscle tissue. Protein is used to rebuild this muscle tissue and must be included in the diet.

Hydration While Skiing

The high elevation and reduced temperature of mountain environments results in reduced water vapor in the air. This drying effect makes it critical for skiers to consume more liquid than they normally would at lower and warmer elevations.

Research has shown that recreational skiers who consumed 177 milliliters (6 oz) of liquid every half hour had less muscle damage than those who drank nothing. When muscle energy stores run low during skiing, muscle cells become damaged and certain biomarkers (myoglobin and creatine kinase) begin to accumulate in the blood. Consequently, the muscles begin to feel sore and fatigued, and performance drops. The skiers who did not drink had twice the muscle breakdown constituents compared with those who ingested water. In the same study, a third group of skiers drank the same amount at the same time (177 ml every half hour), but their drink was a commercially available sport drink containing 8 percent carbohydrate and 2 percent protein. These skiers had almost no muscle breakdown, and their levels of myoglobin and creatine kinase were significantly less than the water and no-drinking groups.



Hydration is important at high altitudes.

Hydration is necessary for skiers. Remaining hydrated will minimize muscle stress, enhancing performance and reducing short- and long-term fatigue. There are many drinks touting themselves as sport drinks. Look for drinks that contain electrolytes

(sodium and potassium), 6 to 10 percent carbohydrate, and some protein (a 4:1 ratio of carbohydrate to protein has been shown to be optimal). Electrolytes stimulate fluid transfer into the cell while carbohydrate provides energy. Protein can minimize muscle breakdown and promote muscle and glycogen synthesis.

Don't confuse hydration with alcoholic drinks. Alcohol is a diuretic, meaning it will stimulate the loss of body water, which is needed at altitude and the accompanying low humidity. Many skiers think a drink will loosen them up so they will ski better, but in reality, it will adversely affect perceptual–motor skills, such as reaction time, balance, eye–hand coordination, and visual perception, all of which are needed in skiing. If you must drink alcohol, leave it to après-ski.

Cold Environment

Skiing is performed in a cold environment. Air cools between 6 and 10 degrees Celsius per 1,000 meters; the higher the elevation, the colder the air. When you step outside the ski lodge, you can count on it being even colder at the top of the mountain except in rare situations. To top that off, there are other factors that can increase the feeling of cold. Windchill and wetness can make the air feel colder than the thermometer would lead us to believe.

Windchill

Windchill is the temperature felt on exposed skin as a result of wind. It depends on the actual air temperature and the wind speed. It is always lower than the air temperature. Figure 4.2 shows the windchill factor for a range of temperatures and wind speeds.

Hypothermia

Hypothermia results when the rate of heat loss exceeds that of heat production. It has been a problem since Hannibal lost nearly half of his troops while crossing the Pyrenees in 218 BC.

Maintaining an ideal body temperature while skiing is always difficult. While skiing, the body loses heat via several mechanisms. Skiing causes the body to generate heat, and then while sitting idly on the chairlift the body loses heat to the environment. Inadequate clothing or gaps in garments, such as at the glove–jacket interface, let heat escape. The wind removes body heat, and sitting on the cold chairlift transfers heat from the body to the chair.

Hypothermia is clinically defined as when the body core temperature is reduced to 35 degrees Celsius (95 degrees F). The symptoms corresponding to progressively decreasing core temperatures can be seen in table 4.1. Hypothermia would seem to be more prevalent in very cold conditions, but humid conditions, along with clothing that holds water such as cotton, contribute greatly to hypothermic conditions. For this reason, clothing selection is important.

Frostbite

Frostbite is the result of very cold air striking exposed skin. The skin freezes as a result of the surface blood vessels constricting. This is the body's attempt to preserve its internal heat, and it results in a decrease of blood flow to the area. Crystals start to form either superficially or in the fluids underlying the area.

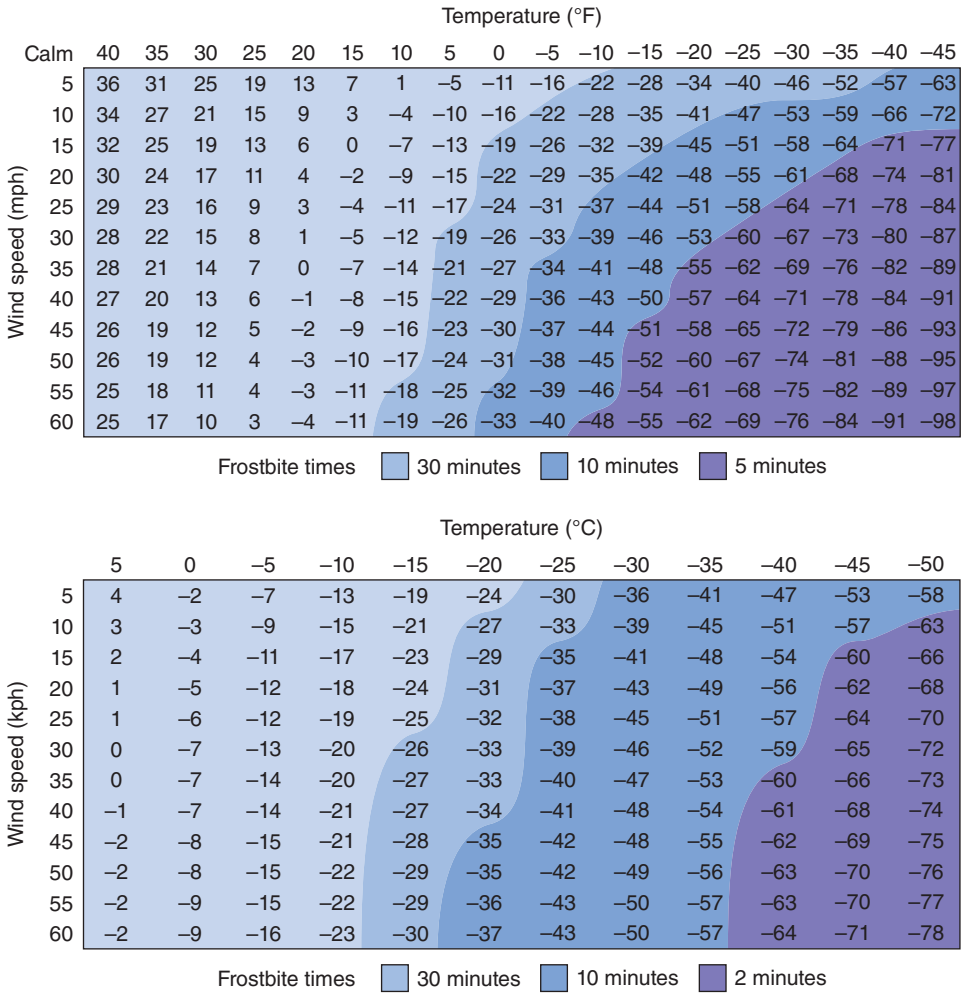


Figure 4.2 Windchill chart. The intersection of the *air temperature* and the *wind speed* is what the temperature would feel like.

Top: Reprinted from National Weather Service.

The affected skin may appear slightly flushed before frostbite sets in (frostnip), turning white or grayish yellow. Initially the affected part may have a painful tingle, but this usually subsides. The area will feel intensely cold and numb. Often victims are unaware they have frostbite until an observer notices the pale, glossy skin. Frostbite can result in permanent damage to the exposed area, although this is rare among skiers.

Because people with frostbite have been exposed to the cold, they should check also for hypothermia and dehydration. If you have frostbite, seek immediate medical attention and ask for instructions about rewarming and hydration. Avoid alcohol and caffeinated beverages. You may be asked to wait for rewarming. Elevate the affected body parts if possible; this will prevent further swelling. Remove jewelry that may be restrictive and reduce blood flow.

Table 4.1 Body Core Temperature and Signs and Symptoms

Core temperature	Signs and symptoms
37 °C (98.6 °F)	Feeling cold Skin cooling Decreased social interaction
36 °C (96.8 °F)	Goose pimples
35 °C (95 °F)	Shivering Muscle tension Fatigue
34.5 °C (94.1 °F)	Deep cold Numbness Loss of coordination Stumbling Dysarthria Muscle rigidity
32 °C (89.6 °F)	Disorientation Decreased visual acuity
31-30 °C (87.8-86 °F)	Semicoma Coma
28 °C (82.4 °F)	Ventricular fibrillation and cardiovascular death

Reprinted from Hart and Sutton 1987.

Altitude Considerations

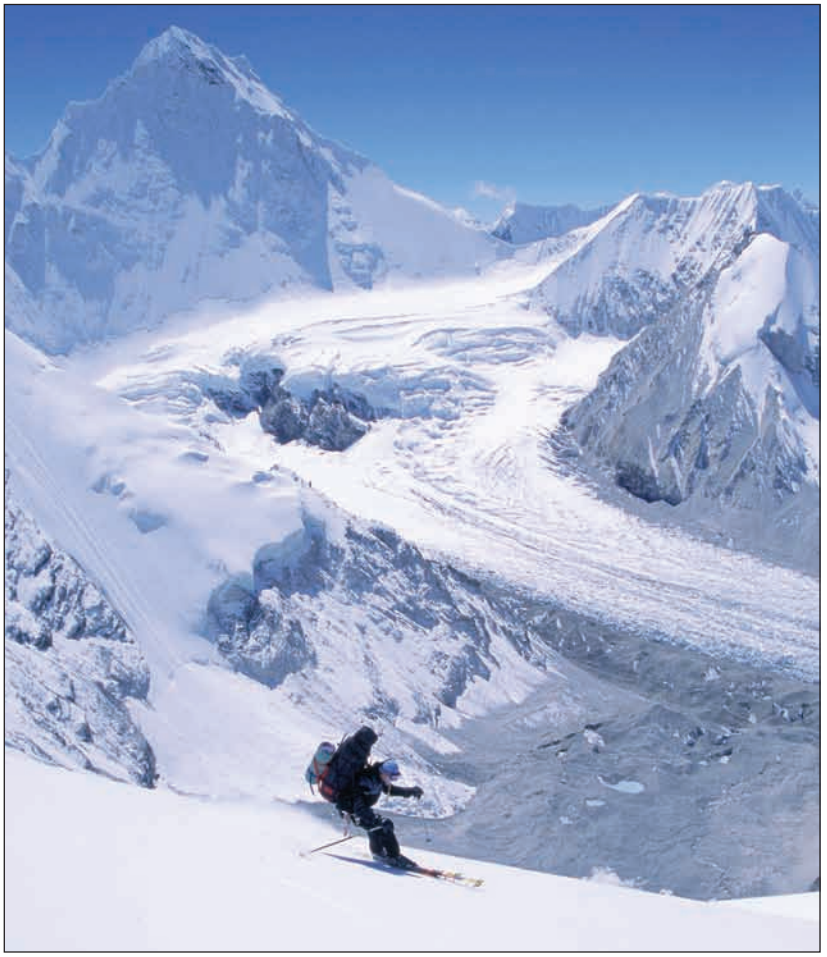
As you ascend in elevation, it becomes more than cold. There is less atmospheric pressure because there is less atmosphere above. Less atmosphere creates some physiological issues that can be life threatening and some that are only an inconvenience. This thin atmosphere also lets in more solar radiation, which has negative consequences for the skin.

Acute Mountain Sickness

Altitude sickness, altitude illness, hypobaropathy, and soroche are all names for AMS, or acute mountain sickness. AMS is the result of going to a high elevation quickly. It is most common above 2,400 meters (8,000 ft).

Symptoms of AMS are much like the flu—dizziness, headaches, insomnia, nausea, fatigue, and vomiting or diarrhea. These symptoms most often manifest themselves 6 to 10 hours after ascent and generally subside in one to two days. In the most severe cases, it can progress to pulmonary edema, which is life threatening. Most cases are mild, however.

People over 50 years of age seem to be less susceptible to AMS, and physical fitness does not seem to be preventative, although obesity may be a risk factor. Medical condi-



High elevation is part of skiing, and skiers need to be prepared for the different atmospheric conditions.

tions such as mild COPD (chronic obstructive pulmonary disease), hypertension, coronary artery disease, and diabetes do not seem to affect susceptibility to AMS.

To avoid altitude sickness, progress to altitude slowly. Drink lots of water and little or no alcohol the first day. Eat light meals.

High-Altitude Pulmonary Edema

High-altitude pulmonary edema (HAPE) is the result of a shortage of oxygen caused by the lower air pressure at high altitudes. Fluid accumulates in the lungs, which leads to impaired gas exchange and may cause respiratory failure.

HAPE is difficult to predict. The most reliable risk factor is previous susceptibility. Additionally, there may be a genetic link, and women may be less susceptible.

Symptoms include difficulty breathing, coughing up blood, excessive sweating, anxiety, and pale skin. A classic sign is the production of pink, frothy sputum. If HAPE is suspected, immediately return to lower elevation and seek medical attention.

High-Altitude Cerebral Edema

Another form of altitude sickness that results from exposure to high elevations is high-altitude cerebral edema (HACE). It generally occurs after a week or more at elevation, but symptoms can occur after just a few hours. Symptoms include headache, loss of coordination, weakness, decreasing levels of consciousness, disorientation, memory loss, hallucinations, irrational behavior, and coma.

HACE is the result of brain tissue swelling from a fluid leakage. It is a life-threatening condition. Descent to lower elevation should be immediate and medical attention should be sought.

Sleeping

Nothing could be more relaxing than a good night's sleep. Unfortunately, new arrivals to altitude may experience poor sleep due to an altered respiration pattern. A pattern of shallow breaths that increase to deep sighing respirations and then fall off rapidly can be noted. Respiration may cease entirely for a few seconds and then the shallow breaths may begin again. This irregular breathing is the result of the sojourner's respiratory center adjusting to the altered serum partial pressure of oxygen and carbon dioxide at high elevations. The result is Cheyne-Stokes respiration. Although annoying for sleep, it is a normal response to high altitude.

Interventions may include acetazolamide (125-250 mg), sold under the trade name Diamox. Acetazolamide is a carbonic anhydrase inhibitor that increases the acidity of the blood, leading to a buildup of lactic acid in the blood similar to that which occurs from strenuous running. This resulting high lactic acid (low pH) prompts the brain to increase the breathing rate, which in turn helps the high-altitude sleeper regain a more normal cycle of breathing.

TECHNIQUE TIP

Cheyne-Stokes respiration is normal at altitude, but it also may be the result of a head injury. Therefore, a head injury at altitude may be more difficult to diagnose outside of a direct medical evaluation. For this reason, any head injury should be evaluated by trained medical personnel.

Nosebleeds and Coughing

The dry air at high altitudes dries out the membranes of the nose, making them brittle. Cold air and general dehydration make nosebleeds a more common occurrence. Humidifiers and staying hydrated will reduce the likelihood of nosebleeds.

To alleviate a nosebleed, stand or sit up (unless feeling faint). Apply pressure to the front of the nose with the thumb and index finger just above the nostrils and hold for five minutes. With the other hand apply ice, or if on the slope, a snowball, to the bridge of the nose.

High-altitude visitors may experience a dry, debilitating cough that can interfere with skiing and sleeping. This high-altitude cough can be so severe that mountaineers,

albeit at much higher elevations, have broken ribs from it. The cough may be due to bronchoconstriction (narrowing of the airways), making the airway receptors more sensitive at altitude.

Sun Exposure

UV radiation, the harmful burning rays of the sun, is less filtered by the thinner atmosphere of high elevations. This and the reflective effects of the white snow make sun exposure a serious consequence for the skier.

For a given latitude, the intensity of the sun increases at a rate of 6 percent per 305 meters (1,000 ft) above sea level. At 1,524 meters (5,000 ft), the sun is 30 percent stronger than at sea level, whereas at 2,440 meters (8,000 ft), the intensity increases by 48 percent—almost doubled. Therefore if you use sun protection factor (SPF) 15 at sea level, you need SPF 30 at 2,440 meters (8,000 ft) to attain the same effectiveness.

Low-humidity areas such as the western United States dry out the skin. Dry skin absorbs sunscreen faster and deeper than moist skin does. This reduces the sunscreen filtering capacity because the sunscreen is not on the surface of the skin where it can block UV radiation.

Sunshine is beautiful but can easily damage the skin at high altitude.

Snow Blindness

Snow blindness, solar or UV keratitis, or photokeratitis is easy to acquire at altitude with the sun reflecting off the snow. It is an excruciatingly painful state that comes from the sun burning the cornea, the covering of the eye. Symptoms include dizziness, severe headache, and sensitivity to light. Treatment is immediate removal to a totally dark area. Wearing goggles and sunglasses with UV protection may help.

Studies have shown that frequent exposure to bright sunlight may be a precursor to cataracts later in life. Other eyewear concerns are addressed in the chapter on equipment and gear on page 53.

Corrective Eye Procedures and Altitude

Altitudes greater than 3,048 meters (10,000 ft) may have an effect on visual acuity in patients who have had conventional or custom wavefront Lasik, All-Laser Lasik, PRK, LASEK, Epi-Lasik, and RK surgery. Lens-based refractive surgery procedures like RLE and P-IOL are less likely to be abnormally affected by altitude because they do not dramatically change or weaken the cornea. There is some evidence that PRK may have may have advantages over RK at altitude.

Medications at Altitude

High altitude changes the way our physiology works. Medications that were prescribed at sea level have a differing effect at enhanced elevation. For example, barbiturate sleeping pills, prescribed under such names as Nembutal and Seconal, may have a greater effect and should be used with caution.

Oral anticoagulants such as the blood thinner warfarin (Coumadin) may be more active at high altitudes. High-altitude sojourners taking such drugs should have their prothrombin times checked frequently. Diuretics such as Lasix may cause significant falls in blood pressure when upright, resulting in lightheadedness or fainting.

Prudence would dictate that before traveling to altitude, people who take prescribed medications should inform their prescribing physician and learn the consequences of their personal medications.

Skier's Responsibility Code

Elements of risk are associated with Alpine skiing. A degree of common sense and personal awareness can reduce this risk. Etiquette and courtesy to others, not unlike driving defensively on the motorway, will go a long way toward reducing accidents and increasing enjoyment for all who occupy the ski slopes together.

The following is the Canadian Alpine Responsibility Code, which is similar to the skier's responsibility code endorsed by the NSAA and the National Ski Patrol (NSP) in the United States.

1. *Always stay in control. You must be able to stop, or avoid other people or objects.* The number of skiers and snowboarders on the slopes is increasing as a result of the sports' growing popularity and higher lift capacities. As a result, control is more important than ever. Control means being able to avoid a collision or accident, as well as being safe if another skier or rider falls close to you or if there is a sudden change in the terrain. Ski

defensively and always be prepared for the unexpected. Be aware of where others are on the run and ski under control so that stopping or avoiding collisions can be easily done.

2. *People ahead of you have the right-of-way. It is your responsibility to avoid them.* A skier's path or line is determined by watching others' movements and anticipating their direction changes. Uphill skiers must avoid people downhill and never ski close enough to them to scare them or make them lose their concentration and control. Many riders experience a blind side, so it is important to always be aware of what the person in front or alongside of you is doing.

Novice skiers tend to make wider, less predictable turns and will sometimes traverse from one side of the run to the other. Downhill skiers and riders have the right of way; however, they should not shoot across the hill without warning or cut off other people. Always be in control. If you have stopped on a slope, always check uphill before starting again to avoid interfering with others.

3. *Do not stop where you obstruct a trail or are not visible from above.* When stopping on a slope, skiers should take a quick glance to consider the general pattern of traffic. It is usually best to stop at the side of the trail, in view but out of the way of oncoming skiers and riders. Keep in mind that you want to be seen by others coming down the slope, but you don't want to be in a spot that will cause oncoming skiers and riders difficulty in stopping or changing directions to avoid you.

4. *Before starting downhill or merging onto a trail, look uphill and yield to others.* It is the responsibility of the skier who is starting downhill or merging onto a trail to yield to those who are already on the trail. If you have stopped on a trail and are about to resume, always look uphill to make sure that you do not move out in front of another skier or boarder. When entering a trail, check for other skiers and boarders in order to avoid colliding with someone who is already on the trail.

5. *If you are involved in or witness a collision or accident, you must remain at the scene and identify yourself to the ski patrol.* As with all collisions or accidents, it is important to know the details and establish the cause of the accident. Once the ski patrol arrives at the accident scene, they will take control. Witnesses will be asked to provide any information they may have and may be asked to help control the public. Offer to help in any way possible, but if your assistance is not required, leave the area so that the ski patrol can do their job.

6. *Always use proper devices to help control runaway equipment.* Skiers must use a braking or retention system at all times. Ski brakes are recommended as the best method of ski retention. Skis with broken or missing ski brakes are not allowed on a hill and must be replaced with a pair with functioning brakes. It is also mandatory that snowboards have a brake or retention device. Runaway skis or snowboards without proper braking systems can cause injury or even death. They can pick up enough speed and force to pierce car doors and injure passengers, hit people standing on a lodge balcony, and injure bystanders on the ground.

7. *Observe and obey all posted signs and warnings.* Signs are posted for important reasons. There are directional signs, level-of-expertise signs, and warning signs. Warning signs may advise of a potential safety hazard. For everyone's safety and enjoyment, it is imperative that these signs are acknowledged and obeyed at all times.

8. *Keep off closed trails and closed areas.* Ski trails and areas are closed for reasons. Runs are usually closed because of snow cover. Snow cover is too thin and presents danger

from rocks and shrubs. If the snow is too deep, there is risk of an avalanche. Another reason for a run to be closed is if a race is taking place. In any case, a closed sign means "Do not enter!"

9. *You must not use lifts or terrain if your ability is impaired through use of alcohol or drugs.* Judgment, coordination, and reaction times may all be impaired by the use of alcohol or drugs. This impairment can result in serious injury when on a ski slope. Remember to ski or ride responsibly at all times.

10. *You must have sufficient physical dexterity, ability, and knowledge to safely load, ride, and unload lifts. If in doubt, ask a lift attendant.* There are many types of lifts, ranging from rope tows, T-bars, and platter lifts to multiperson chairlifts and gondolas. If you are unfamiliar with a particular style of lift, ask the attendant for assistance. Chairlifts are equipped with restraining devices that should always be pulled into position as soon as possible after sitting down.

Conclusion

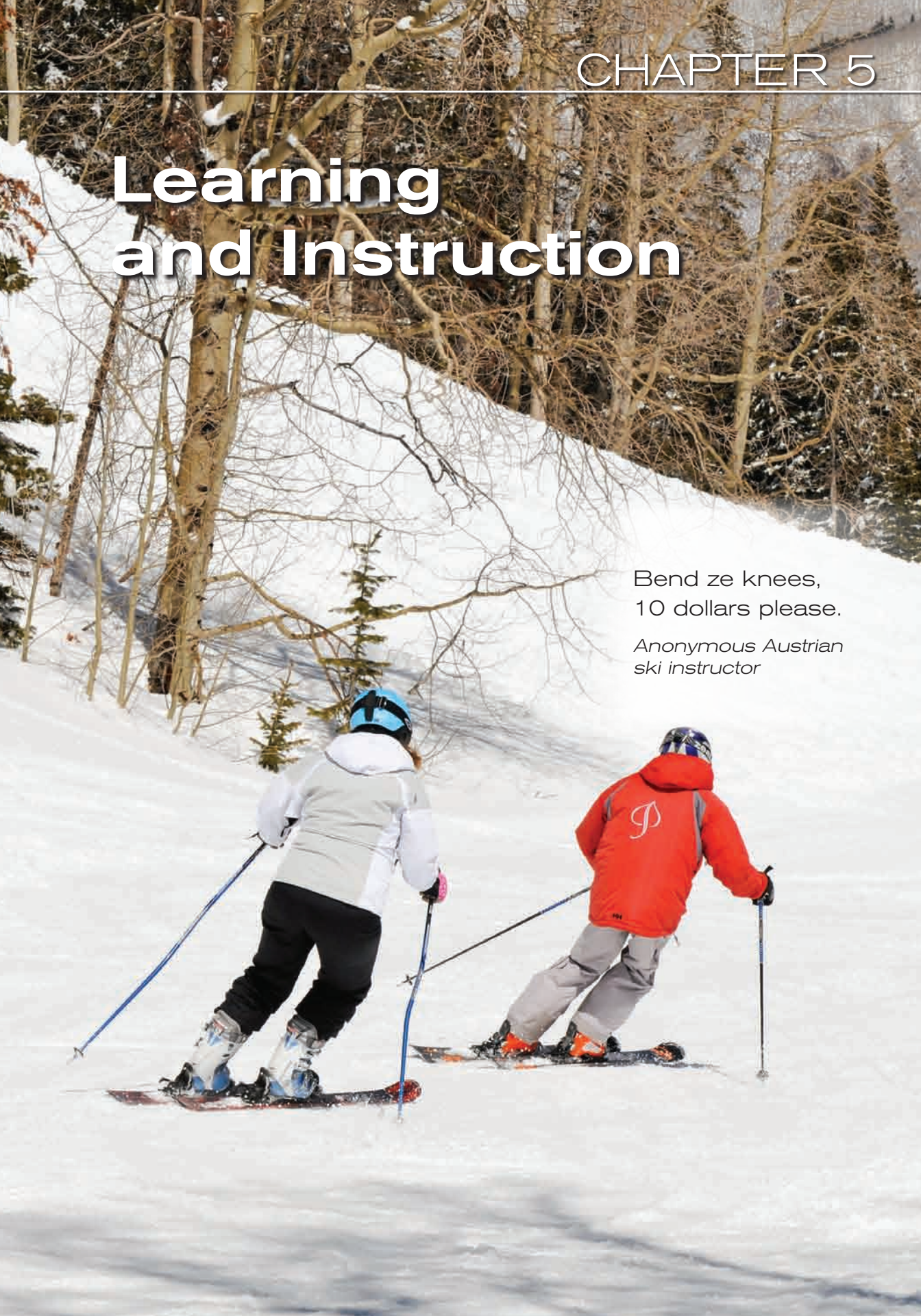
The ski area is composed of many types of slopes, weather conditions, and resort amenities. Slopes have designations classifying them by their difficulty, which is based on slope steepness and many other factors. Snow conditions, trail width, and even obstacles such as trees or race gates can add to the challenge of skiing. Some snow conditions may present exciting opportunities, although precautions must be heeded when there is a chance for avalanche. Avalanche prediction is not perfect, and the skier venturing into such terrain must be trained and equipped for this risk. Even skiing inbounds can present risk if etiquette and responsibility are not observed. Finally, the ski environment does not end at the base of the mountain. Each resort offers its own special amenities, from the world-famous on-hill grooming at Deer Valley, Utah, to the superb dining at Il Caminetto Di Umberto at Whistler Blackcomb, British Columbia, to the rowdy après-ski at the Krazy Kanguruh slope-side in St. Anton am Arlberg, Austria, to the reassuring children's ski school in Lake Louise, Alberta. Each resort has its own character and ambience.

CHAPTER 5

Learning and Instruction

Bend ze knees,
10 dollars please.

Anonymous Austrian ski instructor



Skiing is a challenging endeavor. This is part of its allure. There are always steeper slopes, larger moguls, and deeper powder to add challenge to the skiing adventure.

The challenge for the beginner on the bunny slope is not unlike the challenge the virtuoso experiences in the narrow, steep, double black diamond couloirs. Both skiers are at their skill ceiling. The adrenaline, the fear, and the excitement for both skiers are maxed out. They are redlined with stimulation.

The common thread connecting the beginner and the expert is that they both want to perform in their own personal arena with more proficiency. Whereas the beginner would like to just learn to plant the pole, the expert would like to refine the pole action so that it is exactly timed with the edge set. These are different outcomes, but the goal of increasing their skiing skills is similar.

How Do We Learn?

People learn in many ways. Some learn by watching expert demonstrations while others like a declarative explanation. The range of learning styles is limitless. It is important for skiers to understand that there is no limit to what they can achieve on the slopes.

Skiing is a motoric sport—coordinating and timing movements are the key. Being able to squat 200 kilograms is great for conditioning but will not endow you with the ability to edge your ski with precision.

The movements and their blend are what differentiate the great skier from the average skier. The actions of skiing are relatively simple, but putting them together in the appropriate combination is what counts. Anyone can do a knee-bend exercise. We do it every day just sitting down in a chair. So why are the flexion and extension movements, which are vital in the moguls, so difficult for the intermediate skier? Combining movements in a coordinated action is the explanation.

Learning is a complex endeavor and proficiency is an ongoing goal. The path to improvement is best traveled when there is guidance.

Practice

Practice is the most important component of learning a motor movement. It is essential to perfecting performance. You can read, hear, and eventually understand every aspect of the sport, but unless you buckle up the boots and click into the bindings, all you will be is an encyclopedia of skiing knowledge. The ability to ski skillfully comes from practice, specifically practice at figuring out the appropriate blend of efficient movements for a given situation. How do you get to Carnegie Hall? The same way you get down an intermediate slope: practice!

Feedback

The next prerequisite for learning and improvement is feedback. Feedback is what the coach, instructor, or even video communicates to you. It can be as simple as remaining upright after a difficult turn or situation, a proverbial twist from the airplane pilot's "Any landing you walk away from is a good landing" to "Any turn in which you are still upright is a good turn."

Feedback has differing forms. It may be as basic and descriptive as, "You pressured your ski and then edged it." A more prescriptive version may be, "You need to edge your ski before pressuring it." Feedback may also be more instructive: "To make that ski hold an edge, move to the big-toe side of the foot before transferring your weight." Descriptive, prescriptive, and instructive are all valid forms of feedback, but the degree of information contained in each is different.

Why Take a Ski Lesson?

Skiing ability is often viewed as something you either have or do not have. "Yes, I can ski" or "No, I can't ski" are the customary responses when asked about participation in the sport. So are those who can ski all equal, or is there a gray area within this group?

What is good skiing and what is not? When you are picking yourself up from a fall, it does not take a PhD in skiing to tell you something went wrong. If a beginner on the beginner slope fell, a natural reaction would be to say that she needs a ski lesson. Would the response be the same if she were an expert skier performing a daring exploit down a double black diamond? The retort would be more one of awe than a recommendation of a ski lesson.

When is a ski lesson needed or even justified? A skier could say he is happy with his present ability, and he may not want to venture to the double black diamond for various reasons. However, enhanced ability does not necessarily imply harder slopes. Becoming more skilled implies making competent movements that are efficient, that do not contain useless gesticulations that end up hindering balance while contributing nothing to the desired goal.

If you don't want to ever venture into a run called *Widow Maker*, what benefit will you realize from ski instruction? You will become more efficient. Efficiency can be seen in many ways. Have you ever seen a skier struggling on the beginner slope? Her jacket is unzipped and her brow is sweating—a lot of effort for the beginner slope. A more efficient skier would be bundled up while skiing effortlessly down the same slope. The skier with the unzipped jacket is inefficient. This is evident by the amount of effort she is using to accomplish what could be a simple task.

The efficiency continuum can justify taking a ski lesson. Elite ski racers are well aware of the value of a trained eye and accurate feedback. The majority of their runs are recorded on video under the trained eyes of several coaches. The amount of feedback and instruction the racers get is enormous. There is also a basic human characteristic of wanting to be proficient at whatever we do. Rarely do humans perform a task without wondering how they could do it better. Add all this up, and a ski lesson may fulfill some basic human needs.

Types of Ski Lessons

Ski lessons are booked through a ski school. Today, many ski schools are also called *snowsport schools* or *mountain schools*. Lessons come in many forms, including private lessons, group lessons, and specialty lessons. There are no set industry standards for ski lessons, only the creativity of the school trying to attract students and provide a better service than the competition.

Private Lessons

Private lessons are the ultimate in one-on-one coaching. Your strengths and weaknesses are of primary concern to the instructor. Feedback, exercise, task, and even terrain selection are fully directed toward one target student.

Private lessons are usually booked by the hour, half day, full day, and multiples of full days. The greater the amount of time booked with an instructor, the cheaper the cost per hour.

Some schools sell semiprivate lessons with two or three students to one instructor. This is desirable for couples, siblings, or just two friends of equal ability and desires. As with group lessons, the semiprivate lesson does lose some intimacy of the student–instructor relationship.

Once a student finds an instructor he is comfortable with, he can request the instructor for further coaching. This has many advantages for the student. Obviously a relationship has been established, which is not only comfortable but more efficient from a learning standpoint. The instructor now has experience with the student's learning style, which permits her to relate concepts and adjust teaching strategies to best fit the student's needs. No matter how proficient the instructor, gaining this insight into learning styles takes time.

Group Lessons

Group lessons are divided based on skier ability. More advanced groups may be further divided based on terrain aspirations, such as moguls or off-piste desires.

The initial group divisions are usually made via a verbal split. The students express how they are skiing now and the types of slopes they are comfortable on. From this information, groups are formed according to the size that particular ski school advertises.

CONSUMER TIP

There is only one type of ski lesson that is not recommended, and that is the one from friends or relatives. Without proper training, they can actually inhibit your skiing advancement and compromise your safety. Acquaintances receive no money and have the greatest of intentions when they offer to teach a friend. The only thing they are lacking is competency. Additionally, there are professionals who engage underground ski teaching as a money-making activity. This is an illegal endeavor in the United States. Since one avenue of revenue for the ski area is its ski school, the underground ski teacher can be charged with theft of services and even trespassing. In Europe and South America, the scenario is a bit different. A single instructor or groups of instructors create an alliance with the ski area and are permitted to teach even though they are not technically employees of the ski area.

Group lessons are less directed at the individual. Although you can expect to receive feedback pertaining to your personal skiing, it will not be as often, and many times the instructor will attempt to find group themes to address. From these commonalities, exercises and drills will be devised and executed according to the group average.

Specialty Lessons

Specialty lessons are designer lessons. They tend to have a theme such as race camps and seniors' clinics. Others revolve around a ski celebrity with a theme attached. The Mahre Training Center with Olympic gold and silver medalists Phil and Steve Mahre would be an example. Then there are those lessons that attach themselves to a more esoteric topic, such as psychology and fear.

These specialty lessons are great for staying on task. Usually the instructor has not only advanced ski teaching credentials but also special knowledge of the subject matter. Many lessons are multiday clinics, so fun group dynamics are an added bonus. Some incorporate indoor lectures and may conclude with banquets or other events, which can add to the educational value and increase enjoyment.

Specialty lessons focus on a particular theme or topic and sometimes include celebrity coaches, such as Olympic gold medalist and world champion Phil Mahre, as shown here.

Children's Lessons

Children enroll in ski school for a variety of reasons. The obvious intention is to learn to ski or learn to ski better, a motive that usually evolves from the parent. This is important to remember, because the student is the child and it is the child's motives that are important. Ski instructors have a time-honored mantra: Safety, fun, and learning—in that order. Safety is obvious, but it is the element of fun that is important to keep in mind. Without this ingredient, participation in the sport is rather ridiculous. Learning is last on the list, and it will remain last on every child's list. Fun drives most of children's desires. This motivation cannot be changed and must be honored.

Does that mean children will spend their entire lesson in the pursuit of fun? Yes, the skilled instructor will play games to ensure the children are always smiling. If truly skilled, however, the instructor will include games and play that direct the children to ski-related movements and experiences. Parents are concerned about the value of their dollar, so the instructor must have a strategy to accomplish skill advancement. The theme of safety, fun, and learning is the Hippocratic oath of the children's ski instructor. Violating this order will lead to disaster. It is easy to understand the prioritization of safety, but if fun is taken away, no learning will happen. When children are smiling, they are primed to learn.

For children, fun is the most important element of a ski lesson.

PARENTAL GUIDELINES FOR THE CHILD'S LESSON

- Be on time. Being late causes anxiety for the child. Arriving early, the child can take notice of the new surroundings.
- Ask the school what you need to bring. This may be anything from an extra pair of mittens to a signed medical release with insurance and telephone numbers.
- Check to see if a helmet is required for participation.
- Mark all clothing and accessories with the child's name.
- Pick up your child on time. Besides the anxiety your child will acquire, many schools impose a heavy financial penalty if you are late. If you are on time, a face-to-face discussion with the instructor is always informative. If you don't score much time with the instructor, many schools have a fun, cartoonlike report card outlining your child's progression.
- If you don't see much advancement, don't belabor it with the child. Remember that children are growing and sometimes overt improvement takes time. If they are having fun and skiing, they are learning.

How to Take a Ski Lesson

Ski lessons are booked through a school. This can be done in person, by phone, or online with some of the more sophisticated resorts. They will ask for the normal billing information and your ski ability. Ski ability refers to how you ski prior to the lesson, not how you would like to ski. This is most important for group lesson assignments so that you are placed in the correct group. Being in a group that is above your ability will not amplify or accelerate your learning; in fact, it will probably slow your advancement since you will be spending all your time just trying to keep up.

Meeting time and place will be given upon registration. European lessons are overtly structured, while American instruction is more casual. Either way, expect to hit the slopes right away. Experienced instructors will most likely take you on an easier slope than anticipated. This is because they have found themselves in situations where students overestimated their ability and turned the goal of the ski lesson into pure survival. Expect to ski almost the same as you would with a friend or group of friends. At first your instructor may just throw out some advice, such as, "Direct your weight more to your outside ski" or "Try to look and visualize two turns ahead." Eventually the instructor may incorporate some drills and exercises. These include maneuvers such as skiing on your inside ski or sideslipping. A sideslip is where you slide perpendicular to the fall line on your uphill edges—not something you would do on your own. Many times drills and exercises do not even look like conventional skiing. Don't fret—drills and exercises are chosen by the instructor to tease out deficiencies while exaggerating the proficient movements in your skiing. Though you may be able to make a parallel turn, your instructor may see some edge-control deficiency. This can be identified in your struggle through the sideslip exercise. In the end you will gain valuable precision with your edge control.

Learning Style

Everyone has a personal learning style. Some like to receive detailed explanations while others just want to shadow the instructor and mimic his technique. No learning style is superior. What is important is that the instructor figures out which style is dominant for the student. We are all a bit heterogeneous with our learning styles, meaning we exhibit multiple characteristics of all learning styles, but in the end, everyone leans more toward one style over others. Your instructor may ask questions such as "What do you think about when you turn?", or she may inquire as to how you learned other sports or activities.

Everyone has a different learning style; some students learn best by shadowing the instructor and mimicking his technique.

Teaching Style

Just as students have learning styles, instructors have teaching styles. Experienced instructors will spend some time figuring you out in order to adjust their teaching style to match your learning style. When this is successful, you get the feeling that you clicked with the instructor. For this reason, don't judge instructors too quickly; they may just be trying to figure you out. When you find an instructor you click with, get her name or business card so you can request her on a future occasion. Instructors like to be requested. It's like seeing an old friend when you come back, and they already know a lot of baseline

information about you that will make both of your jobs easier. On the business end, they often receive a small bonus for requested lessons.

When to Take a Lesson

Since learning anything involves practice, the earlier you can discover where to direct your practice, the better. This would imply early in the season as opposed to later. For a weeklong trip, it would be best to start on the first or second day. Waiting until the end of your skiing time reduces the practice time available. You can only learn by practice, and the more directed practice, the greater the learning.

Goals of the Ski Lesson

Other than the never-ever skier who has an obvious goal, what you would like to achieve is important. Just like any other goals in business or life, ski goals are important if you desire to reach a certain destination. Don't be afraid to overstate your goals. If you want to learn to ski moguls but still haven't made it down a blue run, don't apologize. Communicating this goal with your instructor is valuable information. Together you can map out transitional goals that can keep you on path and establish benchmarks for your learning progression. This will also help direct your practice. Even though you may not have made it to the mogul field yet, your instructor will direct your practice. Your practice or homework might be to finish your turns more across the fall line and work on your sideslip. This is practice that will help your skiing in spite of your goals and will also keep you on track to reach your goals. As with any sport, skiing has basics. These

A good ski instructor will give you practice or homework after the lesson such as the sideslip practice here.

basics cannot be practiced too much or too often. When trying to accomplish a new task or when things break down, go back and work on the basics. Even without your instructor, you may be able to coach yourself if you have experienced this progression before.

Expectations From the Ski Lesson

The good instructor will have spent time skiing and watching you before suggesting ideas about what you need to improve. This is where more is not always better. A good instructor will have a plethora of things he would like you to work on, but you can only do one thing at a time. Awareness of your goals along with knowledge gained from watching your skills will allow the instructor to triage your problems and formulate a workable plan. Sometimes your instructor may tell you something simple, such as "Direct your weight more to the outside ski," or she may introduce an exercise that will amplify the movement, such as skiing on one ski with the other ski held off the snow. If the advice or exercise is difficult, that is good. If it is easy, it probably was already in your repertoire of skills and did not need attention.

At the end of the ski lesson, ask for clarification on one or two items you should take away as homework. This will allow you to direct your practice time when you are away from your instructor. Also, you should confirm your equipment options with your instructor. This is usually skis but could also include boots. Your ski instructor by now should know enough about your style to be able to advise you on a ski length that is appropriate for your skill level. This will be valuable the next time you rent. If you are intent upon purchasing skis, consult your instructor. As with buying shoes for a child, you may want to build in a bit of growing room. Either way, an instructor is your best source of information.

INSTRUCTOR CERTIFICATION

There is a certifying body for ski instructors in every skiing country. In Canada, it is the Canadian Ski Instructors Alliance (CSIA), and its counterpart in the United States is the Professional Ski Instructors of America (PSIA). PSIA has nine geographic divisions. Though each division has a slightly different certifying procedure, they all certify ski instructors according to PSIA's national standards.

Certification in the United States involves three levels. Level I is the introductory level and level III is the top level. It usually takes five to eight years of full-time teaching for an instructor to reach this top level. Some ski schools have few level III instructors while others have more.

In the United States, certification is not required to teach at a ski school. In lieu of certification, most ski schools have their own programs in which to introduce new instructors to teaching. If instructors continue to teach after a year or so, they usually pursue PSIA certification. This is encouraged and wages are usually based on the instructor's certification level.

Canadian ski instruction is similar to the U.S. system except that it has four levels. The first three levels are similar to those in the United States, and level IV is equivalent to the PSIA examiner. Level IV Canadian instructors and PSIA examiners certify ski instructors.

The International Ski Instructors Association (ISIA) has a membership of 38 countries with 3 pending countries. This governing body sets a minimum standard for ski instructor certification. When ski instructors have achieved full certification through their country, they are recognized members of ISIA.

Determining Ability Level

Ski ability is a continuum. From the first time on skis to elite ski racing, ability is a range based on what skiers can accomplish on their skis. The most visible end result is when the skis are parallel. The universal method to arrive at this parallel position is to start off with the skis in a wedge, or what used to be called a *snowplow*. Due to the converging placement of the skis, children know this as a *slice of pizza*. With proper instruction, the ski will come to match in a parallel attitude, or what children call *French fries* or *pommes frites*.

Level 3 skier makes a solid wedge turn.

Even though the position of the skis from the first-timer to the elite skier is different, the skills involved are similar. To turn, the skis are rotated or steered into a new direction, and to make them hold or create friction they are then tipped onto their metal edges. If they are overly tipped before the reorienting, there is too much grab with the snow and they cannot be maneuvered to the new direction. Just the ordering of these two skills is important when distinguishing the level of the skier.

Skiing proficiency involves making movements correctly and then learning to coordinate those movements with others. Think of Gene Kelly or the most accomplished dancer you have ever seen. Each movement they make is relatively simple. It is the combining of movements that makes the dance difficult. When these proficient dancers link movements together, they create a single continuous motion that appears flowing and simple. Though beginners can rotate their skis and achieve some sort of edge angle, the virtuosos can start the rotary movement while applying exactly the correct amount of edge in conjunction with the previously started rotary movements, all in one motion.

Advanced level 8 skier. Notice the body moving into the turn, tipping the skis onto edge.

Abilities are usually described using some sort of scale. The most common labels used in ski instruction are *beginner*, *intermediate*, and *advanced*. Occasionally there will be additional

categories such as *expert* and *specialist*, and sometimes there will be a split in the difference between advanced and expert with the inclusion of *advanced/expert*. The DIN binding charts imply similar ability levels but include an aggressive scale using terms like *cautious*, *average/moderate*, and *aggressive*.

The instruction scales of beginner, intermediate, and advanced can be further broken down, as PSIA has chosen to do with three subgroups per phase (see figure 5.1). Beginners are levels 1 through 3, intermediate skiers are levels 4 through 6, and advanced skiers are levels 7 through 9. This is understandable in that skiers are beginners before they have ever put on skis and are still beginners even when they can make rudimentary wedge turns on green terrain.

Advanced wedge christie level 5 skier. The skier starts the turn in a wedge and finishes with a christie.

A word of caution: Binding guides also use the term *level* to describe the same three phases (beginner, intermediate, and advanced). The difference is that the binding companies use Roman numerals while the ski instruction system uses Arabic numerals. Just to keep it complicated, ski instructor certification also uses the term *level* with Roman numerals, although sometimes this scale is written erroneously with Arabic numerals. So when you see the word *level*, you have to understand the context it is used in—student ability, skier ability for binding-setting purposes, or ski instructor certification.

Conclusion

Skiing is a motoric sport that is first learned with gross movements. With practice and feedback, these individual movements morph into one smoothly coordinated action. Ability should be seen as a continuum of steps that skiers advance through as opposed to finite definitive levels. There are many types of ski lessons that assist skiers with their advancement. During the lesson, the ski instructor will attempt to discover the student's learning style. With this understanding of learning style, the ski instructor can adjust the teaching style to create a symbiotic relationship. Children have their own types of lessons. Children are motivated differently than their parents, and for success, parents must understand this difference. Skilled ski instructors understand these motivations and have methods to keep the child learning in spite of the outward appearance of play. All lessons can be taken anytime and cover all skill levels. Although, to maximize practice, it is best to take them early in the ski experience.

Student Phases or Zones

Beginning

- Level 1: First time on skis.
- Level 2: Student has spent a few hours on the slopes and can ski in a cautious wedge stance on easiest terrain; can link basic wedge turns.
- Level 3: Skis with a solid wedge turn on easier green trails.

Intermediate

- Level 4: Skis on all green trails confidently with wedge turns or beginning wedge christie (starts turns with a wedge and matches in the fall line).
- Level 5: Skis wedge christie turns on easier blue runs (using a wedge or step to enter the turn, then matching the skis in a wide stance).
- Level 6: Skis beginning parallel turns on green terrain and advanced wedge christie turns on blue terrain.

Advanced

- Level 7: Skis in a comfortable, open-stance parallel (stance about hip-width) on all blue and less challenging, groomed black terrain. Also skis in easy blue bumps, maintaining rhythm and speed control.
- Level 8: Skis short and long dynamic parallel turns on green, blue, and black terrain, while skiing more open-stance parallel turns on harder slopes. The student can ski in the fall line in blue and less challenging black bumps with few stops and good speed control but hesitates in steep bumps. The student skis with confidence in light powder but still has trouble in heavy, wet, or crusted snow.
- Level 9: Is proficient in all kinds of skiing at dynamic speeds.

Figure 5.1 Student phases or zones each with three subgroups.

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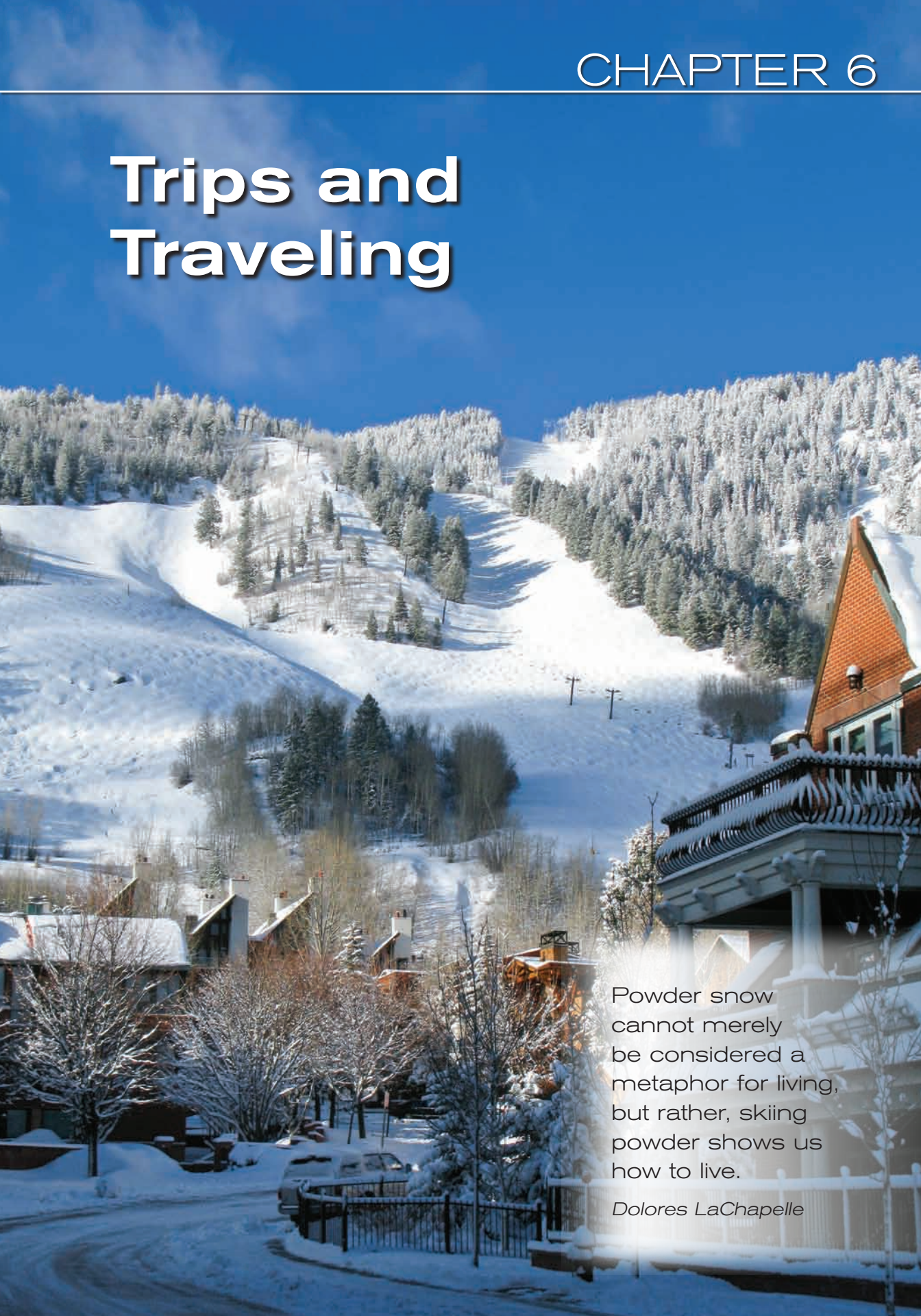
CHAPTER 6

Trips and Traveling



Powder snow cannot merely be considered a metaphor for living, but rather, skiing powder shows us how to live.

Dolores LaChapelle

Unless you happen to live in a ski town, traveling is inevitable if you want to ski. Depending on where you live and the intent of your ski excursion, you may be going for the day or multiple days. No matter what the length of the adventure, planning is necessary.

Types of Trips

A ski day or a ski vacation? Though they might be the same on the hill, they are extremely different in terms of planning. A ski day might involve just getting the ski gear together and hopping in the car. A multiday sojourn, on the other hand, will not be successful with this level of spontaneity.

Day Trips

Day trips are reserved for those who live within a few hours of the ski area. In addition to packing the ski gear, there are a few decisions to be made.

Due to locality, the day skier might have the option of only skiing a partial day. This can be smart since some areas have part-day tickets available at a reduced price. These part-day tickets are usually for the afternoon, so you might want to check first. Although they are called *day areas*, some offer night skiing under the lights. This is a convenient option for after-work skiers or those getting a late start. Senior and military lift-ticket discounts may be available, and many ski areas allow children under a certain age for free, sometimes with the purchase of an adult lift ticket or for certain lifts.

Day trips are often taken to day areas. These may be mom-and-pop hills or large, well-known resorts. The small ski areas offer a special ambience. They do not have the glitz and amenities that come with large amounts of financial investment, but they have a special feeling—something akin to coming back to your hometown after being away for a long time. People know each other, and as a result the buildings may lack a sense of direction because most of the customers know where they are going. More of the patrons may bring their lunches due to the lack of options for eating or as a money-saving strategy. Coming from home, it is much easier to make a lunch from items in your own kitchen as opposed to the condo kitchen, which lacks various accoutrements. Due to the smaller size, financial resources may be more limited and as a result the grooming may

TECHNIQUE TIP

Blaming skiing problems on the snow is usually speculative at best. Was it the snow or the skier that caused the problem? Snow just sits there in whatever form. Whether it is smooth or bumpy, it is a passive element in the realm of performance. Skiing, on the other hand, is an active process. Viewing conditions with this state of mind is much more advantageous. There is a saying: "There is no such thing as bad snow, only bad skiing." That sums up the mental approach that will lead to a fun day out on the slopes.

resemble that of ancient times. Grooming machines may be a bit older and lack some of the sophisticated technology present in state-of-the-art machines. Berms or ridges between grooming passes may be more visible or there may be more undulation left in the snow. These imperfections shouldn't be deal breakers when choosing the smaller area. Though snow conditions are factors in the ski experience, mental attitude often is more significant.

Day trips and day areas have a lot to offer. Planning is minimal and impulsiveness prevalent. The convenience is high and the price can be low.

Weekend Trips

Weekend and many holiday trips last a couple of days. Packing for a two-day trip may be as involved as packing for two weeks. You still need the ski gear and clothing for après-ski, although you may only need one night's lodging. If your trip is to a destination resort, you may be able to maximize your skiing by skiing the afternoon you arrive. There are ski areas located close enough to the airport that this is a possibility. Some of these areas will give you a free afternoon lift ticket if you show them your plane ticket.

Depending on the size of the ski area, accommodations may be cheap and easy to find or expensive and difficult to book. One option at small areas is ski clubs. Anywhere from 5 to 40 families own, maintain, and clean up ski clubs. Meals are often as a group, and as you might imagine, everyone knows everyone. Many times if there is room, an owner is allowed to bring a guest. If you know a club owner, it may be worthwhile inquiring to see if this is an option.

A disadvantage of weekend and holiday trips is that many other people have the same days off in which to ski. These may coincide with national holidays or student vacations and may make for crowed slopes, lift lines, and restaurants. Discounts of any type will be hard to find on lodging and lift tickets, and restaurants will definitely require a reservation.

Destination Trips

These are the ski areas on postcards, the places that end up with celebrities walking the streets and restaurant names starting with *Chez* even if they are not in France. They are taller in vertical drop and steeper in price. Along with fantastic skiing, expect après-ski that will include shopping, night lifts, and sleigh rides.

Part of the draw is their size. It is human nature to believe bigger is better, and ski areas play on this instinct. They brag about the number of runs and the amount of acreage to ski. The number of lifts will be too great to count and may include a gondola or tram. Heli-ski options might also be available for those looking for that special stash of powder only accessible by helicopter. These resorts often have been on the cover of the ski magazines.

On the hill, expect good grooming. There will be a plethora of high-speed lifts with trail maps awaiting you at the lift line. Hosts will greet you and the staff will appear well organized.

Due to the size of destination resorts, many have a reservation service that can book everything for you, including lodging, lift tickets, ski school, rental equipment, and even airline and ground transportation. They often offer discounts and can steer you to the best deals in town.

A destination trip to a ski area can be an experience of a lifetime.

Amenities

A great mountain is the foundation for any ski area. Just like a good cake, it is even better when it is iced. When selecting a ski area or resort, there are additional factors to consider. These will keep the fun meter pegged and help guarantee a great all-around vacation experience.

Snow amount. You need snow to ski. Some geographical areas receive more snow than others. This could also depend on the time during the season.

Snow quality. Snow density is the usual indicator. Numbers are fine, but few know what they mean. What is the word on the street? The lighter the density, the easier the skiing.

Weather. Though you can't order it on the reservation form, you can go with past history and average snowy and sunny days. There's no guarantee, but this will up your odds for a good skiing experience.

Snow making. Manmade snow guarantees that there will be snow on the ground. Nothing can ruin a ski day more than no snow.

Grooming. This is an expensive investment for ski areas. Reputation is a good indicator of what to expect. Is the ski area groomed daily, and what percent of the ski area is groomed?

Slope selection. No matter what your skill level, take a look at the trail map and see if the area has the type of slopes (e.g., blue squares, black diamonds) you will be spending most of your time on (see page 57).

Snowcats groom the snow in unison like a choreographed dance to ensure the perfect slopes for the destination skier.

Racecourse, park and pipe. You don't have to have them, but they add flavor to the skiing experience.

Ski school. Is one available, and do they have availability for you? If you have children, ask about the ages they take and staff credentials.

Lodging. This is essential for multiday trips. Ski-in, ski-out lodging is the most convenient and most expensive. Check distances to the slopes, along with public transportation options.

Dining. Eating in, you will want to check with your lodging arrangements to see how much of a kitchen you are getting. Eating out is important for some vacationers, who will want to check out the choices.

Après-ski. Activities could include dinner, drinks, dancing, and shopping. How are the base facilities set up for your evening adventure?

Spa. This could be an après-ski activity, or it could be the prime motivation for a nonskiing member of your party.

Nonskiing activities. Some skiers just want to rest, but other options may include tubing, sleigh rides, snowmobiling, cross-country skiing, ice-skating, pools, and hot tubs.

Ambience and character. Ski resorts range from plain Jane to upscale and sophisticated. Pictures on brochures and web pages might be all you need to inform you of what to expect.

Accommodations

After the big decision of where you want to go skiing, the next choice is accommodations. Where you stay can be as important to some family members as the quality of skiing, so careful consideration when booking accommodations is advised.

Housing options include inns, condos, bed-and-breakfasts, and motels. All have benefits. Prices are proportional to the distance to the slope and ski area. Just staying a little ways outside of the ski town will result in a large savings. Eating in may not have the ambience of a candlelight dinner on Main Street, but it also will not have the price tag. Many condos have kitchens equipped for cooking. Add the fireplace in the living room and you can make your own ambience.

CONSUMER TIP

Some vacationers like the option of making their own meals, but grocery shopping is not their idea of vacation. Fortunately, some ski towns offer grocery services. By sending your shopping list in advance, you can arrive to a well-stocked condo with all your favorite meal-making items and snack options. Those who want to eat in without the chore of cooking may be able to hire a chef to come to the condo and prepare meals. Along this same line, massage therapists often make house calls to condos or hotel rooms during the after-dinner relaxation time.

Some accommodations are listed as ski in, ski out. This means you can ski right to your door. You will be putting your boots on in your room or in a locker room nearby where you can also house your skis. Of course, you will pay for this luxury. There are some fantastic options that can be found on the side of the ski run. Before booking these, make sure that the adjacent run is of an ability level that all guests can ski, or have an alternative method for transportation to the appropriate ski slopes. One more word of caution: At the end of the day, you will need to get back up the hill. If you have any après-ski activities after the lifts close lower on the mountain, you will need to arrange a ride back up to your housing if there is no in-house shuttle service.

Next in line for lodging convenience and price is staying close enough to walk to the ski slope. These accommodations are not far enough to take a bus or shuttle, so there is no constraint conforming to a transportation schedule. Then, of course, there is housing where a bus or shuttle is necessary.

Travel

Traveling is an eventful part of the trip. Though a challenge, it should be enjoyed, not shunned. Travel can be a means to an end, but if done right, it can be a memorable part of the vacation. Sometimes this is just in the mindset, although inevitably it will hinge on the extent of the planning. Knowing what to expect and what options are available goes a long way in making the travel part of the trip memorable.

Auto

The length of drive will determine when you will arrive. This depends on traffic and road conditions. Having a car equipped with snow tires is essential, and four-wheel drive is a nice option. In Europe, don't expect to see as many four-wheel drives, but many rental cars come with easy-to-install tire chains if you ask for them. SUVs are nice for their size but are more prone to rolling over due to their high center of mass. Their ground clearance is nice but not often needed with today's efficient snow-removal equipment. Gas prices may be higher in the resort area, so filling up beforehand might be prudent. Driving is convenient compared with other ground transportation, but parking is difficult to find at many of the larger resorts and you may have to pay for it.

Since you are headed to the snow, you may well see snow on the road. Although road crews strive to keep roads free of ice with chemicals, salt, sand, and gravel, it is a never-ending process. Even the best highway crews cannot prepare a perfect road, but they do usually keep the road open for prudent drivers. Snow turns to ice when driven over many times. Sun helps in the ice-melting process but at the same time can give drivers a false sense of security; shady areas that have not had as much sun may still be slick. Snow can also end up on the road via avalanche. Avalanche paths have history, and the road crews are intimately aware of these areas. To prevent avalanches from sliding all the way to a road, avalanche crews shoot guns or deposit explosives to release the slides before they get too big and natural physics releases them. Most avalanches are naturally released during a storm or shortly afterward. Therefore when driving in narrow canyons and along steep slopes, it is wise to keep an eye out for avalanche debris that has made its way to the road and is blocking travel. These types of roads usually have gates at both ends, but sometimes the snow comes unexpectedly or in amounts not anticipated. It was not that many years ago when skiers who frequented Little Cottonwood Canyon in Utah drove with their transceivers in the transmit position. You can never be too safe.

A popular way to transport skis is in a car-rack carrier. These can be purchased at many sporting goods and outdoor stores. They come in many styles and are designed for specific car or roof designs. Before purchasing a new rack, make sure it will fit on the car intended. Options for racks include locks, many of which may be adapted for other sporting devices such as bikes and kayaks. When putting skis in the rack, point the tips backward. This will reduce directed air flow under the tips and avoid overly stressing the rack attachment points. Although skis on the roof are great to free up room inside the car, be aware that road chemicals, grit, and grime are not good for ski bases or the moving parts of the ski binding. If practical, put them inside the vehicle whenever possible. With some rooftop racks, you may attach the skis while in a ski bag. This is probably a good choice considering the chemicals, grit, and grime, although the added wind resistance may be hard on the rooftop attachments and will reduce gas mileage due to the added wind resistance. Another option is a cargo box attached to the roof rack. These rocket boxes keep skis clean and offer the opportunity to stash a few extra items alongside. They have evolved in shape, becoming more aerodynamic, but still are a drag on gas mileage.

Airline

Flying is the fastest means of travel, but when choosing a destination, don't forget to add ground travel time and cost. When calculating the price of air travel, consider your

Car-rack carriers are handy for skis and freeing up space inside of the car.

baggage. All airlines charge fees for extra bags, weight, and baggage size, and many airlines even charge fees for just one or two checked bags. It is easy to accumulate baggage and thus fees when you consider all that is needed for skiing. Skis are sometimes charged as extra baggage, extra weight, or just as skis. Some skis are not charged if they are under 62 inches (157 cm) in length, and some boot bags are charged if they are over a cumulative 62 inches (157 cm) when adding the length, width, and height of the bag. Some will count a ski bag and boot bag as one piece of luggage if they have a combined weight under 50 pounds (22.7 kg). No matter the cost of the skis at the airport, you will pick up your skis at the oversize area in the baggage claim.

Train

In 1935, the first destination ski resort in the United States, Sun Valley, was developed by the Union Pacific Railroad, primarily to increase ridership on passenger trains. This established trains as a legitimate means of transportation to ski areas. In France, the *chemins de fer*, or paths of iron, were the only way to many mountaintop resorts. Even if roads existed, they were snowbound and provided for tough travel. Many ski adventures started with friends traveling together, singing songs and sharing stories.

Train travel is popular today with visitors to mainland Europe. Being reasonably priced, a visitor can travel through the night and wake up ready to ski at any number of posh European destination resorts. Most trains traveling in the direction of a ski resort have special sections in a dedicated train car in which to hold skis. Traveling to Zermatt, Switzerland, for winter or summer skiing is only possible via train. This beautiful village at the base of the Matterhorn gets part of its charm from being in a car-free valley.

Trains, which are popular in Europe, offer an alternative and inexpensive travel option. Some ski destinations, like Zermatt, Switzerland, are accessible only by train.

In Europe it is still easy to travel to ski resorts by train, but this is not so in the United States. Train travel initiated many to skiing, but today it has almost totally disappeared. Even the famous ski train from Denver, Colorado, to Winter Park Resort, which started service in 1940, ceased operation after 69 years of delivering skiers to the Rocky Mountain ski resort, ending an era in the United States.

Packing

Traveling with ski gear requires some thought due to the amount of gear and its odd shapes and sizes. Packing efficiently is essential when going skiing. First there is what to take and then how to travel with it. The following are some ideas to make the travel less difficult. Also see the sample packing list. Though not a total list, it should provide you with a minimum to start with. Personal idiosyncrasies and needs will dictate exact amounts and exceptions.

- If traveling on an airline, ask your airline what constitutes a ski bag. There are ski bags that will hold one, two, or three pairs of skis. A small or large ski bag may or may not be a good way to travel. Should you divide up two pairs of skis, or should you travel with them in one bag? This will be dictated by the airline carrier.
- Strap skis with their bases together. You can purchase ski straps at most ski shops. This will inhibit them from sliding around and damaging the bases and edges.
- Pack ski pants, jeans, and other rugged clothing items next to your skis. This will help protect them in the ski bag.
- Be careful where you pack your poles in the ski bag. Composite poles can break when stored next to bindings with sharp corners.
- Protect pole tips from poking through the ski bag and items in the ski bag.
- Some ski bags have wheels, which can come in handy.
- There are companies that will pick up skis and other bags from your home and deliver them to your lodging destination. Check with UPS and Luggage Forward.
- Always carry your boots on the plane. This is the one piece of equipment you don't want to lose. Your boots should be intimate items that have been fit to your feet.
- Consider boot bags with heaters. They will make putting on stiff ski boots easier, not to mention more comfortable.
- If you carry your boots without a ski bag, Velcro one of the power straps to the other boot's power strap. This will make a convenient carrying handle.
- If you use a boot bag, put breakable items such as goggles in the boots.
- Wear your bulky ski jacket or fleece on the plane. This will save valuable space in your luggage.
- Ski gloves and mittens make nice padded protectors for MP3 players and cell phone chargers.
- Put sunscreens, lotions, and shampoos in baggies. With the reduced atmospheric pressure at altitude, these types of containers may explode in your luggage. Open them carefully the first time after you arrive at altitude.
- Pack clothes fabricated from synthetic, wicking, quick-dry materials so they can be washed in the sink and dried overnight. They fold up small and will reduce the number of items you need to pack.

Sample Packing List

- ☐ Skis
- ☐ Boots
- ☐ Poles
- ☐ Helmet or ski hat
- ☐ Goggles and sunglasses
- ☐ Sunscreen
- ☐ Ski jacket
- ☐ Ski pants
- ☐ Long underwear
- ☐ Turtleneck
- ☐ Sweater or fleece
- ☐ Ski gloves
- ☐ Ski socks
- ☐ Après-ski wear
- ☐ Passport

Conclusion

Ski areas are in special and often remote parts of the world. Far or close to home, travel to ski areas always presents challenges. Certain ski and travel essentials are required regardless of the length of the trip. Understanding and appreciating the travel options, as well as the variety of accommodations available, can make planning a ski trip enjoyable. Although planning what to pack is obviously needed, planning for what to expect is also useful.

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PART II

On the Slopes

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Getting Started: The Never-Ever Skier

Anyone who stops learning is old, whether at 20 or 80. Anyone who keeps learning stays young.

Henry Ford

The first time skiing is filled with new experiences. With so many new things going on, it can be overwhelming. To reduce the overload of new information, we will move slowly and methodically through the mechanics of skiing. Skills are improved by adding elements to preexisting skills. Taking small steps in an orderly manner is recommended. These small steps will build the foundation on which to keep progressing.

The true beginner is one who has never stood on snow with skis on. Notice the word *stood* is used, not *turn*, *skid*, or even *slide*. Just standing in skis on snow is difficult when it has never been attempted. Don't get disheartened and think that if just standing is formidable, the rest must be horrendous. Progressive steps will lead you to competency that will allow you to experience the excitement of skiing.

We start with how to put on equipment and then discuss strategies for getting acquainted with this new environment before we even get on the snow. Once on the snow, we cover specifics of the first descent, slowing down, the first wedge turn, and stopping. And just in case we need it, we cover how to get back up in the event of a fall.

Equipment

The new equipment will require some getting used to. Even carrying ski gear can be a challenge. Putting on boots, skis, and poles will take some instruction and then practice at just moving around. Some of this can be performed indoors, but the real challenge begins on the snow.

Carrying the Equipment

Carrying the equipment is a seemingly mundane task that can be easy or dangerous. With the bases of the skis together, the brakes will assist in holding the skis together. The brakes are the two short shafts protruding from the sides of the heelpieces of the binding. To get the brakes to grab each other, place the skis bases almost together, one ski higher than the other. As you bring the bases the last few centimeters together, lower the higher ski toward the lower ski. The end result is an overlapping arrangement of the brakes. In an uncrowded area, the skis can be carried on your shoulder, but in a lodge or tram loading area, they should be carried upright with the tips in the air.

To carry the skis on your shoulder, lift the skis onto your shoulder with the tails pointing backward (figure 7.1). With the skis resting on your shoulder, hang onto the front part of the skis with just enough counterforce to keep them in balance. Poles can be carried in the opposite hand, or if you have large enough hands or small enough pole shafts, you can use the hand on the skis to carry the poles between a couple of fingers. Sometimes this is just enough to get a door open or find your car keys. Be aware, though—a turn of the body can set the ski tails in motion and cause some damage. You don't want your skis twirling around in the parking lot like the blades of a helicopter, whacking other skiers in the head.

To carry the skis upright in a crowded area, use the fingers of one hand to grab under the toepiece of the ski that has the brake arms interlaced lower (figure 7.2). The lower one is grabbed because its brake will be supporting the other brake and ski. If you grab the wrong toepiece, the skis will start to slide apart. If that happens, just slide them back together and grab the other toepiece. For those with strong hands, another method is to grip both skis above the binding area. If the plate under the binding projects forward,

Figure 7.1 Carrying skis on the shoulder.

Figure 7.2 Carrying skis with the toepiece in a crowded area.

you will need a Superman grip due to the increased circumference. Either way, one of these methods should be used in crowded areas for etiquette and safety.

Your boots can be hung over your shoulder by their power straps. Taking one Velcro piece from each boot's power strap, mesh them together, making one long band connecting the boots. This can then be hung over your shoulder, or if shortened, carried like a bag. If you have a day pack, the boots can be hung over the pack left to right by the same strap arrangement.

Getting to Know Your Boots

Compared with most footwear, ski boots are heavy, bulky, and awkward, although it may be unfair to compare them with the footwear you have worn in the past since they are not designed for walking. Their job is to connect you to the ski and provide

support so you can balance and turn the skis. When sized and used correctly, they do an excellent job.

Ski boots are made of plastic. Plastic provides support, has longevity, and keeps out the elements. Plastic is also thermal sensitive, which means it becomes stiffer when it is cold. Ski boots are made with this sensitivity in mind, so their stiffness is optimal for skiing when they are cold. The bad news is, if you try to put them on when they are cold, it is difficult to maneuver into the plastic shell. A boot that is warm will not only be easier to put on but will not rob your foot of its heat after it is put on. A rookie mistake is to leave ski boots in the car overnight in preparation for the following day's skiing. Even during the drive, put ski boots in the passenger compartment, not the trunk or rooftop cargo box.

Most modern boots are of the conventional overlap shell design (see chapter 3, page 44). Pull the tongue forward and use both hands to open the two sides of the shell while sliding the foot into the boot (figure 7.3). The liner inside the shell contains a gel substance that will mold to your foot in time. Wiggle your foot around for a second or two to start moving the gel in the liner. This will move the gel out of the tight spots and into the loose cavities, making the fit custom and snug. Tap the heel of the boot gently

Figure 7.3 To put on your ski boot, open the boot shell with both hands while sliding the foot in.

on the floor to move your heel to the heel pocket of the boot. Starting with the buckles most forward toward your toes, put the bail into the first rung of the ladder and pivot the buckle. If there is no tension on the buckle, move up a rung. Continue up the boot, fastening each buckle in the same manner. Flexing your knees and ankles again, feel your foot moving toward the heel pocket. Finally, tighten the buckles by moving up the ladders. You do not have to achieve a final fit at this time; it is usually advantageous to be slightly loose for the first half hour or so. This will allow the gel inside the liner to move away from areas of pressure and fill in the voids. If you start off the day tight, the gel will not have an opportunity to move around, resulting in a less-than-custom fit. Don't be surprised if you need to retighten as the day proceeds due to the movement and compaction of the gel over time. It is not a bad idea to loosen the buckles at lunch so the gel can uncompact. Lastly, loop the power strap so that its tension is similar to the tension felt with the buckles.

Walking in ski boots is inevitable. Be aware that your ankle will not bend with the same freedom as in the shoes you are used to. Also, ski boots are slippery on manmade surfaces and areas of snow that have had lots of foot traffic resulting in ice. Many recreational ski boots have rubber toes and heel inserts. Even with these, ski boots are difficult and dangerous to walk in. Some entry-level boots and boots for randonnée skiing have a walking cuff that can be adjusted to achieve a more upright stance, making walking less difficult.

To walk, swing your leg as normal, with your heel touching the ground first. Roll to a flat foot, swing the opposite leg with minimal toe-off, and repeat. A common error is to try to walk flatfooted. To climb a hill of snow, kick your toe into the snow. Due to the stiff sole of the ski boot, you do not need much purchase with which to hold a step. Avoid overstriding by taking short steps up the hill. To walk across a hill, use the uphill edge of the boot, not unlike on the skis. Again, the stiff soles will provide an ample base in which to support yourself. Walking downhill, plod your heel into the snow to make a base of support for your step. In all cases use your ski poles as walking devices if you have them.

To gain some feel for the ski boots in a skiing mode, start by standing in the boots, body weight even between both feet, while flexing and extending your ankles. Move your weight from left to right, right to left, getting a feel for the boots. Now rotate in a circle. Small steps are the key because soon this same sequence will be performed with skis on, and skis will end up with crossed tips if large steps are taken. Be sure to rotate in both directions in preparation for turning on snow in both directions. Now walk across the room like a duck with your toes out. This is one of the methods (herringbone) used to climb slight hills. Then come back walking sideways, always pointing your feet in the

TECHNIQUE TIP

To get the feel of the wedge position at home, stand in stocking feet on a tile, linoleum, or hardwood floor and perform the wedge movement exercise. What is important is repetition and the feeling of rotating the heels out.

same direction, and repeat in the other direction. This method will also be used to climb up the hill (sidestepping). The initial phase of a ski turn is rotation of the feet, and the first movement to learn will be the wedge position.

The wedge position is just as it sounds, a wedge formed with the feet. The toes are together, forming the tip, while the heels are splayed out. How much they are splayed depends on the slope steepness, how much turn is required, and possibly braking. For now what is important is the movement of the feet from the parallel position to the wedge position.

Getting to Know Your Skis

A flat, smooth area is most desirable for putting on the skis. Without this terrain, the skis will want to go skiing with or without you being ready. If a perfectly flat area cannot be found, place the skis across the fall line, however minor (see figure 7.4). This way neither the tip nor tail will be tempted to seek the fall line. Perpendicular to the fall line, place the skis about 20 centimeters apart in a parallel fashion. Plant the poles in the snow about 10 centimeters outside the toepieces. You will use the poles as supports to assist balance.

Putting on skis is really putting on the bindings (figure 7.5). Bindings have a toepiece and heelpiece just like a foot or boot. Walking on the snow will often result in snow adhering to the boot sole. To remove the snow, stand facing the same direction as the skis are pointing while straddling the downhill ski. In this position you will be putting on the downhill ski first, which is a good rule of thumb to remember. Using the uphill pole for stability, lift your downhill foot and give it a hit with the downhill ski pole. If this doesn't release the unwanted snow, knock it against the other ski boot or drag it across the buckles. You can also lean over while flexing your leg and use the pole tip to poke the snow away. Once the snow is removed, try not to put the foot down in the snow; instead, immediately slip the toe of the boot into the covered notch on the toepiece while aligning the heel with the direction of the ski. Position the heel of the boot over the heelpiece of the binding. Stepping down firmly, you should hear and feel the click of the heelpiece. Without this click you cannot be sure the boot is correctly

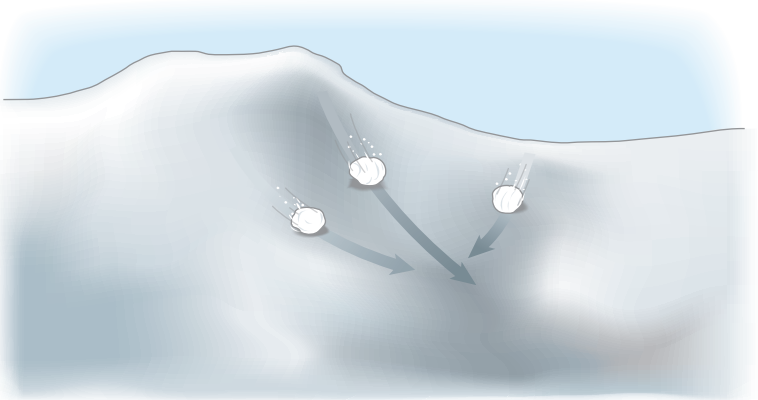

Figure 7.4 The fall line is the direction a ball would roll down the hill.

Figure 7.5 Putting on the skis is easy when you follow a few simple cues. Slip your toes in, center the heels, and step down.

in the binding. We could put on the other ski next, but instead let's get familiar with moving around on snow.

Pick up both poles by the grips (don't worry about the straps at this time). Start by just sliding the ski and walking and pushing with the free foot, as if you were on a scooter. Gradually increase the glide distance on the ski by using the poles as pushing devices, trying not to overly rely on them for stability.

Turning around so you can return to the starting place is accomplished with the same small steps you learned when you only had your boots on. Although there is still no opportunity to cross your tips, you want to practice the rotational movements that will pay benefits when you do have two skis on—that is, taking small steps. This gliding on one ski will pay dividends when you put the second ski on. You have now learned the feeling you will have on skis. Your progression is not unlike that of children when they learn to ride a bicycle with trainer wheels.

Before stepping into the binding of the second ski, reposition both skis so they are perpendicular to the fall line if needed and reposition your poles out from the toepieces. Enter the second ski just as before, knowing that once it is on, it will become slippery.

With both skis on, perform the same maneuvers as before, although the scooter turns will be limited to forward ambulation. Taking small steps will reduce the out-of-balance feeling, which results in novices taking erratic corrective steps. These uncontrolled steps work on the city bus when you are jolted but only result in crossed skis on the snow. Balance should come from the ankle, and when small steps are employed, this difficult assignment will be easier.

Getting to Know Your Poles

Poles are grabbed by the grips, and that is usually enough information to start. The strap is not obligatory, especially at this beginning level, but some may want to put it on. To put on the pole strap, slide the hand up through the strap (figure 7.6). With the strap between the index finger and thumb, grab the pole grip. One of the advantages to using the pole strap is that the wearer is not concerned with a tight grip in fear of losing the pole. When using the strap, your grip can stay loose. When the hand is too tense, that tension tends to carry on through the rest of the body, which is not conducive to good skiing. If the pole becomes dislodged, it is easily retrievable with a slight flick of the wrist. For more information about poles, see chapter 3, page 50.

Stance

The basic skiing stance is with skis about hip-width apart, knees over toes and weight distributed evenly between the two skis. Ankles are flexed with the shins in contact with the boot tongues to enhance fore–aft balance. While standing tall (but not stiff), the back will be slightly rounded with hands held wide and in front of the torso as if carrying a wide lunchroom tray.

Stance is an important component of skiing. Many critics believe that if stance is highlighted, students will assume some sort of military at-attention attitude, resulting in a stiff posture. Although this may have some basis, the reality is that if skiers do not

Figure 7.6 Putting on a pole strap. Slide the hand up and grab the strap and grip.

TECHNIQUE TIP

Poles at the beginning level are used not so much to hold up the skier but to give a sense of where the body is in space, or kinesthetic stability. Some ski instructors find that more students are successful when poles are left behind. This is usually the case with children, although most adults will use the poles because they do afford that extra sense of balance.

have some sort of reference of correctness, the body will move in a haphazard fashion without objective.

The body has inherent reflex mechanisms that return to their original positions after being stretched. This starting position or reference of correctness is the basis of postural balance. Without the reference cues, the body will not have a home base to come back to. This concept is important at this level because it will set the stage for more advanced skiing. Since skiing is performed on a slick surface, balance is constantly challenged. The basic posture and stance that are learned now will carry over into all levels and aspects of skiing.

Climbing

To go down the hill, first we must go up. For a beginner, this implies climbing up the hill. This may seem nonsensical in this age of chairlifts and tramways, but the reality is that it also has learning implications. There are two ways to climb the slope: herringbone and sidestep. These manual climbing methods not only get you up the slope but also deliver experience that will make the ski a less awkward and more natural extension of the body. Just as children need to learn where their body is in space, skiers with extensions on their hands and feet need to learn spatial awareness. A baby does not learn how to feed herself in a few meals. She learns by awkwardly picking up the spoon and wildly directing it near her face. With many meals of practice, it gets slightly better each time—each meal is a learning experience. The same is true of movement on skis. The more trials and novel experiences that the skier encounters, the better the skill will be acquired. Unfortunately, like the child learning to feed herself, it does not happen overnight. Many days, weeks, and months may be required just to see some advancement. This does not mean the skier is a slow learner. Sometimes it is choice of experiences. Novel experiences that challenge the skier will go a long way toward developing the spatial sense that is so important.

Herringbone

The herringbone method starts by facing up the hill. Splaying the tips very wide and keeping the tails relatively close, the skier walks up the hill, leaving a herringbone pattern in the snow. The key is the inside part of the foot. Step so that your arch is moving toward the snow. As a result your knees will be drawn together. With your weight on the inside of your feet and your knees close together, or knock-kneed, the skis will be on their inside edges. In this stance, these edges penetrate the snow and provide grip for the walking ascent. Moving the poles with each step facilitates balance.

Sidestepping

Sidestepping is another method to ascend the slope (figure 7.7). Position the skis across the hill, or more specifically, perpendicular to the fall line. This is difficult because if they are not exactly perpendicular, the skis will want to go down the hill in whichever way they are biased. Sidestepping may take some trial and error, correcting with small steps until the skis achieve a more perpendicular position to the fall line (refer back to figure 7.4). With that accomplished, tip the knees toward the hill. This will encourage the uphill edges to bite or penetrate into the snow, manufacturing a stepping platform in which to step sideways up the slope. The key is staying perpendicular to the fall line. Imagine the hill as having long steps like the steps up a capitol building. Stepping up one step at a time sideways will create the desired result. You can use the ski poles to assist with balance by planting the uphill pole in the snow at the same time as the uphill ski is stepped and the downhill pole at the same time the downhill ski is stepped.

Figure 7.7 Sidestepping requires the skis to be perpendicular to the fall line.

Going Downhill

Now is when the wind will be in your face. This not only sounds exciting, it may offer a cool relief from the physical effort of trudging up the hill. Ideally the hill you are on has a flat area at the bottom, and even better, a slight rise after that. This type of hill will allow you to come to a natural stop. If you are not fortunate to have this flat area at the bottom of the hill, skip ahead to the technique tip on page 115. Ideally, it is best to perform a straight run first, but if you are without a flat area to stop, it is possible to skip the straight run and learn the braking wedge to slow down and stop. The good news is that less hill climbing is involved, but initially it will prove a bit more difficult. Ideally, we would like to isolate the skills of the straight run (keeping the skis running straight) and wedge (holding the skis in the wedge position) before adding the skill of pushing the skis out into a wedge from a straight run, but eventually we would end up there anyway.

Bullfighter Turn

To face down the hill, do the bullfighter turn. From the sidestepping position with your skis across the hill, make sure you have a comfortable perch on the slope. Slide your hands from the pole grips to the tops of the grips. Turn your upper body so it is facing

down the hill. Reach out and downhill with the poles, placing them firmly in the snow like a matador addressing a bull. With your arms straight and in line with the poles, step your skis around with small steps until they are facing straight down the hill. Your poles and ski tips should be about in line and at the same level on the hill. Since your arms are straight, it should not be too much effort to hold yourself, although as soon as you feel you are in balance with your skis (remember the stance, page 110), you are free to start down the hill in a straight run.

Straight Run

From the bullfighter position, step your skis to a parallel position until they are aiming straight down the hill (figure 7.8). Let gravity take over and allow the poles to pivot forward. Move your hands from the tops of the ski poles and grasp the pole grips. This will allow your hands and arms to assume the lunchroom-tray position as the pole tips come out of the snow. Make sure the pole tips are behind your body and pointing backward. Staying flexed in the ankles and knees will permit you to stay balanced between your toe- and heelpieces. A slight lean forward should be felt; you want to keep up with your skis. If you could watch yourself from the side, your general body position would be perpendicular to the hill.

Congratulations—you have just skied!

Figure 7.8 Straight run down the hill with joints flexed, hands in front.

First Wedge

Using the bullfighter start position, step the skis around until they are in a wedge position. Standing in the bullfighter position, you will need a bit more edge to hold onto the slope. This is achieved by bending your knees forward and slightly together. When you feel balanced between the bindings, separate the knees slightly. As before, a slight forward lean should be felt so the skis do not leave without you. The wedge is not a passive position; you will need to keep pushing the tails apart as you glide down the hill. Another challenge is keeping the tips relatively close together—not too close or the tips will be in danger of crossing, and not too far apart or the wedge will be lost. There is no exact distance required between the tips, but about 10 centimeters (4 in.) is in the ballpark.

Straight Run to a Wedge

When performed in the boots only, the wedge is an action that has the heels pushed out (figure 7.9). With the skis on, their length will push the heels out even more, and your legs will have more spread than when the wedge was performed in place. We will refer to the parts being pushed out as the tails, because with the skis on, it is the tails that are being pushed out.

Before heading up the hill, it is best to feel what it takes to brush the tails out. Standing in place with poles out at the sides in the snow, brush the skis out as if you were trying to push up a mound of snow.

Figure 7.9 Wedge skier with tips close and tails being brushed apart.

Back up the hill in the bullfighter position, start this time in a straight run as performed previously. This time while gliding down the hill, brush the tails out into the wedge position. You have just made a wedge while skiing down the hill. This skill, which involves the rotational movements of the wedge, will be valuable when you start to learn to turn.

Wedge Changeup

Because making the wedge while going downhill is so important, we will add another step to hone the skill. This is exactly the same as before when you made a wedge after starting in a straight run, but after the wedge is made, you will come back to the straight-run position: straight run, wedge, straight run, wedge. Keep practicing this variation until you can do it on command. Try moving in and out of the wedge slowly and quickly. Change to steeper and shallower hills to alter your pacing. If a sidehill slope is available, give it a try. The goal is not just doing the wedge and straight run but the action of separating the ski tails and rematching them. This skill will become important as you venture into turning.

TECHNIQUE TIP

The braking wedge is used solely to slow down or stop. The main difference between the gliding and braking wedges is the intensity of the mechanics. The tail splay will be wider in the braking wedge, which increases the angle between the edge of the ski and the snow. This creates greater friction, which will slow the skier down and make it more difficult to turn.

A braking wedge can be quite useful. Advanced skiers can be seen using the braking wedge to slow down when entering lift lines and in more harrowing situations such as at the top of a high cliff or cornice before jumping off.

After a Fall

Falling down is a reality of skiing. Some falls are dramatic while some are no more than a sit in the snow. The first thing to do after falling is to take note of your physical condition. Most falls are simply an inconvenience, but some are more serious. In the event of a dramatic fall, don't just hop up; take inventory of your condition first. When in doubt, summon the ski patrol. Next, where did your equipment end up? Ski bindings are designed to release when they have encountered a large torque such as a fall. This means your skis may or may not be near your stopping point. In the event of a yard sale, or a fall where a noteworthy amount of equipment is strewn about the slope, you may need the help of friends or passersby to help gather your gear.

If your skis stay on after a fall, you may end up in an awkward position. Take note of where your extended limbs ended up. Many times taking the poles off will untangle the mess enough for you to work through the tangle. Either way, you will need to work your way around so the skis are downhill from your body and perpendicular to the fall

SAFETY TIP

Here are some ways to summon the ski patrol:

1. Cross the skis (stick the skis in the snow, making an X out of them) above the skier in need (see photo).
2. Call from an on-hill phone.
3. Ask a passing skier to relay a message to the lift attendant.
4. Use your cell phone to call the area and ask for the ski patrol.

Possible injured skier is only moved by the ski patrol. Skis are crossed to warn upcoming skiers that there is an emergency.

line. This may involve a couple of wiggles, or you may find it advantageous to roll onto your back or stomach with skis above and then place them below your body. Skiers get most frustrated when they try to hurry and end up in a fight with their equipment and the hill. It is rare that a skier cannot untangle himself.

After a fall, your skis may still be on your feet. This is probably not a deficiency of the ski binding, assuming it has been examined and adjusted by a certified binding technician; it probably just did not encounter the torque necessary to release.

After the skis are positioned downhill or below your body and are perpendicular to the fall line, you should be in a sitting position. Hold one pole (or both) in front of you and stick the tip just uphill from you while gripping the pole shaft just above the basket. Place the downhill hand on top of the grip. The goal now is to get your body over your feet. Work your feet up under your rear end as much as possible. Using the poles for balance and as a pushing device, use your legs to stand up. If the skis were perpendicular to the fall line, this should not be too difficult. If the skis slide forward when you try to stand up, reposition the tips slightly more uphill.

After a dramatic fall, you may need to put on one or both skis. The advice presented earlier about putting on skis still holds true, but with a couple of added cautions. First, the spot where you will put the skis on may be steeper than at the base area. Aligning the skis perpendicular to the fall line is essential. Second, because of the steeper slope you may have to work the ski into the snow to make its purchase as level as possible. Remember to put on the downhill ski first and use the previously mentioned tricks to remove snow from the boots (page 108).

Conclusion

Donning ski equipment for the first time can be intimidating. Understanding the idiosyncrasies of the ski equipment along with initial skiing movements goes a long way when starting out. Movements are easy when the user understands their peculiarities. Using progressive steps to advance from shuffling to the wedge position is an achievement. This mastery should be exciting and bring confidence to the beginner. With efficient body movements, the new skier will feel more comfortable on the skis and on the slope, gliding down the hill with poise and control in no time.

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Wedge Turn

The purpose of education is to teach one how to think, not what to think.

Manly P. Hall

Turns are the essence of skiing. Postcards and movies show streams of spindrift trailing skiers midturn. Turns are what separate skiing from a free fall down the hill. Careening down the hill on a sled is exciting, but the thrill is short lived. Making turns in the primitive environment of snow and mountains that is ruled only by gravity stimulates a basic human instinct. Controlling the powers of gravity in an environment that is hard to stand up in at best leads to a satisfaction like no other. Although it would be presumptuous to say the mountain has been tamed, it could be said that one has entered and played with the mountain on its own terms. The ski turn is the method that allows us to experience this intimate relationship with nature.

The sensation of linking turns creates an emotion like no other. Linking turns that mirror each other creates an aesthetic dance with tempo and proportion that delight the senses. These linked turns are pleasing to watch, but it is the skier who gets the most enjoyment from them. The skier is like the painter, with skis taking on the role of paintbrush and snow the canvas. Searching for proportionality and balance, the artist finds her elixir in her craft. There is not a skier leaving symmetrical linked arcs down a fresh powder slope who cannot wait to look back up the hill at his track and enjoy them a second time.

Making a ski turn is a major advance. This is not because it is difficult, because it isn't, but because it will open up a new opportunity on the ski slope. Without turning, you would careen uncontrollably down the slope. By turning, you will be able to ski the terrain accessed by the chairlifts. The mountain will gradually open its doors wider as your skills progress.

Before your first turn, you experienced the thrill of movement down the hill, one turn, and stop. This is exciting, and you have learned more than you may think. At first blush you probably think you only know how to go down a short hill with skis straight and in a wedge position. Though this is true, it would be like trying to describe a book by only looking at its cover—there is a lot of information hidden under that

TECHNIQUE TIP

Balancing while skiing is a dynamic activity. If your skis jet forward a bit faster than anticipated or even a bit faster than they had been traveling, your body has to react. It has to recenter itself or you will look like the cartoon character that just slipped on the banana peel. This may have happened to you on your first attempt. It might have even happened on the second attempt, but what you are learning is how to create equilibrium within your system. You cannot learn balance by being in balance. You only learn balance from being out of balance and regaining that balance. If you are in a wedge and one of your skis encounters a bit more snow than the other, resulting in it slowing down relative to the other, you have to shift your weight ever so slightly. As your skill level increases, these small perturbations will become unmomentous and eventually you will disregard them cognitively. This is an indication that your body has learned well enough that a cognitive response is not needed because you have developed an automatic reaction in response to the disturbance.

cover. Just balancing while sliding down the slope contains more muscle actions, more neurostimuli to the muscles, and more coordination between the muscles than could ever be described.

Combining Rotation, Edging, and Pressure

So far you can perform a straight run, wedge, and wedge changeup. During the wedge you probably found it difficult to go exactly straight down the hill. Your straight run might have even had a bit of turn to it, although not of your own volition. What made the ski turn? For starters, you might have rotated one leg a bit more than the other. Or, you might have had a bit more edge angle on the turning ski. Or lastly, you might have had more body weight directed to the outside turning ski. These three movements make up the three skills of skiing: rotary, edging, and pressure. Combining them will be our ultimate goal (figure 8.1), but for the sake of simplicity we will keep them relatively separate in our explanations. Later, combining them will become very important.

Rotating one ski in the desired direction more than the other ski will facilitate a turn in that direction. This is not much different from turning the steering wheel in a car, although this car has two steering wheels. If one is turned more, the vehicle (you) will be biased in that direction. We emphasize the outside ski in the turn as the dominant ski, but the inside side also has a role in the turning process and should not be forgotten.

Figure 8.1 Wedge turn showing edging and pressure.

Turning the ski in the desired direction will only work if it has some grip with the snow. **Edging** skills are used to tip the ski onto its edge while the ski is moving sideways. This creates friction between the edge and the snow. Like a butter knife on toast, this friction will either slow the ski down or result in the ski altering its direction.

Finally, there needs to be weight or **pressure** against the ski and ski edge. This is accomplished by shifting body weight from foot to foot. Without pressure the ski can be pointed in any direction and it will not turn. This is similar to a truck on snow, its rear wheels spinning and spinning if there is not enough pressure on the wheels. In winter, truck owners put sandbags and other heavy items in their truck beds to give them the needed pressure against the wheels. Then when the wheels turn, they will engage with the snowy road surface.

When these three skills (rotary, edging, and pressure) are combined, the result is a coordinated ski turn. Getting these three skills in the right proportion at the correct time is the goal. You can do one or even two skills perfectly, but without the third, the turn will only be a deprived rendition. When all three are in harmony, the synchronization results in an incredibly efficient ski turn.

Rotating the ski is easy when the ski is flat against the snow. If it is overedged, the ski will not be able to rotate. Conversely, if the ski is underedged, the rotated ski will just slide sideways and there will be no turn. Even if the ski is rotated in the new direction and it is edged exactly, it will not turn unless there is some pressure on the ski. It is the combination of these three skills in the right amount that creates the recipe for the ski turn. The challenging aspect of skiing is that every situation requires a slightly different percentage of each skill.

TECHNIQUE TIP

Let's clarify a term first, then we can start turning. A left turn will be a *right-foot turn*. Sounds backward, doesn't it? When making a left turn, the right foot is doing the lion's share of the work; therefore we have a right-foot turn.

Completing the Turn

Now that you have mastered the wedge–straight run–wedge (wedge changeup) combination, it is time to make some intentional turns. On a low-angle hill, the same exercise will be performed with only a slight modification. Remember the unintentional turns? Those were caused by steering one ski more than the other, edging one ski more than the other, or possibly putting a bit more pressure on one ski relative to the other. Most likely it was some combination of these, but the important thing is that now we are going to incorporate these unintentional movements by doing them on purpose.

Going down a low-angle hill, make the wedge. Say you want to make a right turn. This will be a left-footed turn, meaning the left foot will be the dominant foot or ski. Both skis will be steered to the right, although the left ski will be the primary workhorse. Flex the ankles and knees while tipping the left or outside ski up slightly on its inside

edge, or your big-toe edge. The inside (right) ski will also be on its inside edge but with less edge angle against the snow. To achieve this slight edge, move the inside foot toward the little-toe side, keeping your knee over the ski. (Eventually you will want to make the ski flat against the snow, so the less edge, the better.) Meanwhile your weight is shifted slightly toward the outside (left) ski. This is your turn. The longer you continue the turn by steering, edging, and pressuring, the more it will take you out of the fall line. Continuing the turn will eventually take you out of the fall line, and you will gradually slow down and stop.

Angulation

Creating edging and pressure causes the body to do two differing actions. To edge the skis, the legs must be tipped to the inside of the turn. To pressure the outside ski, the upper body must lean toward the outside of the turn. The result is the body going two different directions. This is angulation, a comma or *C* shape of the body (figure 8.2). Because there are not great forces in a wedge turn, angulation is only slightly present. As forces become greater as skills progress, this angulation will increase. Since it is assumed you eventually want to advance beyond a wedge turn, the concept will be presented here.

Because of these two differing actions, angulation is not unlike rubbing your head and patting your stomach at the same time. With angulation you are leaning in and

Figure 8.2 Angulated skier. Notice how the lower part of the body is to the inside of the turn while the upper part of the body is to the outside of the turn.

leaning out. Edging is in and pressure is out. When you go around most curves, you lean your body to the inside of the turn as you do on a bicycle. This is similar to when children play airplane and naturally lean their wings and body into the turn. With these natural responses, it is not surprising that the body wants to repeat this action when skiing. Leaning out away from the turn or curve goes against our internal makeup.

Leaning out away from a turn is not only unnatural, it is also precarious. Humans have an internal survival mechanism, a subliminal cue that says don't lean down the hill, lean up the hill. Though this is a good rule of thumb for hikers, climbers, and mountain goats, it is inefficient when the ski needs to be pressured. A little voice inside the head is telling the body that it would rather fall up the hill because it is closer than falling down the hill, which is farther away and more precarious. This dichotomy haunts skiers no matter how skilled they become. Still, they tip the lower body toward the inside of the turn and the upper body toward the outside of the turn. For common problems and their solutions, see table 8.1.

Table 8.1 Common Problems and Solutions

Problem	Solution
The ski will not rotate.	This may be due to an overedged ski. What you want to do is make the ski flatter against the snow. Move your knees apart so that they are more over your boots. Decreasing the wedge size may also help.
The ski is pointed in the desired direction but there is no turn.	Increase the edge angle by moving the knee in slightly. Or, shift your weight slightly to the outside ski.
It is difficult to edge.	Focus the edging movement on the ankle. To do this, first analyze your stance. Are your ankles and knees flexed? Could you jump up and down from this position? Adjust your stance accordingly and practice making the edging movement while standing still.
You end up overturned or facing uphill.	The upper body is contributing too much; ideally, it should appear quiet. Emphasize turning with just the legs. Force the lunchroom-tray position such that the tray is always downhill from your body.
You fall backward.	Keep shin contact with the tongue of the ski boot by increasing flexion of the ankles. The goal of the stance is to keep the body more or less perpendicular to the hill. Keeping shin contact will encourage the upper body to maintain this perpendicular posture, keeping up with the constant forward motion of the skis. Along with the ankle flexion, the hips and torso need to follow and move forward at the same time. Sometimes pushing the hands forward can help, but this should not be relied upon to solve the problem.

Linked Wedge Turns

After one turn comes the beauty of skiing: linked turns. If you found going down the hill exciting, you will find linking turns together stimulating—truly one of the joys of skiing.

Now that you are able to turn across the hill, we will add just one element: a weight shift, or to be more descriptive, a weight transfer, since we will transfer the weight from one outside ski to the new outside ski (figure 8.3). All three main skills of rotary, edging, and pressure will be present in the ski turn. Here we will concentrate on just the weight transfer, which is a pressure skill.

Figure 8.3 Weight transfer in the wedge turn.

TECHNIQUE TIP

Learning to flatten the old outside ski during the weight transfer will pay huge dividends when you get to parallel skiing and will even open the door for advanced skiing. This release timed simultaneously with extension of the new outside leg is termed a *directional movement*. The end result is the body moving down the hill in the direction of the new turn. To some it will feel like a falling action. To judge how you are doing, check your ski tracks. Check out your track from the end of one turn to the beginning of the next turn. Is there a clear single line in the snow from the edge of the ski? Or is it a smooth, smeared track like butter spread on bread? The smeared track is the desired track. This track lacks the edge set in the snow and is replaced with the aforementioned directional movement.

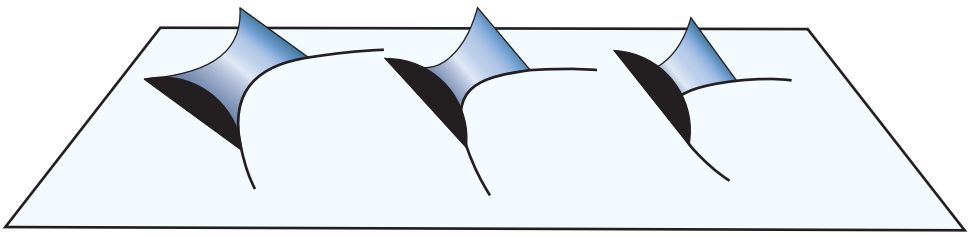
At the end of one turn, extend with your outside ankle and knee to facilitate the transfer of weight from one ski to another. This can first be tried standing in place while in a wedge position. As you extend from one ski, the weight is transferred to the other ski. This should be a smooth transfer that initiates the rotation of the new outside ski and gradually edge engagement.

All of these steps have been presented as if they were performed once and mastered. This is never the case. It takes many repetitions to master each step. When should you move on to the next step? When you feel comfortable performing the task and feel you could do several repetitions successfully. You don't have to do everything perfectly, but you do have to do it a lot. Although there is temptation to move to steeper slopes, these skills will be learned and mastered much easier and faster on green slopes. Moving to steeper terrain will result in nonproductive movement patterns detrimental to future development. For example, on steeper slopes there will be an urge to get the turn completed quickly by rotating or pressuring the ski unduly fast in response to the steeper hill. This creates an *L* or *Z* turn shape, which is hard to manage and usually has undesirable consequences. Shallower terrain will allow you the time to blend the skills in a more productive fashion, producing a more desirable rounded or *C*-shaped turn.

WHAT IS SKI FLEX?

Along with the skills of rotary, edging, and pressure a ski turns due to its flex and sidecut. Flex is how the ski flexes or bends. You can feel this flex by holding a ski upright with one hand on the tip and the other hand on the binding area. Pushing the midbody of the ski will bend the ski into reverse camber, which is what happens when you pressure the ski during a turn.

It takes more than just flexing. We already mentioned the sidecut in chapter 3. This is the hourglass or bow-tie shape of the ski: wider at the tip and tail and narrower in the middle. When the ski is tipped up on its edge and pressured, the ski flexes and the sidecut contacts the snow surface. It is this relationship between the edging and pressuring that causes the ski to turn.



Sidecut and flex conforming to the terrain, making the ski turn. As the ski is edged or flexed more, the radius of the turn decreases.

Reprinted, by permission, from R. LeMaster, 2009, *Ultimate skiing* (Champaign, IL: Human Kinetics), 26.

Chairlifts

At most ski areas, once you can make a rudimentary linked wedge turn, you are ready for the beginner chairlift. Chairlifts are devices used to ascend a hill, and they come in many forms. Originally they had one seat or chair. These are all but impossible to find

today. Many beginner chairlifts have two seats, although there are some with four. Either way, the technique to get on the chair is similar (see figure 8.4).

Beginner chairlifts are usually short and lead to gentle terrain. One way to tell if you are ready for the chairlift is to watch the skiers coming down. Do you see any who ski like you do? Don't worry if some are better; you want to see if your ability is appropriate for that chairlift. Once you determine that your skills are enough for the chair, scope it out a bit. There will be some routes down that are easy and others that are more difficult. They will most likely all be green runs, but some will be easier. Just like the technical ski progression, terrain can present a progression also. On the beginner lift, the progression will be flat to steep.

Figure 8.4 When loading the chairlift, point the skis straight and hold the poles in one hand. Sit down like you sit in any chair.

Chairlifts provide an easy way up the mountain, saving energy and increasing skiing time. Learning how to use the chairlift safely is important. Some ski areas will have a teaching chair that hangs somewhere around the base area. In lieu of the teaching chair, you can still learn safe loading and unloading. At the loading area there may even be a sign laying out general strategy for loading. Also, there will be a live operator to assist you if needed. Follow these steps to get on the chairlift:

1. Start by watching other skiers load the lift.
2. Watch how skiers shuffle their way up toward the lift.

3. Find the spot where skiers wait for their turn to move up to the loading spot. This could be a couple of posts, a line in the snow, or even a mechanical gate or red and green traffic light. This is where you will stop and wait for the chair in front of you to pass.
4. As soon as the chair passes, your time starts and you move up to a line in the snow or cones at the side by shuffling your skis and pushing with your ski poles.
5. On the line, put your poles in either your inside or outside hand. This will be determined by the bar that holds the chair. If the bar is on the outside of the chair, you will hold your poles with the inside hand. If the chair has a center bar, hold your poles with your outside hand. This will permit the free hand to grab the bar, helping you to your side of the chair.
6. If the chair is a four pack or six pack, meaning that four or six skiers ride one chair, watch where the chair divisions or individual seats are on the chair in front of you when you move up to the line.
7. As the chair comes, keep your skis straight in line with the direction of travel.
8. When the chair arrives, sit down as you would in any chair.
9. Make sure your ski tips stay up so they don't catch anything on the loading ramp.
10. Once in the air, sit back and enjoy the ride.
11. As you approach the unloading ramp, take notice of where you will be standing up. If this is not obvious, you will be standing up when the ramp gets flat right before it gets steep.
12. Approaching the ramp, keep your skis straight and tips up.
13. Stand up at the marker or on the flat ramp as indicated by leaning forward and pushing your hands forward.
14. Stand up as if you were getting out of a lawn chair.
15. Keep your skis running straight down the ramp.
16. Straight ahead will be a flat area where you will come to a gradual stop.

SAFETY TIP

Some chairlifts have footrests and safety bars. Many beginner lifts don't have these features. If the lift has a bar, extra caution should be used when lowering or raising the bar. Before lowering the bar, make sure everyone on the chair is prepared for it to come down. This means that everyone is back and square in the seat. Also, arms should not be sticking out to the sides or residing on an armrest because they could be pinched when the bar is lowered. Without moving in the seat, reach up and pull the bar directly down. It should be relatively effortless and it will stop on its own. Before unloading, reverse the procedure. If there is a footrest, make sure all riders have removed their skis and are ready to raise the bar while maintaining a quiet seated position.

If you drop a pole or a ski comes off during the loading process, don't fret or change your loading procedure. The lift operator will send it up on one of the chairs behind you. If it is your pole, this should be no problem unloading. If it is your ski, the lift operator is trained to call up your chair number to the lift operator at the top. This top operator will slow or stop the chair and help you off. Just in case your chair number was not called up, you can start signaling by waving and pointing to your boot that is missing the ski. The final plan would be to try to ski off on one ski. Since this would be a novel task for you, it probably would end up with you on the snow. Hopefully you would at least travel far enough to get out of the way of the moving chairs before falling down. Just stand up as before, keep your unshod foot off the snow, and recenter your weight to the foot that still has a ski.

If you misload on the ramp, the lift operator is trained to stop the lift, but even the best operator may take a second or two to react. With this in mind, prepare for the upcoming chair either by moving out of the path of the oncoming chair, or if you have fallen, by lying on the ground as low as you can so that the chair can pass over you.

Conclusion

Going from a straight run down the hill to making a turn and linking it to another turn is a worthwhile accomplishment. With these skills, the skier can ski most green runs on any mountain. This means many chairlifts will open more slopes to explore and practice on. With practice, your skills will continue to refine and blend.

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CHAPTER 9

Christie

Scheeing iss not a schport, it iss a vay of life.

Otto Schniebs

A christie, sometimes spelled *christy*, is the phase of a turn where both skis are parallel, positioning them on corresponding edges. The skier is on the edge that is in line with one big-toe side and one little-toe side (figure 9.1). In the wedge position we have been on opposing edges, or the two edges toward the inside of the skis (the big-toe sides) when looking down at them.

Figure 9.1 Parallel skis on corresponding edges.

The goal of this chapter is to become skilled at the christie. Although presented here in the progressive learning order, these skills could be valuable for any skier. Many advanced skiers have reached a plateau in their skill progression due to lack of edging skills. This is extremely prevalent today with carving skis. Carving skis have led many to the delusion that edges are either engaged or not. If carving is black and not carving is white, skidding is gray. It is having control of the intermediary amounts of edge angle that is essential. Skiers who have only one turn are only able to ski one type of slope. This skill will allow you to vary the size and speed of your turns, opening the entire mountain to you.

Weight Transfer

Getting the skis pointed in the same direction is an essential part of the christie. This parallel position of the skis is an obvious goal of many skiers. It would seem we should start with a rotary movement to reorient the skis from their initial wedge. Twist the foot

and turn it in the intended direction—seems simple enough. A case could be made for this logic, but if the ski is not free to rotate because there is too much weight on it or too much edge, then all the rotary power available will not budge the ski. We need to set up the ski so it can rotate.

During the wedge turn, you shifted your weight to the turning ski. This was further embellished during the linked wedge turns when you shifted your weight from one outside ski to the next outside ski. It is this outside ski that did the turning. The inside ski during the wedge would appear to be opposing the turn since it is not headed in the direction of travel, but the role of the inside ski role is to provide balance and to be angled in the direction of the upcoming turn.

So why even bother to do a wedge? If it is the outside ski that is so influential, why not just line up the skis parallel? It has to do with balance. When you draw the outside ski in and create the narrower parallel stance, side-to-side balance is overly challenged and the skier will fall sideways. The wedge position establishes a wider base of support so the skier can stay up. Remember earlier when we talked about the things your body was learning that couldn't be seen and all those small muscular and neuromuscular actions that the body had to do to stay upright? Through repetitive practice, the body has learned balance. If sufficient practice has been performed, the body will have learned and will be better able to balance.

The inside ski during the wedge did no more than act as a strut for support. This allowed you to stay up long enough to challenge your balance and learn to make the corrective maneuvers to stay upright. The inside ski of the wedge is similar to the training wheels on a child's first two-wheel bicycle. These training wheels give the child time to learn to balance. As the child becomes more and more astute with balance, the parent raises the training wheels to further challenge the child's balance, and soon the child does not need the training wheels. The wedge with its inside ski acting as a training wheel has its influence gradually reduced via the weight shift. Gradually more and more weight is transferred to the outer ski, and the inside ski is less involved in maintaining balance. Eventually you could just pick up the inside ski and set it beside the outside ski. Though this is not a suggested strategy, the point is made. When the ski is light enough, it will want to line up with the outside ski. As we move on, we will see how the other two skills, rotary and edge, play into this equation, but for now let's look at some methods to transfer the weight.

Balance

Weight transfer is possible when the skier is in balance. A key to balance is starting with the right joints. If you watch beginner skiers, they are bending at the waist and throwing their arms around in circles. Meanwhile the expert skier appears quiet in the upper body. So how does this virtuoso balance?

Balance is achieved when the skier's center of mass is over or in line with the base of support (figure 9.2). Center of mass is the central balance point of all your mass or weight. The skier's base of support is the skis. The longer the skis or the wider the stance, the larger the base of support, and the middle of this base of support has the most room for error. Therefore, think of the base of support as the skis and the binding area as the best place to center your balance and stand on the skis. Skiers will use the tip and tail of the ski when balance is challenged, but not as a place to concentrate their balance during normal posture.

Figure 9.2 Note the wide stance, which widens the base of support, while the center of mass is over the base of support.

When skiers are sliding on the snow surface and the center of mass is in line with the base of support, there is no loss of balance. When the skis speed up or slow down, the center of mass moves back or forward relative to the base of support. If the skiers bend at the waist or swing their arms, it does little to alter the position of their center of mass, although if the ankles are involved, the upper body is pivoted fore or aft as necessary to regain balance. This explains why the expert skier's upper body appears to not move—he is using his ankles to regain the momentary loss in balance. Novice skiers sometimes assume that since they are in a stiff plastic cast, there is no movement and

CONSUMER TIP

Good ski boots have high, stiff backs or spoilers. The spoiler is not meant for technique. It should only be used when you get thrown backward in the backseat—that is, when this high spoiler is available to assist you in levering forward and regaining balance. A good skier might go all day without ever needing the high back of the boot.

the boot is only for support. A stiff boot does offer support, but it should not be relied on for this exclusively.

Good boots also have hinges located on both sides of the ankle joints. These should be used, and used a lot. This hinge design allows the boot to flex just like the skier's ankle. Since the ankle joint is so important for balance, designers constructed a boot that would mimic the ankle joint (figure 9.3). The bottom line is, the ankles are joint number one for balance. Any exercise that promotes flexion and extension of the ankles is key in learning and improving balance.

Figure 9.3 The ski boot is designed to flex at the ankle to enhance balance.

Balance Exercises

Skiing relies on balance no matter what the skill level. Therefore balance exercises are not exclusive to the novice skier; they are just as important to the advanced skier. The following exercises are critical at this juncture of the learning curve, but they could just as well facilitate advanced skiers in improving their balance.

After the following drills have been performed statically, try them while you perform a straight run down the hill. Don't expect perfection, and even if you cannot do them, do not fret. It is the attempt that is applicable to learning. While straight running downhill, the shift of weight in the attempt may not even be visible to the outside observer. However, remember the cover of the book we mentioned—you are firing relevant neurons that are connected to your CNS and are stimulating learning. Learning cannot always be seen.

Flat-Terrain Exercises

- Standing on flat terrain in your skis, flex and extend the ankle, knee, and (slightly) the hip while moving up and down. Stay tall with your upper body. To keep your balance centered over your bindings, imagine you have a glass of water on your head. As you flex and extend, try to keep a posture that would not spill the water.
- Standing on flat terrain in your skis, see how far you can move or pivot your body forward and then backward. You will notice that at the extremes, you rely more on your boots than your skeleton and muscles. After the extremes have been discovered, try stopping at intermediary positions in which you don't have to rely on your boots. Rocking fore and aft, eventually hone in on the spot where you feel as if you are neither forward nor aft but in an ideal position for balance. A good check is to see if you could jump up and down from that location.
- Standing on flat terrain in your skis, lift one ski and then the other as if to march in place. After marching, see if you can march in slow motion. Evolve to just standing with one ski in the air like a flamingo. After mastering one leg, switch legs.
- Stand like the flamingo described previously. Using the ski in the air, pivot the tip and tail up and down. Then swing the ski right and left. Next, swing the tip to the right and stop, followed by a swing to the forward position and stop, followed by a swing to the left and stop, and so on. Switch legs.
- Skate as if on ice skates. The movement should include a forward extension from the ankle and then knee. This is a handy skill to master because it will make crossing flat areas on snow quicker and easier than double-poling.

Straight-Run and Turning Exercises

- During a straight run, shuffle your feet and skis forward and backward.
- During a gliding wedge straight down the hill, rock back and forth in your boots, with the majority of the fore and aft movement coming from your ankles.
- While doing right and left turns, make some steps as if marching.
- Start your turn while reaching for the sky with your hands, and finish by reaching low by your ski boots.
- Props such as a hula hoop can be placed around the waist. Start the turn by lifting the hoop (and extending the ankle and knee), and then complete the turn by lowering the hoop (with flexion of the ankle and knee). This can be a fun game for children or a mnemonic for adults to remind them when to extend and when to flex. The hula hoop could be their pants; pulling their imaginary pants up would be extension of the joints, as in the start of the turn; and lowering their pant would be flexion, which happens at the end of the turn.

Edging and Body Awareness

Edges can be your best friend or your worst enemy. Tipping up the ski and enticing it to turn can be one of the finest sensations in skiing, while catching an edge can be one of the most humiliating.

Tipping up the ski and edging causes friction, whether it is with a skidded turn or in a carved turn. A skidded turn is when the ski moves forward and sideways (think

of a car skidding on ice), while during a carved turn the ski moves primarily forward with the tail following in the path of the tip. With old wooden skis, this friction of the edge against the snow was a major contributor of skis wearing out. When crafted by a master woodworker, these skis had a square 90-degree wooden edge. After skiing on abrasive snow over time, they got sanded down to a rounded corner. It wasn't until 1928 that Rudolph Lettner decided to screw segmented steel edges on his skis in order to salvage the square shape. Skiers found out that not only did Lettner's steel device give longer life to their skis, but they performed much better. These steel edges provided a superior grip and opened the door to more advanced skiing. Edging as a skiing skill was discovered, and that interface between the ski and snow has never been the same since.

Tipping the ski up can be accomplished in many ways. It can be with the entire body, a sideways bend at the spine, a flex at the pelvis, the knees tipped inward, or a combination of these. All will work, although with some limitations.

Tipping the entire body to achieve an edge is termed *inclination* or *banking*. This is a common way for many skiers to edge while resisting external forces. *Inclination* is a broader term, while *banking* refers to the whole-body lean and has a negative connotation. It works moderately well for one turn—and then you fall over. That may be an exaggeration, but it does elucidate the problem. It puts skiers so inside the turn that they are in danger of falling over. Having the body so inside the turn can also reduce or even eliminate the edge contact with the snow surface, which defeats the purpose of edging. Even if the turn is successful, moving the body out of that extreme position takes excess effort and time.

Another way skiers attempt to achieve an edge angle is bending laterally at the spine or waist. Many skiers confuse this with angulation. It is not uncommon to hear the skier's cliché of pinching an inch, referring to the waistline fat that is pinched during this sideways bend. However, this is abusive to the spine. The spine consists of a series of stacked bones (vertebrae) interspersed with jellylike disks. Any flexion of the spine squishes the disks. When flexion is within the normal range of motion for the spine, there is no problem. Excess lateral flexion, as in this misperceived angulation, will result in the disk material oozing out of its space, not unlike jelly oozing out of a jelly sandwich when squished. This misplaced disk material then puts stress on nerves running up and down the spinal column, resulting in low back pain. Sixty to 80 percent of the population will suffer from back pain sometime in their life from non-ski-related stress. There is no need to exacerbate the problem with this mischosen ski technique.

These well-intended skiers are seeking a movement to create edging, and they are not far off. They just picked the wrong body part: The hip joint is stronger and has a greater range of motion. This is appropriately termed *hip angulation*. Whereas the spine is a bunch of oddly shaped bones stacked on disks like a house of cards, the hip joint is a strong ball-and-socket joint, sturdy like an army bunker. The primary function of the hip joint is to support the weight of the body during weight-bearing activities. It is indeed a tougher body part. This is important, not so much for the forces in the wedge, but for what the body will learn by bending in a biomechanically correct fashion. Since the hips do not flex laterally very well, create efficient hip angulation by turning the hips so that they are facing downhill. With this slightly twisted relationship between the upper and lower body, the femur or leg bone can pivot or flex in the pelvis, creating a biomechanically efficient position (figure 9.4). Adding a flexed knee into this position creates what is called *knee angulation*.

Figure 9.4 Parallel skier entering the turn. Notice the lower body turning under the upper body.

Knee angulation is not so much angulation of the knee but the result of the knee position during angulation. To clarify, we need to first look at the knee anatomy. The knee is capable of flexing and extending, and when flexed it will rotate slightly medially and laterally. The one thing it cannot perform is lateral flexion or knee angulation. What looks like knee angulation is the ball-and-socket hip joint moving the upper leg inward and rotated while flexing the knee. This position puts the knee in a precarious position. Any external jolt will have a negative effect on skeletal stability and the well-being of the knee.

Angulation is achieved with the acetabulofemoral joint—in layman's terms, the joint of the hip and the thigh bone, or the hip joint. *Acetabulum* in Latin means "vinegar cup," a cup so large it once was used as a unit of measurement. It is also the strongest joint in the body due to its design. With the ball or head of the femur more covered than uncovered by the acetabulum and with a ligament inside, it is rarely dislocated. When it is, it sounds like the release of the cork on a bottle of champagne. The joint is ball and socket, meaning that it can move in any direction, not unlike a joystick. With this mobility and strength, it seems as if it were built for angulation and the accompanying forces.

Performing efficient angulation from the hip joint allows the spine to maintain a relatively neutral posture (figure 9.5). Without undue stress on the spine, the spine is in a better position to encounter an unexpected bobble. It will still have a range of motion to move through before it encounters a critical injury intensity.

To summarize, the hip is the most biomechanically efficient joint to create angulation. The spine and knee do not allow movement in the direction that angulation requires. To attempt movement and try to create angulation with these joints would lead to orthopedic distress.

Figure 9.5 Skier performing efficient angulation with his spine in a good position.

Edging Exercise

With the mechanics just described, it will seem strange that one of the first methods to get the ski on edge involves the knee. If you move your knee inward, the ski will edge. To clarify, it is the knee that is moving, but it is moving due to the thigh bone or femur articulating in the hip joint or acetabulum.

At this level, you direct your knee forward for balance and inward to edge. Move the knee inward from a balanced position, and the ski tips up on its edge. Edging is relatively simple, whereas unedging or decreasing the edge angle is usually more difficult. So why do we want to reduce edge angle? First, edging leads to carving, which is a goal of many skiers. The inference is that if some edge is good, more is better. This is an inadequate presumption, however; it is the ability to adjust the edge angle, and not just increase it, that is essential to good skiing.

The outside ski, which is the ski doing the lion's share of the turning, will not have a change in job description. Just as in the wedge, it will rotate in the new direction, tip up to an edge, and even accept pressure. It is the inside ski, the one pointed in the conflicting direction, that needs a new role. Up to now, the inside ski has been on its inside edge. Looking at a parallel skier, you will notice that one ski is on the inside edge while the other is on the outside edge, or big-toe and little-toe sides (figure 9.6). This is the christie or parallel position. What you need to learn is how to achieve these corresponding edges.

Standing on flat terrain in a wedge, shift your weight to one ski. With less weight now on the opposite ski, pivot that ski from the tip so that the skis become parallel, almost as if someone drove a nail through the tip that you pivot from while bringing the tail into

Figure 9.6 Parallel entry into the turn.

the parallel position. This rotary motion is exactly what you will be doing while skiing. The result will be a christie or parallel arrangement of the skis. Practice this plenty of times until you get the feel of the weight shift and then the feel of the rotary portion.

This rotation is a different motor pattern than the rotation first introduced with the wedge. To achieve the rotation for the wedge, you rotated both legs internally, toward the midline of the body, so they ended up in a *V* or wedge. With the christie, the outside leg is still rotating the same way, but now the other leg is externally rotating away from the midline of the body (figure 9.7). The result is the christie or parallel relationship with the skis. The new movement to learn is the external rotation, or rotation away from the midline of the body.

But first, one more static exercise. Standing in the skis in wedge position, move the uphill knee outward or away from the midline of the body. Moving the knee in this manner, the ski goes from one edge toward the other. The goal is not to be on either edge but to move the knee such that the base of the ski becomes flat against the snow so it is not on either edge. When the ski is flat against the snow, your knee will be over your ski boot, or better yet, since it is flexed, your knee will be over your toes. This flattening of the ski is a key element in the christie. Practice this a few times so you don't have to look down at your ski to determine if it is flat. Get the feeling for when your ski is flat or on edge.

Now we move on to the traverse. *Traverse* is a generic term used to describe any sliding in a direction that deviates from the fall line slightly downhill so gravity can take over but mostly across the hill. It is used to get from the left side to the right side of the slope.

Starting in a wedge, traverse across the hill while directing more and more of your body weight toward the downhill ski (figure 9.8). (If this were the end of a ski turn, it

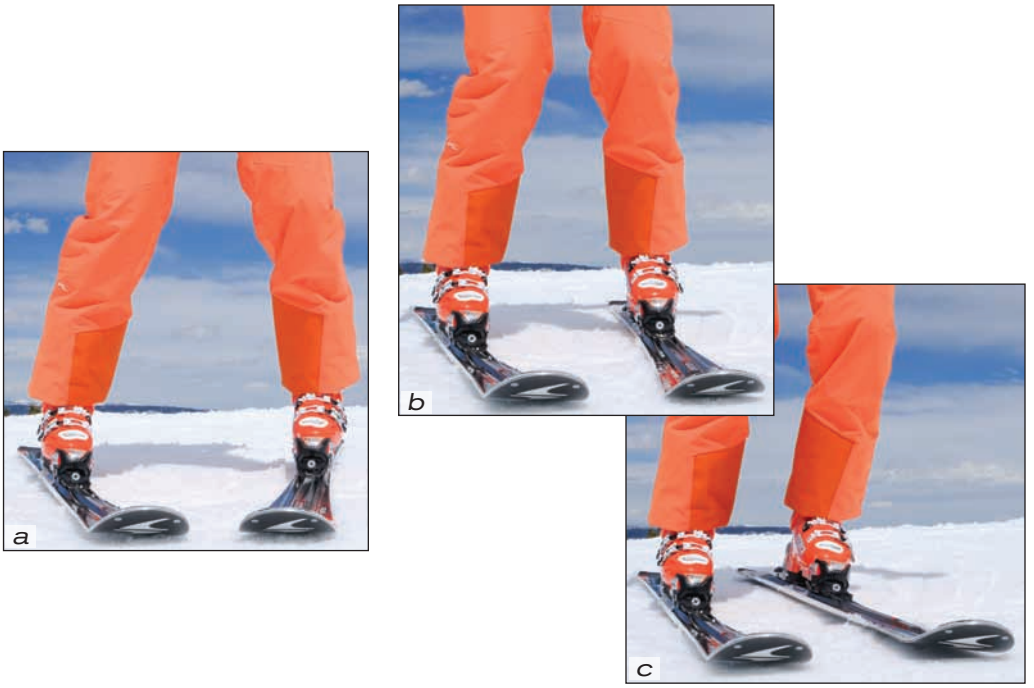

Figure 9.7 The inside ski is now externally rotated.

would be called the *outside ski*, but in a traverse it is the *downhill ski*.) To facilitate skills later on, make sure this downhill ski is not locked onto an edge but skidding with an edge angle similar to the uphill ski. As you get the feel for this weight shift, you will undoubtedly notice your uphill ski becoming lighter. As it becomes lighter, you could just lift it up and place it beside your downhill ski. Although effective, this method is unconventional, mostly because it is the result of only a weight transfer, or technically, a pressure skill. Good skiing is the product of a combination of skills (rotary, edging, and pressure). Without this blend of skills, skiing is one dimensional and has a robotic appearance.

When the skis are in the wedge, the uphill ski is on its inside edge. To get the skis to match, or christie, simply move your uphill knee away from the midline of your body, or in the direction of the hill, with the same movement you performed in the static exercise. How much does it move away from the body? The first rule of thumb was so the knee was over the toe, although this is technically determined by what it takes to make the ski flat against the snow. Sound familiar? This movement could be a little or a lot; what is important is that the ski base is flat against the snow. When flat, the ski is free to rotate such that it is in line with the downhill ski with the same external rotation performed prior to sliding. The end result of this external rotation is parallel skis while you are still heavy on your downhill ski. If there is still room to traverse farther, wedge your ski out and perform the weight shift and external rotation again. At the end of the traverse, you can do a wedge turn and proceed in the direction from which you came. It is a good idea to practice in both directions since you will be making turns in both directions.

Figure 9.8 Inside ski (skier's right ski) flattening out so the ski can start to rotate.

The skill of bringing the skis into this parallel relationship is essential to the christie and parallel skiing. From this position you will learn to modulate your edges, which will eventually control turn shape and speed. Continue to practice this skill of matching the skis in every opportunity and condition possible.

Sideslips

After matching the skis into the parallel position, the next piece of the christie puzzle is skidding. This is where the skis move sideways through and after the turn in the parallel posture. The skill of skidding is essential to the christie. Making a parallel turn requires the skis to be tipped on edge. It is the interface between the skis and the snow that permits turn size, turn shape, and speed control. Without this friction, the skis would careen off on an unrestrained tangent.

Stand in a traverse position with parallel skis on a fairly steep slope. Stick your upper ski pole in the snow a few centimeters in front of your toepiece and your lower pole a distance from your lower ski. If you are successful standing on this steep slope, you probably have your uphill edges engaged into the snow, creating miniature platforms. If this is difficult, move your knee or knees toward the slope to enhance the platforms. This will engage the upper edges, similar to the sidestepping exercise you did when you were first starting. If your skis want to run forward or backward, take small steps to move your tips or tails uphill or downhill until you are perpendicular with the fall line

and not moving. When you feel comfortable and balanced (use your poles for support initially), move your knees slowly and gently in the downhill direction. This will release your skis and, if balanced, you will begin to move sideways down the fall line toward your lower pole. Keeping your weight equal between the skis will ensure that both skis move and not just one. To stop, merely roll your knees back into the hill to achieve more edge and establish a platform on which to stand again. This moving on and off the edge is essential for skiing no matter what the ability. Many advanced skiers have limited slope selection due to a lack of this skill.

After you have mastered sliding between the poles, try the exact same exercise without poles. Practice increasing and decreasing the sideslip speed. This will require extra control of the edge angles—less edge angle to speed up and more edge angle to slow down. Control your upper body so that your hips and shoulders are facing down the hill. This refers to the direction the hips and shoulders would be looking if they had eyes, although actually facing down the hill is a bit of a stretch. The idea is that the hips and shoulders are biased in that direction as opposed to facing up the hill. As you advance, how much you face down the hill will take on an important role. For now, if the upper body is biased in that direction, it is a good start.

Matching the Skis

With the wedge turn and your newly acquired matching skills, you have all the tools needed to make your first christie. This is called a *wedge christie*, a moniker saying it is a wedge and a christie. Start by making wedge turns that are not linked anymore but are connected with a traverse. Coming back to this traverse, you will have performed the same ski matching exercise you previously mastered. Bravo—this is technically your first christie. Keep practicing until you can do the matching with little effort. Remember the steps. Shift the weight to the outside ski, then move the knee of the inside ski out to flatten the ski, followed by a bit of external rotation with the inside ski to match the skis. The overt feeling or rotation will diminish as you become more skilled at the weight transfer and flattening the ski. The ski will want to come in and match due to the way your feet naturally point. By flattening the ski, you are merely letting the skis assume their natural orientation. Eventually all three skills will become one motion. Weight shift, knee moving laterally, and external rotation will become the christie!

Matching the Skis in the Fall Line

After you have mastered matching the skis and they are parallel in the traverse, the next step is to match the skis in the fall line (figure 9.9), meaning your skis are pointed down the hill or in the fall line. This will use the same steps as before, just a bit sooner in the turn and with a greater blend of the three skills. The three skills are becoming more of one motion.

The turn initiation will be the same as before with the wedge. As you come around the turn into the fall line, you will be transferring your weight, flattening your inside ski, and starting to rotate your ski. The inside ski will match the outside ski and you should be on the uphill edges of both skis. When on these uphill edges, the inertia from the turn will assist you in the sideslipping motion. This is where a little speed may be scary, but it will also assist in the sideslipping or skidding motion. You are performing a christie now.

Figure 9.9 Skis matching in the fall line.

To link the turns from this parallel position, brush the tails of the skis out into a wedge emphasizing the uphill ski. This uphill-wedged ski will be the new outside ski. Recall the feeling when you first linked the wedge turns, weight shifting from foot to foot or ski to ski, extending to start the turn and flexing to complete the turn. This same rhythm is what you are searching for again. On flat terrain you can make these quick weight shifts because you will not be turning out of the fall line very much. This accelerated action will not only create rhythm but will facilitate the blending of skills into one movement followed by its mirror image and back to the original movement.

Matching the Skis Before the Fall Line

As you have developed rhythm linking the turns, your attention has been with the weight shift and moving it to one ski or the other. By now you should have a skid that is fairly even, without too much on-again, off-again edge engagement, and your upper body is fairly quiet as the lower body does the turning (figure 9.10). Finally, you have achieved some successful mileage and maybe even have attempted this rhythm on the tougher green slopes. You are ready to try to match your skis before the fall line.

There are no real secrets to matching the skis before the fall line. It is all timing and intensity of the movements. The inside ski will not match if it is still on edge, so flattening the ski will be key. When matching the skis at the end of the turn, you move your inside knee toward the hill while sinking or flexing from a tall, extended position.

Figure 9.10 Skis are matched at turn entry—a parallel turn!

When we introduced the concept of flattening the ski, you had a rudimentary wedge and wedge turn. Now with the skidding sensations of the christie, your skill level has developed to the point that it is possible to add some refinement.

In the wedge christie, we facilitated flattening the inside ski by laterally moving the knee away from the midline of the body. Paradoxically, we will make this movement more advanced by staying on fairly easy terrain. Release the ski as before with the knee along with a concurrent hip movement also toward the inside of the turn. For example, in a left-footed turn (where the left foot is the outside foot or ski), the right knee is moved (right) toward the inside of the turn. As the knee moves toward the inside of the turn, the hip will also move toward the inside of the turn. The reason we are referring to the hip and not the upper body is because you will have to achieve an edge with the ski along with pressuring the ski as the turn develops. The result is angulation. Therefore, as the hips move in, the shoulders move out.

TECHNIQUE TIP

The hip moving toward the inside of the new turn is termed *crossing over.* It refers to directing the center of mass from the inside of one turn to the inside of the next turn.

Conclusion

The christie is a huge step in technique. It has historical roots that are based on technical advancements. Before edging could be a viable skill, the ski needed viable edges. After this was accomplished, turn shape, turn size, and speed control took on a new look. The ski as a tool was performing such that skiers were able to expect more out of the ski.

A cornerstone of the christie is the edges of the skis and the skier's intimacy with them. Tipping the ski up to create an edge angle is based on the desired turn outcome. The ability to adjust and regulate the ski edges is a complex skill that can be a limiting factor in a skier's repertoire. Skiers who spend time learning edging skills will be rewarded with a whole new ski area of opportunity.

Parallel Turns

If you marry a skier, marry tall—they walk with their knees bent 10 months out of the year.

Author unknown

Parallel turns are the objective of many skiers. Depending on how strictly you adhere to the mathematical definition of *parallel*, most skiers are parallel skiers. This is a worthy achievement but is very broad in scope. Could there be degrees of parallel skiing, or notches up the ladder of parallel skiing? Can one parallel skier be better than another? Imagine one skier who initiates the turn from his heels with a tip of the body and a rotation of the shoulder in the direction of travel. The skis are relatively parallel while sliding sideways erratically around the turn on an immaculately groomed blue slope. Now imagine another skier who seems to release the skis magically. She has the skill to engage the edges precisely while controlling the arc of the turn with pressure, looking effortless on a double black diamond in cut-up, heavy crud. Both are parallel skiers, but they show us that the scope of parallel skiing is expansive. Although the gross movements are similar, it is the idiosyncrasies that delineate the good skiers from the better. The only way to fill in the blanks with respect to skill is to pay attention to detail. Movements that may seem irrelevant and even unexciting come into play when advanced achievement is desired.

Good skiing has many definitions. Does a flailing outside hand indicate a wild ride by a talented skier, or is it a red flag signaling that the skier is out of control? Better skiers would have their hands in control, but is that as electrifying? Good skiing is not always exciting in this context. Good skiing is exciting because the skier is in control of the skis and has made the terrain her playground.

Before we can describe the movements of efficient parallel skiing, we need a system for explaining movement. We will see how movement occurs in three dimensions and then use the three analogous planes of motion to define good skiing.

Three-Dimensional Space

The movements in skiing are fairly straightforward. We rotate, edge, and pressure. It is performing them while balancing that is difficult. The body has mechanisms to sense balance. The eyes are the most important. We are reminded of this when skiing in a whiteout, where we cannot distinguish up from down, left from right, and we lack depth perception. Also, the inner ear has a sophisticated balance mechanism. With the semicircular canals arranged in the three cardinal planes, they provide balance information in these same three dimensions—left and right, fore and aft, and horizontal (rotation).

Skier movement can also be described in three dimensions. Each of these three dimensions is represented by a plane. A sheet of plywood is similar to a plane, as is a sheet of paper, although these are not planes because they have thickness and don't extend into space forever. If you walk down a hallway, the hallway is the plane you are moving your arms and legs in. The swing of your arms and legs rubs along the wall because they are moving in that plane. A room in your house is three-dimensional space. It has length, width, and depth. Length is one dimension, width is another, and depth is the third dimension. Each dimension is represented by a plane. If you are standing in the room, the walls parallel with your sides are one plane, and the walls perpendicular to those walls are parallel with your front and back. The floor you are standing on or the ceiling (assuming a flat, horizontal ceiling) is the third plane. As mentioned, a skier also has these three dimensions or planes. He has fore–aft, side to side, and rotation to describe three planes of motion. To be consistent with the motion science literature, we will use the corresponding terms *sagittal*, *frontal*, and *horizontal plane* in lieu of *fore–aft*, *side to side*, and *rotation*.

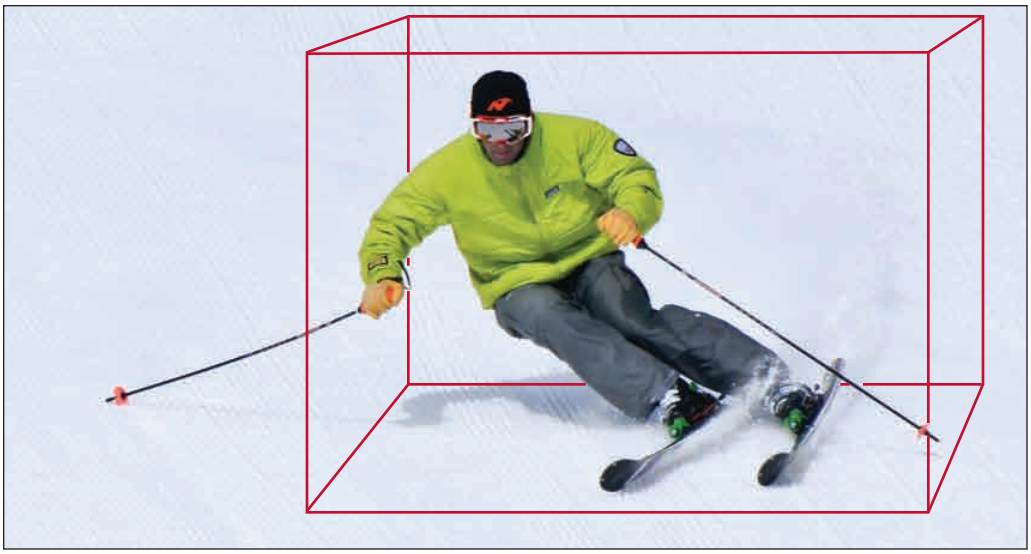

Figure 10.1 Skier moving in three cardinal planes.

Using the building model just described, imagine a skier in a simple cube (figure 10.1). A cube is a three-dimensional object with length, width, and depth. The skier will also move in three dimensions, or planes.

Movement in the Sagittal Plane

Movement fore and aft is in the sagittal plane. This is movement in which the skier moves along a plane that runs fore and aft in the same direction, or parallel, with the skis. This plane technically cuts the skier into equal left and right halves, but it can be visualized as the parallel sides of the cube on the skier's left and right sides. Flexing and extending the ankles and knees would be moving in the sagittal plane. Imagine wet paint on the skier's left and right sides. Any movement that the skier performs that would result in rubbing paint on one side of the cube would be a sagittal plane movement. Movements in the sagittal plane include any fore and aft movement such as flexion from the ankles or falling straight backward, along with flexion and extension from the ankles and knees used for pressure control or balance compensation.

TECHNIQUE TIP

The three planes that describe movement in three-dimensional space are referenced from the skier. This means that the planes will always be in relation to the body that is standing upright and looking forward, not unlike a military attention stance (although technically the palms of the hands are facing forward, which is not overly important for us right now).

Movement in the Frontal Plane

Lateral movement from left to right is in the frontal plane. This plane would cut the skier into a front half and a back half. Putting paint on this skier's front and back and moving laterally or side to side would rub paint in the frontal plane. It would also smear paint on the skier's face while moving side to side. Jumping jacks and flapping your arms like wings would both be in the frontal plane. In skiing, all edging movements are in the frontal plane. This is the only way a ski can tip to achieve an edge (figure 10.2). Tipping the ski sideways from the lower body or the whole body is moving in the frontal plane.

Figure 10.2 Skier moving in the frontal plane to achieve an edge.

Movement in the Horizontal Plane

Two types of rotational movement have already been described—lower-leg rotary movement and whole-body rotational movement. These are in the horizontal plane. Imagine paint on the bottom of the skis or the top of the head. Any movement that twists or rotates from left to right or right to left will leave a paint imprint on the bottom or top plane of the cube.

Coordinating Movement

These three dimensions described with the corresponding three planes are the only possible directions that a skier or anyone else can move in. If we moved in one plane

Figure 10.3 *(a)* Skier moving in the sagittal plane; *(b)* skier moving in the frontal plane; *(c)* skier moving in the horizontal plane.

at a time, we would move like the robot C-3PO from *Star Wars*, making erratic movements. It is the timing of movements that creates a synchronized flow. This coordination between movements is what distinguishes the good from the better skier. First, however, we need to learn the movements, then we can learn the timing. Mastery of timing defines the great skier.

You have already learned to coordinate some movements. When you wanted to rotate the ski and it was stuck on edge, you needed to unedge the ski (in the frontal plane) before you could perform the rotary movement (in the horizontal plane). Through practice your body learned that an edged ski needs to be flattened and it sensed this, almost in a reflexive manner, prior to rotation of the ski. In another example, moving the body downhill laterally (in the frontal plane) made the ski flatten, so you could rotate it into the new turn. Learning to blend the skills in the three planes has led to more efficient skiing. Coordination comes about when these single movements are combined into one synchronized motion.

Skills Move in Planes

A ski turn, whether it is the first wedge turn or an advanced parallel turn, will move in the three planes (figure 10.3). For example, to make a wedge turn, you rotate your foot, a movement in the horizontal plane. This is followed by tipping the ski laterally to increase the edge angle with the snow—a movement in the frontal plane. Lastly, to pressure the ski, you flex the knee and ankle to transfer weight to the ski, a movement in the sagittal plane.

Movement in the three planes corresponds to the three skills. Pressure-control movements are always in the sagittal plane. Edging of any kind is always in the frontal plane, and rotary movements are always in the horizontal plane.

Key to Balance: Stance

The motions and movements in skiing are relatively simple. The legs rotate to reorient the skis, they move laterally to create edge, and they flex and extend to decrease or increase pressure on the skis. These three movements are undemanding when taken by themselves. When recombined into the ski turn, however, coordination becomes an issue and balance is upset. Staying in balance is imperative so that these movements can be performed. If we were to peel back one more layer of balance, we would find that stance is the basis of all balance issues. Stance refers to the positions the body strives to maintain while skiing.

What should stance look like? There are numerous ways to describe stance. Many talk of a balanced athletic stance where if you stood on your skis and jumped up and down, you would land in the optimal stance for your body (figure 10.4). This deals with the width of the skis and the amount of flex in the joints. This description is a good start, although it is not enough.

Figure 10.4 Skier in a balanced position.

Ankles

The ankles are the key to balance, and the stance we assume while skiing and the resulting posture hinge on this joint. We can change the distance between skis as the snow changes, using a wider stance on hard ice and a narrower stance on soft powder. We can also change how flexed or extended the body is. We stand taller as speed builds and shorter or more flexed during turns with a smaller radius. But we are getting ahead of ourselves. The important thing is that the ankles are the key to stance and ultimately balance.

The largest movement the ankle joint makes is flexion (dorsiflexion) and extension (plantar flexion). This bending and unbending action is a critical element in the ski turn. The ski turn starts with unbending the ankle, and then after the ski is released the ankle progressively flexes through the rest of the turn. While they are bending and unbending, the ankles should be flexed evenly such that the left and right ankles have the same amount of ankle flexion, or equal angles with similar muscular tension. The shin is in contact with the tongue of the boot, although not excessively. Since falling rearward is a common error, many skiers assume that they must have excessive pressure against the tongue of the boot to counteract this backward pull. Instead of excess pressure against the boot tongue, they should be striving for tension in the ankles. Excess pressure against the boot tongue flexes the boot unduly and either alters the fore–aft stance of the skier or limits flexion and extension. Tension is a muscular strategy for readiness, one that prepares the skier for the upcoming forces and unexpected surprises. Having this tension will ensure that balance will be maintained.

The muscular tension should be the same for both ankles. This is due to the fact that the skier is on two skis or two bases of support. If this foundation is maintained by differing tensions, each will have a tendency to react differently, leaving the skier unstable. The end result of this asymmetrical tension will handicap the skier, resulting in one ski jetting forward and the other backward. This will create a cascade of problems up the kinematic chain, leaving the skier in a precarious position and ultimately out of balance.

Ski Lead

The ankle flex establishes the posture for the rest of the body. Stand on the slope with the skis perpendicular to the fall line. Shuffling your feet forward and backward, you can adjust your ankle angle until you arrive at a position in which both angles are equal (figure 10.5). When this is achieved, the uphill ski will be ahead of the lower ski. In ski parlance this is *ski lead*, since one ski tip is in front of, or leading, the other.

Ski Lead Affects Body Position

It has already been mentioned that the upper body, that is the hips and shoulders, face down the hill. This is a generalization—the hips and shoulders are facing downhill, as opposed to facing across the hill or uphill.

The goal is equal ankle angles. When the ankles have equal angles while on a slope, the resultant posture of the hips and shoulders is also physically facing or biased down the hill. This is not a serendipitous but contributive relationship aligning the body in a posture that, given it is standing on a slope, is a biomechanically strong position. If the upper body were facing more down the hill, it would be overly twisted, and if it were facing less down the hill, it would be undertwisted. Both result in a posture that is less efficient biomechanically. This answers a common question: How much should you face

Figure 10.5 Equal ankle flexion results in a natural ski lead. Notice how the upper body is biased downhill, not fully pointing downhill.

down the hill? The answer is based on the ankles. Having equal ankle angles results in a lead change that, when replicated with parallel hips and shoulders, determines how much the body should be facing down the hill.

Hands and Arms

Hands have always been used for balance, originally during quadruped locomotion and then progressing to upright stance. Today they are used to aid in balance recovery and maintenance. They move quickly and require little effort. When you are pushed backward, whether on an accelerating bus or skis jetting quickly on the ice, the hands instinctively react by moving forward to counter the unexpected movement.

Hands are very noticeable in skiers. A skier in balance seems to have her hands in control, while a skier out of balance swings and twirls her arms uncontrollably. Even the World Cup downhill ski racer flying off the Hausebergkante at Kitzbühel can be seen regaining his balance with his hands rotating as if manually rolling down the windows in an older car, trying to maintain or regain balance.

The general rule for hands, as mentioned earlier, is to place them as if you were holding a wide lunchroom tray (figure 10.6). To be more specific, hands are carried above the waist and are held wider than the elbows, and elbows are in front of the torso. Hands should be in line with the forearms.

Figure 10.6 Hands in a position to assist balance.

To be more specific, hands should mimic the angle of the ski lead. As one tip moves farther forward, the corresponding hand also moves forward. Consequently, as the skis adjust their lead change through the turn, so do the hands, which will also be reflected in the hips and shoulders.

Hands are less important than the hips or shoulders, although attention to their location in the skiing stance reinforces the positions of the hips and shoulders. Sometimes a quick glance down at the imaginary line between the hands or pole grips will permit a reference to their desired location of being parallel with the ski tips. When the spatial reference of the hand is established, it is sometimes easier to feel where the hip and shoulders are.

Constantly Changing Ski Lead

Until now, we have assumed a traverse position with the skis across the hill. Establishing this position is the first step. As soon as you start a ski turn, the relationship between the hill and the skis changes. Remember that the steepness of the hill ultimately determines the amount of lead change. The lead change, or more specifically which ski is in the lead, depends on which direction the skier is going across the slope. If the skier is going left, making a right-footed turn, the uphill or left ski will be in the lead. After this same skier turns and is headed right, having made a left-footed turn, the uphill ski has now switched to the right ski (figure 10.7). During the turning process, the right and left skis had to shift into the new lead position.

Figure 10.7 The ski lead changes constantly through the turn.

At the initiation of the turn, the skis flatten in preparation for their initial rotation. The moment the skis start to rotate, the lead change starts to alter. This happens the moment the skis have been rotated ever so slightly. How fast will the lead change happen? That depends on the rate at which the skis turn. If the skis turn quickly, the lead change is quick, and if the skis turn slowly, the lead change is slow. The lead-change speed needs to be consistent with the turn speed. Notice we said *turn*, not *rotate*. That is because not all turns have this rotation at turn initiation. Carved turns will go directly to the edge, but both will be turning (figure 10.8).

A common problem is the skier pushing the inside ski forward. Skiers do this for several reasons, none of them good. Place your emphasis on equal ankle flexion and the ski lead will take care of itself. Concentrating on the ski lead is placing the cart in front of the horse. Awareness of the ankles will result in the appropriate amount of ski lead.

Efficient and Inefficient Body Positions

Although maintaining equal ankle flex is preeminent, the resulting body posture is what maintains balance. One of the most prevalent causes of instability during skiing is upper-body rotation. Upper-body rotation should not be confused with the rotation that has been mentioned previously. This rotation was leg rotation—the rotation of the femur or thigh bone in the pelvis. This ball-and-socket joint separates the lower body from the upper body so that the lower body turns one way while the upper body turns the opposite direction. The inefficient version is whole-body rotation. This is a lack of leg rotation so that the lower and upper body are bonded. This melded connection creates a full-body rotation, thereby increasing the turning mass that must be arrested each time the rotation of the ski is complete. After the turn is complete, the new turn must

Figure 10.8 Tip lead change throughout the turn.

be restarted by external means that are not conducive to efficient skiing. Short-radius or fast turns are grossly inhibited and the ability to angulate sacrificed.

Whole-body rotation can result from its use as a turning force to initiate the turn or from an overzealous upper body that assists in turn completion. Either way it is a bad habit, to say the least. Whole-body rotation as a turning force for turn initiation is the most prevalent. This turning impetus is needed in every turn. The problem is that it should be coming from the lower body. Counterintuitively, making it come from the lower body involves the upper body. This is an action–reaction reality and is covered next.

Action–Reaction

When you turn your legs, the turning impetus has to come from somewhere. It is a physical impossibility to turn the legs without something else happening. Newton explained this with his third law of action and reaction. According to Sir Isaac, turning the legs comes from something unwavering; in skiing, this is a stable upper body. So how do you get a stable upper body? Contrary to popular belief, you cannot just tense your upper body or aim it somewhere such as down the hill. If there is an action, there must be a reaction. This action and its resultant reaction is termed *counterrotation* in skiing jargon.

You might think that the action is the legs turning, but actually this is the reaction. The action is the upper body turning opposite the lower body so the lower body can turn in the intended direction of travel. This is difficult to see, because in good skiing the upper body appears to not move. The bottom line is that the upper body turns opposite the lower body, which creates stabilization and makes the upper body look quiet so the lower body can turn. In essence, the upper body turns right so the lower body can turn left. To the observer, the upper body never moved and everything came from the lower

body. A common misconception is that the upper body is just along for the ride, but the upper body has to contribute so the lower body can turn.

Remember that both ankles need to keep the same amount of flexion throughout the turn. On the slope, this equal ankle flexion results in the amount or degree of ski lead. The resulting degree of ski lead is mimicked up the entire body with the hips, shoulders, and even hands. As the turn develops, the height difference between the two skis increases and the degree of ski lead increases in response. The degree of lead change is simultaneously mimicked with the hips, shoulders, and hands giving the upper body its rotational aspect: facing down the hill.

Picture this: The skis are going to turn left, which means they start out with the right ski forward of the left ski. As they start the left turn, the lead change is reduced such that the left ski is starting to even up with the right and take the lead. Imitating this lead change, the upper body is moving to the right. Skis left, upper body right: This is why it is termed *counterrotation*. The lower body is countering or moving in the opposite direction of the upper body (figure 10.9). When performed correctly, the upper body looks quiet, and more important, it is quiet in space. When the upper body is flailing around, it makes balance unstable and the job of the lower body is difficult. Besides, it is not a good way to impress your friends.

Figure 10.9 The upper body countering so the lower body has something to turn against.

Inefficient Turning Strategies

A characteristic of efficient skiing is separation of the upper and lower body. While the skis turn left, the upper body turns right. To the observer, it looks like the upper body is quiet in space. This counterrotation should not be confused with full-body rotation,

which, unfortunately, is a common turn-initiation strategy. On the surface, full-body rotation seems logical. Its most obvious feature is rotating the upper body along with the lower body as one unit. The ski slopes are littered with this inefficient skiing model.

An example of this upper-body rotation results from using wide-bodied skis on firm skiing surfaces. Due to the wide width of the ski underfoot, it is difficult to release the ski on the firm snow. The tendency then is to push off the old outside ski to initiate the turn. This is called a *rotary push-off*. The term is backward, because the skier pushes off an edged ski and then rotates the upper body to turn the skis. The action of pushing off provides the impetus for the upper body to rotate, creating a turning effect. This upper-body rotation is an inefficient turning technique, as discussed previously.

A related problem with turn initiation is tipping the upper body. This is when the skier's first movement is to lean or tip into the inside of the turn. Although this has an intuitive feel based on riding bicycles and watching airplanes, it leads to several problems.

When the body is tipped, it is difficult to regulate pressure to the outside turning ski since everything falls to the inside of the turn. Tipping does get the ski on edge, but when tipped, the only way to reorient the skis is by full-body rotation. We have mentioned previously how this is inefficient. It will be possible to make larger-radius turns, albeit out of balance, but short turns will be nearly impossible.

To oppose tipping, keep the upper body vertical. This is called a *vertical spine line*. Where you view the vertical spine line from is crucial (it's that three-dimensional phenomenon again). The spine line should be vertical when the vantage point is straight up the hill or from directly behind the skier. You would not want to see a vertical spine when watching from the side (which would be a different dimension). The vertical spine line is a good reference because the spine is close to the center of mass. Keeping the center of mass quiet and stable is important for balance. When the spine line is vertical, the lower body is free to move underneath the upper body to rotate and to create edge (rotation being in the horizontal plane and edging in the frontal plane). Performing these to actions simultaneously is difficult enough without the upper body swinging from side to side. A vertical spine line will anchor the upper body, giving the lower body the freedom in which to perform the actions needed (figure 10.10).

Figure 10.10 A skier maintaining a vertical spine line.

You may see some body tipping in certain situations, such as large and fast turns. These turns have more time from turn to turn along with greater external forces. The tipping in these circumstances occurs after turn initiation and does not interfere with the turn-initiation mechanics (figure 10.11).

TECHNIQUE TIP

One word of caution: Don't confuse the vertical spine line with level shoulders. Although they may seem to lead to the same posture, the shoulders are not fixed to the torso. They have a large range of motion that is independent of the torso, which can lead to confusing results.

Figure 10.11 A super-G skier traveling at high speed will lean to resist the high external forces.

Lateral Body Position

Your back is against the wall and you are swaying left to right. You are moving side to side in the frontal plane. The frontal plane cuts you in two equal halves, a front half and a back half. Your toes are on the same side as your nose, and your heels are on the same side as your ponytail.

Standing sideways on the hill in a traverse position, it is easy to see that the upper ski and boot are higher than the lower ski and boot. The upper knee is also higher than the lower knee, along with the upper hip and upper shoulder. The raising of all these body parts is in the frontal plane, not unlike the sideways movement against the wall. Shrugging your shoulders in an "I don't know" attitude is in the frontal plane, as is shrugging just one shoulder. The raising of the hip and shoulder is also in the frontal plane. Achieving this relative height difference in the knees, hips, shoulders, and even hands is the rule of thumb for the skiing stance when in a traverse or when the skis are pointed across the hill (figure 10.12).

Figure 10.12 A skier with hips, shoulders, and hands all at similar angles in the frontal plane.

Although a traverse is not part of linked turns, there is that one moment when the skier appears to be in a traverse. The skier essentially skis into and out of that momentary traverse attitude. After the traverse, the turn starts and the skis head downhill. At this time the uphill ski and downhill ski gradually switch their uphill and downhill relationship as the turn is completed.

As the skier enters the turn, she begins to edge the ski more and more as the turn develops. As she is edging, she needs to create an angulated position such that she can keep the ski on edge while having the body in a position for pressure control. If she raises the outside hand (or worse, the shoulder or hip), she will lose contact with the edge and won't be able to control pressure. Keeping the outside of the body in line with the stance will leave the skier in a balanced position. It is difficult to stay exactly aligned, but it is the movement in the relative direction that is important.

This movement is constantly changing during the turn due to the constantly changing ski-to-slope relationship. The knees, hips, shoulders, and hands move up and down laterally in the frontal plane almost like a seesaw. As one hip, shoulder, or hand goes up, the opposite side goes down. The speed of this seesaw movement will be consistent with the changing angle of the slope. If the seesaw action is lost in any part of the body, some element of balance will be compromised.

Fore and Aft Posture

Posture fore and aft on the ski refers to movement in the sagittal plane. This fore and aft translation of the skier changes pressure on the ski. How, where, and when we adjust this pressure defines the interaction of the ski and snow. This aspect of posture deserves

attention due to the fact that since we ski down the hill in the same direction as our skis, our balance is thrown off in that same direction (usually aft). Since the skis are moving forward, the body is left in the aft aspect. We fall backward, looking like the cartoon character that slipped on the banana peel. Earlier we talked about the importance of the ankles with regard to stance and mentioned some key aspects, specifically that the ankles should be equally flexed with the knees over the toes. This is a good start, although we need to now comment on the rest of the body up the kinematic chain from this initial foundation.

If we are in balance and we flex at the ankle, we need to make some sort of compensatory flexion in the knee. If not, we have just pivoted the body forward from the ankle and our nose is over our tips. To stay in the same relative position over and between our ski bindings, we flex an equal amount at the knee relative to the ankle. For example, if the ankle flexes 5 degrees, the knee needs to flex 5 degrees also. There is a joke that Austrian ski instructors are famous for saying, "Bend ze knees, ten dollars please." If the students only bent their knees, however, they would end up in a sitting position. To achieve a skiing position, they would need to bend the ankles an equivalent amount.

Stance and balance, as mentioned previously, are optimal when centered between the bindings. That means if we were to draw a line from the center of mass, it would fall within the base of support, or better yet, within the binding area. Sagittal or fore–aft balance is compromised when the skis accelerate forward, leaving the skier behind, or when something unannounced, such as wet snow or a soft snow berm, slows the skis down and the upper body continues forward. Either way, fore–aft balance is upset. When viewed from the side, the skier's center of mass should be perpendicular with the hill when in the fall line. If a snapshot were taken and rotated horizontally, the skier would look relatively normal (figure 10.13).

Since fore–aft movements occur in the sagittal plane, it is best to view them from the side or perpendicular to the plane of movement. To stay lined up between the bindings, match the angle of the shin with the angle of the back. Though there are individual variations in human body-segment lengths, this will serve as a good rule of thumb.

Figure 10.13 Parallel back and shin in the sagittal plane.

Muscle Tonus

The only way to stay in balance in the constantly changing skiing environment is to change along with the environment. Adjusting the body position in response to terrain is a key component of good skiing. These adjustments are not novel positions or movements but remain within the boundaries laid down in all three planes. Understanding where the body needs to be in each of the planes will serve as an internal point of reference. When balance is perturbed, the body will have a home base to come back to, and balance will be regained.

Skiers need spatial references, or locations, in which to assign body parts, such as equal ankle flexion or hands holding the imaginary lunchroom tray. Even though these body positions cannot be achieved exactly, the attempt to remain in that space creates an internal reference of correctness that will be stabilized with the body's muscle tone. Tone is a general way to refer to strong and coordinated muscles. Tone, or tonus, as an anatomical definition, comes from the Greek for *stretching* and refers to the normal state of balanced tension in the muscles, adjusting to heavy or light forces just like a seesaw.

For example, imagine you are asked to stand up and hold your arms out as if holding a lunchroom tray with your palms up and your elbows at 90 degrees. In your right hand is a heavy book, so the tonus in your right and left arm muscles is not the same. Your right arm is innervating, or using, more muscle fibers than your left arm due to the weight of the book. Now you are blindfolded and another heavy book will be placed in either hand. You don't know which hand, but the goal of keeping your elbows bent at 90 degrees is the same, so your attention is set to respond by doing whatever you have to in order to maintain the elbows at 90 degrees. If the book is placed in your empty hand, it will probably sink slightly due to the surprise and then respond by returning to the 90-degree elbow flexion. Without a goal, who knows where your arms would end up. Since you have the 90-degree goal, your body responds by returning to this posture, which is your reference of correctness, or your balance spot. This is exactly the reasoning behind the body positions in the three dimensions. If disrupted, the body has a reference of correctness to come back to.

Muscle tonus does not mean that we ski like stiff statues. The last thing we want to do is become a slave to the position. However, without some direction and attempt to maintain our body in space, we will be like a rag doll without any muscle control or tone. Good skiing is a combination of the three skills. This implies coordination and timing between those skills and the appropriate muscle tonus for maintaining and achieving those skills.

Many skiers think that good stance and the resulting posture is just for demanding situations. Although it is crucial to have good stance and posture in demanding situations, it is in the less demanding situations that the body learns to find in these positions. Then, when the demanding situation arises and the body is thrown out of balance, the body can return to the balanced stance.

Conclusion

Balance is a product of stance. If you built a table, you would pay special attention to making sure the legs were the same length so the stance of the table would be stable. The same is true of a ski stance. You need to pay attention to the pieces you have control over. For a skier, this is where the body and limbs are positioned. And since this positioning is in three-dimensional space, we have discussed where these body parts should be in each plane during all phases of the turn.

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CHAPTER 11

Dynamic Parallel Skiing

Powder snow skiing is not fun. It's life, fully lived, life lived in a blaze of reality.

Dolores LaChapelle

Dynamic parallel skiing is the dance being performed at its best. It is characterized by efficient movements that take less energy while getting more from the ski. The design of the ski will become more important, and for some, being on the right model of ski will become a dinner-table topic. Sidecut and turn radius will become familiar ski components along with the desire to own a quiver of skis—one for every snow and terrain condition. As you become a better skier, you will become a connoisseur of snow, slopes, and indeed skis. Like the maestro with the Stradivarius, the ski will take on a new meaning, and your appreciation of craftsmanship and performance will be transformed. Beauty will seem not so much in the topsheet of the ski but in the experiences the ski can afford.

The next step in the learning progression is to coordinate and refine the timing and rhythm previously learned in the parallel turn. With this and enhanced skill blending, there will be greater control and speed will be more comfortable. Those seeking grace and elegance will find them in the fluidity of movement, while those seeking X Games exploits will find that more is possible.

Carved Turn

A carved turn is when the tail of the ski follows the tip in the exact path (figure 11.1). This translates into no skidding or sideways movement of the ski. A clean arc is the only artifact left in the snow. When the ski has little or no sideways movement, it creates little friction. Since ski racers don't want to slow down, they carve their turns. To recreational skiers, this lack of speed control can be intimidating since speed control is usually high on their list of priorities.

Figure 11.1 Arc left from a carved turn.

There are only two ways to decrease speed (not counting running into something). First is creating friction or skidding, and second is turning more across the fall line. With carving and the lack of skidding, there is limited friction to control speed. This leaves turning out of the fall line as the only option.

Skiers can use the sidecut and natural flex of the ski to fit it to the turn radius desired. The more a ski is tipped up and the more it is flexed, the tighter the turn. This creates a whole new avenue for skiers to explore. This simple thing, sidecut, opened a new horizon for skiing, but with the evolution came a regression in thought. Since the ski was easy to put on edge and carve, many began to think that all turns should be locked on edge and carved. This was a belief that was manifested by those who did not understand the role of the skills. They still believed in edge and pressure, but rotary was old school. They assumed there must be a new method since there was a new ski, and with it came the delusion that carving was the only way to turn. What they didn't take into consideration was that human anatomy and its accompanying biomechanics have not significantly changed since the Lower Paleolithic period, and the physics of the forces in the turn haven't been challenged since Sir Isaac Newton explained them in his three volumes of *Principia Mathematica* in 1687. Only the tool changed. If someone invented a better hammer, it doesn't change the person swinging it or the laws of gravity, force, and momentum. These things stay the same in spite of the improved tool. Old-school rotary with the highlighted edge and pressure are limbs of the same tree. Without each other, there is no versatility in the skiing. Blending these three skills is still the key to successful dynamic skiing.

Carving–Skidding Continuum

Carving is not an on–off binary process. A turn can cover the gamut from a pure carve leaving a track a few millimeters wide to a meter-wide skidded track. Breaking this range down into however many segments you want, a turn can be of any degree of carving or skidding that is needed. This continuum depends on the amount of sideways displacement of the ski (figure 11.2). Part of the problem is the connotation that comes to mind when we say *carve* or *carving*. It is difficult to imagine a turkey that is kind of carved—it is either carved or not. To change the mindset, think of the size of the track left by the ski. A carved track will be a curved line. Its thickness will depend on the snow texture and how

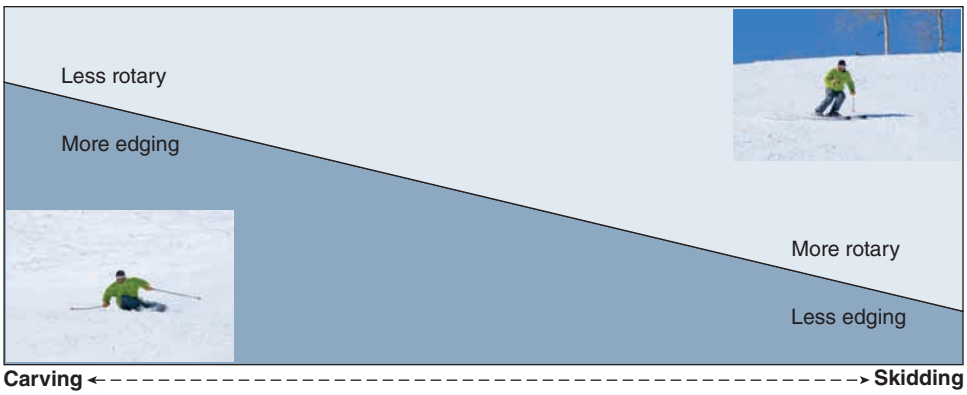

Figure 11.2 The carving–skidding continuum with relative contributions from edging and rotary.

deep the ski is permitted to penetrate. The only thing certain is that the track will not be wider than the ski (except in deep snow where the boots and legs have upset the snow). When the ski goes sideways any amount, it has a degree of skidding. Whereas carving is primarily edging and pressure, skidding involves edging, pressure, and rotary. It is rotary that is considered old school, something that was needed with the old straight skis. Even though rotary was used more with the straight skis, it has not gone away. If the skill of rotary is omitted from the skier's repertoire, versatility will be reduced or even eliminated.

A turn of high-edge angle is dynamic, but it is the ability to turn anywhere that gives virtuosos their genius. Without this control, the skier becomes no more than a passenger on the skis, turning at the whim of the edge angle.

As a general rule, the more a ski is tipped up or edged, the tighter the turn. The only problem with edging as the only means of turning is that control, slowing down, and stopping are limited. Speed management comes from the turn shape and how much the turn is continued across the hill. A turn that crosses less will pick up more speed than one that has continued farther across the hill. Though this straighter path is good on flat terrain, the same route would gradually pick up more and more speed on the black diamond. Rotary enhances control by reorienting the ski before it is edged. If the ski is only edged, it is more or less a slave to whatever edge angle is established. This makes impressive carving arcs in the snow, but the turn may not be exactly where the skier would have liked. When skiers use rotary a lot or a little, they can tease the ski in the desired direction prior to employing the edge angle. Many skiers on open snow fields (where there is nothing to run into) just tip the body into the turn and get whatever edge angle results. Their turns go from left to right, and since there is nothing in the way, all is well. You could argue that this strategy is working, but what if something is in the way that should be avoided, such as a tree, child, or cliff? With the option of rotary at the turn initiation, the skier is able to adjust or reorient the skis and then employ the progressive edging as needed to achieve the intended carve (figure 11.3).

Figure 11.3 Lower body rotation at the beginning of the turn.

Mechanics of the Carved Turn

It would seem that describing the mechanics of the carved turn should start with edging. Edging, or lack thereof, will start this discussion. The moment when the ski has zero edge angle—in other words, that moment between turns when the ski is flat against the snow—is important, because several critical features of the turn happen here. We will call this spot the *critical moment* (figure 11.4).

At the end of a turn, both skis are on their uphill edges. To start the new turn, reduce the edge angle with lateral movement of the ankles, knees, and hips until the ski is flat against the snow. This moment when the skis are flat is the critical moment. It is critical because at this instant you have to time your blending of skills. The two most obvious skills are rotary and edging. In black-and-white terms, you either rotate the ski in a new direction when the ski is flat against the snow or continue to tip the ski up onto the new edges. In reality, at this critical moment skiers blend the two skills into one movement (figure 11.5). They reorient or rotate the skis while

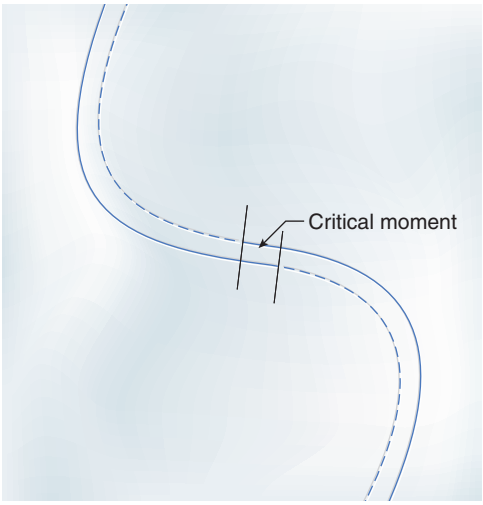

Figure 11.4 The critical moment is the small overlap of the two turns.

Figure 11.5 Skier at the critical moment. Notice the skis are flat against the snow.

tipping the skis up onto their new edges. The amount of rotary and edging determines the blend. This is not unlike a cake mix: If there is too much of one ingredient relative to the others, the cake will not be a success. If the skis are overrotated, the result will be too much direction change with little edge to hold the ski in the desired path. Conversely, if the skis have an overzealous amount of edge, they will be restricted to the physics of the resultant edge angle and may not meet the narrow corridor you had planned.

The amount of time the ski is flat is determined by stance and the resulting balance. If you are out of balance, it is the result of stance, and this must be rectified. The basics outlined in the chapter on parallel skiing must be followed. Balance is important because timing is essential. Remember, this is an important difference between the parallel turn and the dynamic parallel turn.

There is a moment when the old turn is done, and the new turn has not quite started yet. At that moment the skis are flat against the snow, and the body is perpendicular to the hill. If time could stand still at that critical moment, we would see a lot going on (figure 11.6). One turn is finished as the new turn is being born. This critical moment

Figure 11.6 A ski racer knows that the critical moment needs to take one ski length (red line). If the critical moment takes two ski lengths (gold line), the skier's arc ends up outside the desired path.

needs to happen in the time it takes the ski to travel one ski length. If it takes longer, the skier is connecting turns with a traverse. That is why skiing faster is more difficult—the critical moment is over sooner. If the critical moment takes longer, the intended path of the skis will be altered. This explains why running gates is so difficult. Racers often blame the racecourse, saying, "Oh, the gates were too tight." No, the racer's movements were either too slow or not timed at the critical moment. If the critical moment took two ski lengths, the upcoming turn would be in a different place. With this in mind, we must organize all that will be happening at this critical moment.

Concept of *All*

Five essential elements can be defined with a common suffix of sorts: *all*. These elements need to happen at precisely the exact time. If they do not, the duration between the turns is extended and fluidity and linking are lacking. In other words, they will not be dynamic but merely a parallel turn. The five *alls* are ball, fall, tall, wall, and call. These five components are necessary for a parallel turn and are timed with the flat ski or critical moment to constitute a dynamic parallel turn. They are presented in this format as a mnemonic because they all need to happen at the same time.

Ball

Ball refers to the balls of the feet. The ball of the foot is where the toes join with the rest of the foot. You would be standing on the balls of your feet if you lifted your heels off the floor. We won't be lifting our heels, but we do want to concentrate our weight on the balls of the feet at the beginning of the turn. This is an athletic position from which to move.

Moving to the balls of the feet is often called *recentering* because the skier is moving forward in the sagittal plane to reposition himself forward. You might be asking why you would need to recenter, because it sounds like you were in the aft part of the ski. Let's regress to explain. During the parallel turn, you were instructed to position the center of mass over the foot. This general information was appropriate for the basic parallel turn. Now, however, the ski will be carving. The carving action of the ski is not that different from the carving action of a knife cutting a piece of cake. If the knife is just pushed into the cake, the cake will fold in on itself and you will not have a nicely cut (or carved) piece of cake. If you slice the cake by moving the knife forward and backward, you will end up with a nicely cut (or carved) piece of cake with square edges. The skis act like the knife cutting the cake, and the follow-through of the knife slicing is analogous to the ski carving.

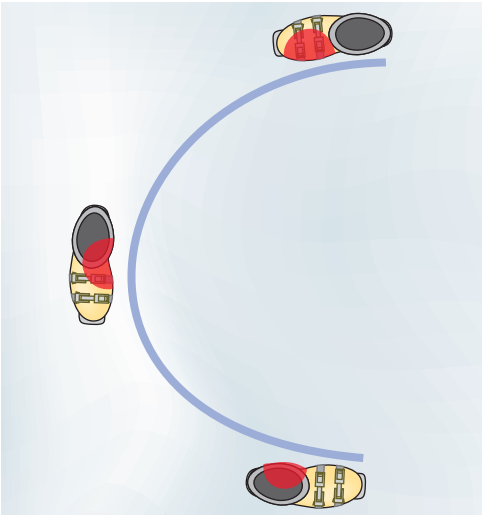

Figure 11.7 The changing center of pressure on the foot through the turn.

To carve the ski, we need to start with the front of the ski. Moving weight to the ball of the feet will accomplish this (figure 11.7). From this position, the skier can rotate and tip

TECHNIQUE TIP

Directional Movements

Directional movements occur precisely when the skier moves forward to the ball of the foot while simultaneously moving the body from the flat ski toward the inside of the turn (a movement in the sagittal plane plus one in the frontal plane) (see figure 11.8). This ball and fall motion is appropriately termed a *directional movement* because the two movements in the two planes create a diagonal path for the body. The path is neither forward (ball) nor lateral (fall) but a new direction that is between these two extremes. As we will see, the other *all* features will also start to fit into this critical moment. Directional movements are only mentioned here because the term has become a cliché in modern teaching.

the ski to start the turn as needed. As the turn develops into the fall line, the skier will shift her weight rearward to the center of the foot and finish on the heel and arch. At no time was the skier ever using the high, stiff back of the ski boot. This feature of the ski boot is for emergency use only. The weight of the skier is always going through the bottom of the boot.

This is a biomechanically efficient movement that also coincides with the mechanics of the ski. Looking at a ski, you can see that there is more ski in front of the toepiece relative to the distance behind the heelpiece. This asymmetric arrangement is based on the supposition that the ball of the foot is a biomechanically efficient location to rotate the ski from; the binding-mounting position will coincide with the ball of the foot at the middle of the ski. This is appropriate considering that it is the initiation of the turn at this critical moment where rotation of the leg will occur to reorient the ski. If you made the ski into an airplane propeller, you would drill the hole for the shaft at the precise location of the ball of the foot (exactly in the middle) so that the ski or propeller would be centered in its rotation. This spot also coincides with the narrow part of the ski. This way the ski can go from edge to edge quickly.

This movement is by itself in the sagittal plane, but it must be remembered that the blending of skills at this level is important. While you are moving forward to achieve the recentering, you are also moving laterally to establish edging. The combined result of these two movements is a diagonal movement of the body into the direction of the new turn.

Fall

The fall is not literal; instead, it refers to the movement of the body downhill or toward the inside or center of the new turn. This movement starts with the ankle and propagates up the body such that the body appears to be falling to the inside of the turn. As the turn develops, the hip continues to move toward the inside of the turn while the body achieves an angulated position.

Since the ski must be flat at the critical moment, the skier's center of mass must be aligned exactly over the skis at this instant in preparation for the fall. This movement is often called *crossover* because the body is crossing over the skis at this time. By itself, the fall is the body moving in the frontal plane. In reality, the fall coincides with recentering to the ball with the body moving in a diagonal direction.

Figure 11.8 The movement of the body forward and down the hill is referred to as a directional movement.

Tall

Looking at a dynamic parallel turn, you will notice that the leg of the outside ski is straighter than the leg of the inside ski (figure 11.9). This longer outside leg is called *tall*. The tall leg is used to increase edge angle; because it is longer and straighter, the skier is better able to resist the high forces in the turn. Sometimes this position is called *bone stacking* because the skeletal bones can support the body better when they are lined up or stacked than when they are in a more flexed position.

Figure 11.9 Long outside leg is used to resist external forces.

This body attitude is also called *long leg–short leg* due to the fact that at this point in the turn the one leg is long (tall) and the other short. After this critical moment, the legs have a role reversal and the long leg becomes short and the short leg becomes long. During consecutive turns the altering of long and short legs can resemble the pedaling action of a bicycle rider.

Wall

The wall refers to the relationship created from the tip lead through the body. If you were to connect the uphill shoulder, hand, hip, and ski tip to the downhill shoulder, hand, hip, and ski tip, you would create a surface, or wall, with few irregular features (figure 11.10). Keeping this wall without punching through or any other disruption is a goal in skiing. It is what keeps the skier aligned on the horizontal plane. Whole-body rotary problems will appear when the wall is not maintained.

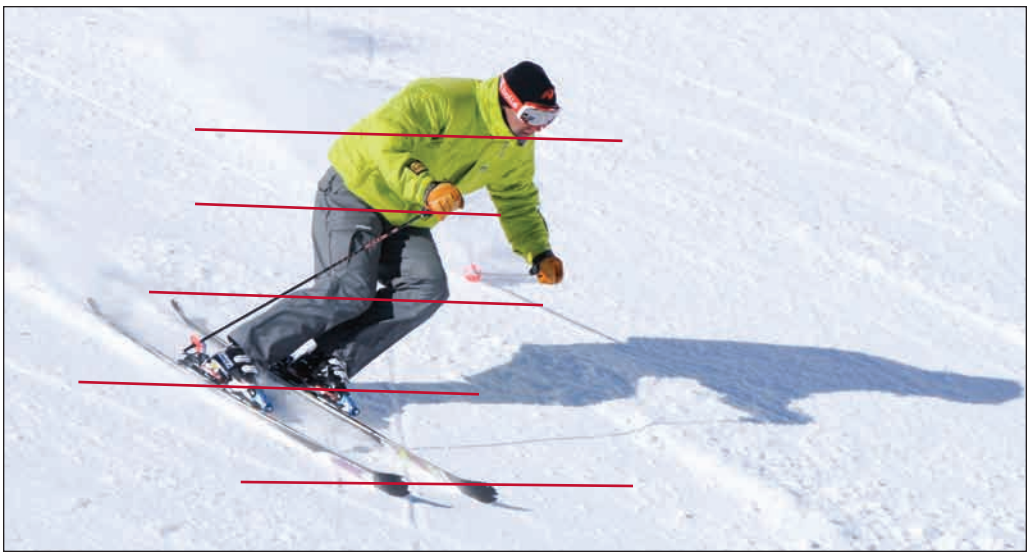

Figure 11.10 The wall can be constructed by connecting the tips, knees, hips, shoulders, and hands.

When making the turn, the wall will be biased, with either the right or left side being forward. At the critical moment, the right and left sides will start to change positions, with the opposite side beginning to creep forward. As the turn develops, the lead change and accompanying wall will increase until the next critical moment is reached in the turn cycle.

Call

The call may be the least relevant of the *alls* and possibly stretches the imagination the most. However, it does highlight an important aspect of the dynamic parallel turn. The call is a summons for the pole. The pole, or more specifically, the pole basket is being called down the hill. At the critical moment, the pole is starting its presentation or swing down the hill. The timing should coincide with the fall. It is almost as if the skier had one rope tied around the waist and another attached to the basket. At the critical moment,

TECHNIQUE TIP

A common mistake occurs when the skier attempts to reach an extreme edge angle too quickly. In this case, the skier rushes the new inside ski forward at the turn initiation. This allows the skier to plummet his hip to the inside of the new turn, resulting in an overzealous edge angle. Since the ski has been forced onto the new edge angle without any finesse, there is no adjustment for turn radius or shape. Pushing the inside ski forward breaks the wall and the skier ends up with a nonversatile ski turn. Breaking the wall is wrong, but it is not the cause of the problem, only the result. The wall will be established by having equal ankle angles, and from these the hip, shoulder, and hands will have their positions identified. Remember to keep the priorities and the rest will fall into place: first equal ankle angles, then the wall.

Having equal ankle angles will help establish the wall.

the ropes are pulled in the direction of the new turn, resulting in the skier and pole moving down the hill together. When timed correctly, the pole tip will touch the snow as the new edges are starting to engage.

Doing It All

The five *alls*—ball, fall, tall, wall, and call—are justly named because they all need to happen at precisely the same time. This part of the turn is so important that it has been given the name of *critical moment*.

The critical moment in the ski turn could be seen as an analogue to stance and its relationship to balance and technique. Without a proper stance, trying to do anything else with the body is fruitless. The critical moment of the ski turn employs the same logic. This end and beginning is when most of the gross technique movements occur (figure 11.11). After the critical moment, body actions are left to small adjusting movements (assuming correct initiation). To change or correct something later in the turn is merely putting a bandage on a much deeper problem. If the skier can initiate the turn with the essential movements and precise timing, there is a good chance the rest will take care of itself and there will be little to correct.

When all five of these actions coincide, you could say the skier is off on the right foot (pun intended). The degree to which these elements line up determines the dynamics of the ski turn. The five actions are listed not in any ordinal progression but only as a list. Their utilitarian value is in the *all* part: All five elements need to happen at precisely the same time. If there is any order to their employment, the ski turn suffers. For example, if the skier starts the fall without the concurrent movement to the ball, she will already be on her heels and the action of moving the center of mass through the length of the foot cannot happen, which will reduce carving effectiveness. Or, if the skier performs the tall action before the fall, her body will be projected upward as opposed to downhill in the direction of the turn.

Being in balance requires the skier to have coordinated actions in each of the three planes. Sagittal balance is achieved with the forward movement recentering the center of mass to the ball of the foot. Side-to-side balance in the frontal plane is with the crossover or fall, while horizontal balance is achieved by the rotary movement to maintain the wall.

Figure 11.11 Dynamic parallel skiing.

Any noncoordinated move that is late, early, or nonexistent will result in balance being compromised in the direction of that plane. For example, if the skier rotates the upper body in the direction of the turn at turn initiation, he will find himself out of balance in the horizontal plane. He may ultimately fall sideways, but it was a rotational problem in the horizontal plane that caused the problem. Since this problem originated in the horizontal plane, the skier needs to fix a movement in the horizontal plane. His upper-body rotational movement disrupted the wall by moving the hip or shoulder beyond the limits of the wall, and he would need to use counterrotation to maintain the wall.

The five *alls* can be used as a form of feedback. Not all turns will be perfect. Giving yourself feedback after a subpar turn is the most efficient way to make a change in your personal skiing. Though there are few replacements for a competent ski instructor, knowing immediately what went right and what was not quite right is the key to valuable feedback.

The *all* procedure is not set in stone; certain assumptions are made. For example, the snow is groomed. This is an aspect of modern skiing, and just like the super sidecut ski, it has changed how we look at skiing. Old-school skiing had some different features, and the tall action that is included here was an old-school up motion. It was relatively the same movement, although the timing was different. Previously, skiers extended their legs, with the same motion as the tall movement, although this movement preceded the fall or crossover when the body moved downhill. This extension was needed for the ungroomed ski slopes. If skiers tried to move the body downhill while the ski was still on the snow, the skis would not have been able to rotate because they would have been buried in the ungroomed snow. For this same logic, an up motion, or the tall aspect, can be employed prior to starting the turn when skiing off piste in heavy, wet snow (figure 11.12). Basically it is jumping up and then turning the skis—not always conventional, but effective.

The original basis of the *all* procedure must be remembered. Dynamic skiing is where the critical features of the *all* procedure must come together exactly at the same time. This results in synchronization of the critical features. Coordinating the *all* is essential for dynamic skiing.

Figure 11.12 Up-unweighting prior to rotation of the skis.

Conditions

We don't want to make the assumption that the characteristics of the ski and the skier's technique are the only factors in the skiing equation. Once a ski is chosen and the skier clicks into the bindings, that variable is established. Technique, on the other hand, has

the ability to change on the fly. What prompts skiers to alter their technique is the snow and terrain. We cannot change the basics of skiing; they are based on biomechanics and physics. What we can change is technique. That may not be as bold as it sounds, however. The changes will be in the timing, tempo, and order of movements. The end results are alterations that allow us to adjust for Mother Nature. They are small yet significant enough to accomplish the goal.

Moguls are the result of the passage of previous skiers. They can change hourly from traffic, sun, or shade, meaning the skier must change also. Powder, another condition challenge, comes in variable depths. Some snow will hardly buoy skis, while deeper depths create spindrift that blocks vision. Snow density can also be a challenge; powder, like the moguls, can change hourly. Warm sunshine and skiers tracking up the snow can change the light champagne powder into Sierra cement or Cascade concrete. Like cement shoes that the Mafia used for their rivals, you will be sunk without a way out, your feet and skis stuck in the snow.

Trees provide an obvious obstacle, while gates are a manmade form of a similar challenge. All conditions require the same basic elements of good skiing. With some minor adjustments, all skiers can master these challenging conditions. These adjustments do not trump the basics in ski technique. They are analogous to adjusting a cake mix for altitude by adding an egg or flour. The cake is still the same; it just needs a little adjustment to compensate for the environment.

Moguls

Created from the passage of previous skiers, moguls can be round, egg shaped, large, or small. The backsides can be steep or gentle. Some mogul runs seem to have rhythm while others do not. In actuality there is rarely a mogul run that has rhythm; instead, the rhythm comes from the skier. This is a harsh statement in that it takes away the number one excuse that aspiring mogul skiers use. "That run has no rhythm!" is commonly heard as the skier picks up himself and his gear after being launched from the pile of snow. You don't need shorter skis or quicker or younger reflexes but only a few basics.

Figure 11.13 Mogul skier recentering to the balls of the feet on the mogul apex.

Moguls have some features that can facilitate turning. The top or apex of the mogul is the critical-moment location, where you want to be on the balls of your feet (figure 11.13). It takes a conscious movement forward with the ankles and entire body to counter the

upslope of the mogul that is forcing your body backward. With the balls of the feet on the apex, the ski is free to rotate into the next turn.

The timing of pivoting is essential. As the skis are rotated, the upper body is rotated in the opposite direction at exactly the opposite rate. Rate is an important feature of the rotation. If the upper body rotates faster than the lower body, it will counter too much. When the upper body does not keep pace with the lower body, it will end up rotated in the direction of the turn. When the lower and upper body perform their independent rotations at the same rate, the result is a well-balanced position that is prepared for the upcoming turn.

Pivoting is unfeasible to master in the bumps if it is not perfected on the groomed slope; there is simply too much going on. Pivoting is not just a rotary skill but also an edging skill, which means the body is performing movements in two planes. The pivot or rotary is in the horizontal plane, while edging is side to side in the frontal plane. Movements in two planes require much more coordination than movements in one plane and therefore are more difficult to master. So get out of the bumps and find a steep, smooth slope. What you need to do prior to your sojourn into the moguls is learn a pivot slip. This is an exaggerated exercise in which the skis are pivoted across the hill and allowed to slip at the completion. To master this task, it must be performed in an imaginary corridor straight down the hill. Novice mogul skiers may be capable of making one or two successful turns but lose control due to the inability to stay in a line down the hill. Remember the rhythm, or lack of it, mentioned earlier—you have to be able to conform to whatever rhythm is presented by the previously formed moguls. Once you are able to pivot and slip while staying in the corridor, you will be able to find your line in the mogul field.

Pivoting is essential for direction and speed control. Direction is a tactical decision directly related to speed control. These two elements determine the success of the mogul run. How much do you pivot? The mogul is a round bump with a trough at both sides. In front of the mogul is another bump with a relatively flat top. Your goal is to get to the next flat top without ending up in the trough. After pivoting on the apex, your skis will start edging on the backside of the mogul (figure 11.14). Make the edging sideslip

Figure 11.14 Mogul skiers skidding down backside of a mogul headed toward the next apex.

last long enough so that your landing will be on the next flat spot or apex. It is this edging that creates friction and controls your speed. The trough is the last place you want to end up. Stay on the side of the mogul as long as possible. When you end up in the gutter, you have no opportunity for speed control and have to wait until you are spit out at the next mogul.

Big Moguls

Big moguls require the same skills as smaller moguls. Due to their size, precise rotation on the apex and the ability to adjust the rate of skidding are essential. Rotation needs to be not just in the approximate direction of the new turn but at the angle the skis need to point in throughout the turn. A countered upper body to anchor from is indispensable. Skidding down the backside of these monsters has to be controlled so that speed can be checked, but enough momentum needs to be maintained to ascend the upcoming mogul.

You will know a mogul is big when it acts like a ski jump, putting you in the air. To counter this anticipated flight, absorb the mogul with your knees and ankles by actively flexing them at or before takeoff (figure 11.15). This absorption will keep your skis on

Figure 11.15 Mogul skier absorbing a bump while recentering on the apex.

the snow where you look again for the apex and recenter on the balls of your feet. Since the backside of the mogul is steep compared with your perch on top of the mogul, keep flexing the ankles to continue to move your body forward so that you stay relatively perpendicular with the mogul as you go over the crest. Actively extend your legs to keep ski–snow contact and consistent pressure throughout the turn. Keeping your ski tips on the snow after the apex is a good barometer for where you need to be with your body. If you find your ski tips are not on the snow, flex forward at the ankle to enable the body to move forward.

A playful modification can be implemented for the truly athletic by accepting the flight the mogul is presenting. As you lift off, recenter onto the balls of the feet with ankle flexion, which will drop the tips of the skis. Land with the skis at the same angle as the backside of the mogul. As before, skid down this backside, creating ski–snow friction for speed control.

Swing the pole forward toward the top of the next mogul as you slide down the backside of the mogul. As you come to the top of the next mogul, you will make a rather abrupt edge set with a simultaneous pole plant (figure 11.16). This pole plant will help stabilize the upper body and assist in creating the edge set and establishing a large base of support. The pole swing is different from the one presented in the call section. That pole swing is used to help release the edges, whereas this pole action is timed with the edge set.

We have presented one method here, but don't assume it is the only way to ski moguls. Skiing differing paths through the mogul field and on differing aspects of the mogul is part of the beauty and creativity of skiing moguls.

Figure 11.16 Mogul skier planting his pole, which coincides with the edge set.

Powder

Powder is a three-dimensional world. The skis can go left and right the same as on the groomed run but now have the opportunity to dolphin up and down, in and out of the power. To assist with this experience, skis with waists greater than 90 millimeters are recommended. Originally they were considered cheating, but today they are standard equipment. They will help buoy you whatever the density of the snow. As a general rule, the lighter the snow, the easier it is to ski in. As snow becomes denser, it becomes heavier and less forgiving.

In the powder, do not turn out of the fall line as much. It is not necessary because the depth of the snow will be slowing you down, and a little added speed will supplement the momentum through the powder.

Stance width can be closer together to achieve a larger platform to help buoy you in the snow. This is especially important if you are not on fat skis. This stance with an exaggerated flexion and extension of the legs will establish the up-and-down motion. Once rhythm is established, the motion of the skis will take over.

Keep the fore–aft stance close to neutral without too much tip pressure at turn initiation, although there is no need to sit on the tail. Sometimes a great powder skier appears to be sitting back. This illusion is caused by the tails of the skis being farther in the snow than the tips (figure 11.17). The tails may be 40 centimeters in the snow while the tips may be almost at the surface. The skier is in balance with regard to the skis; it is just that the skis have a different orientation with the hill.

Figure 11.17 The tails of the skis are deeper than the tips, giving the impression of sitting back.

Crud

Crud is just bad powder. Whereas new-fallen snow is 3 to 10 percent water, heavy or wet snow can be as much as 20 to 40 percent water in the spring. This makes for heavy snow, and moving in it is difficult. The first rule of thumb is upper-body discipline. Short turns must have a vertical spine line and a countering upper body. Any tip of the upper body will tip you over. If you are lucky enough to stay upright, the tip will cause you to rotate and will screw you into the ground. Either way you will be picking snow out of your ears.

Rotating the ski is impossible in heavy snow. The snow just provides too much resistance. Therefore, the only way to turn the skis is to liberate them from the snow. This can be done with an aggressive jump. Once in the air, the skis are rotated in the new direction. Coming down into the snow is a critical time. As the skis are landing in the snow, the centers of the skis will sink farther into the snow than the tips and tails. This turns the skis into trampolines with the tips and tails suspended. Timing the skier's upward vertical motion with the rebound from the bowed ski gives the skier the spring she needs to repeat the process. Once a rhythm is established, this high-energy turn can be exhilarating. Due to the athleticism of this bound–rebound activity, the upper body needs to be very disciplined regarding the vertical spine line and the exact amount of counterrotation between the lower and upper body. Planting the ski pole the same way as in the big moguls can be helpful. This can be used not only for stabilization but also to assist with the liberating up motion.

Crud turns don't have to always be short. Medium- and longer-radius turns add another dimension to the crud. To assist the up motion, look for old moguls or terrain that will act as a small jump. Time the up motion with the liftoff from the terrain to provide enough air to give yourself time to reorient the skis. Landing softly and quietly with legs flexed will set you up for the next liftoff. A degree of tension is needed in the upper body to maintain a stable flight.

Trees

Trees can be dangerous, whether from impact or from avalanche. Large trees usually imply that avalanches are not frequent, but checking the conditions with the local ski patrol or avalanche ranger is highly recommended.

Technique in the trees is mostly snow dependent. What is important is tactics in the trees, or where you go. Seeing the path of your upcoming turn is essential, so your eyes should be looking ahead. See the trees but do not look at them. The body tends to go

SAFETY TIP

When skiing in the trees, helmets are always a good idea, as is taking off the pole straps. If the pole basket attaches itself to something buried and hangs on, it could result in injury to the skier.

where the eyes look, and if you are trying to stare down the trees, you might just end up kissing one. Look where you want to go, not where you do not want to go.

Watch for ripples and undulation in the snow. They mean there could be a sharp drop or rise in the terrain, which could be a fun terrain feature. They could also mean something is buried, such as a fallen tree or limb. Having a ski go under one of these at a high speed is not a welcomed prospect.

Gates

Most gates in the recreational arena are of the giant slalom (GS) variety. These are not quick turns around single poles but require more time between gates without too much speed. A wise person once said that GS is the easiest to do but the hardest to do fast. Though it takes minimal skill to negotiate the GS turns, being astute in the gates requires tremendous timing and precision. It is this coordination of movements explained by doing the *all* procedure that is so important in the gates. Being off on just one element will show in the results. Gates are one of the best ski exercises to perfect the coordinative movements of dynamic parallel skiing (figure 11.18).

Since the gates are dictating the path down the mountain, race tactics will differ from open-slope recreational skiing. Recreational skiing lacks the discipline of tactics. Most skiers just start a turn and end up in a general area. Skiing in the gates requires a precise turn shape with an accurate turn initiation and finish. Being off line by a mere half meter can be the difference between staying in the course and skiing off, much less going fast. Tactically, the eyes must see the path. When gates are set red, blue, red, blue, looking

Figure 11.18 Gate running can be challenging and exciting.

from red gate to red gate or blue to blue and seeing the path the skis will travel gives the skier the needed anticipation. Essentially this is looking from critical moment to critical moment, which will describe the shape, size, and line of the turn (figure 11.19). With this immediate plan in mind, the skier is able to regulate the amount of rotary at the start and engage and adjust the edge angle while adapting pressure.

Turns should be round. Any comma-shaped turns that tighten at the end will be difficult to hold and result in skidding. Pressure needs to be applied early so it can be regulated over more of the turn. To accomplish this, steer and edge your ski early so your turn can be scribed into a round shape. This requires the skier to make the *all* movements at the critical moment midway or slightly higher between the gates. Since there is a set amount of distance between the gates, the *all* procedure must happen in one ski length, or the skier will run out of time.

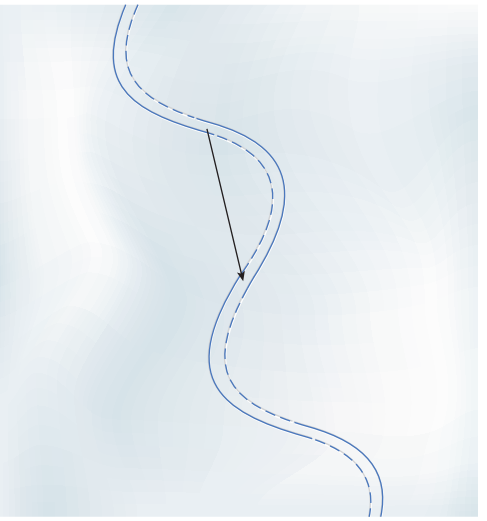

Figure 11.19 Looking from critical moment to critical moment will dictate the shape, size, and line of the turn.

Conclusion

Dynamic parallel skiing is similar to the basic parallel turn. They both employ the same three skills in their coincident cardinal planes. Accurate timing of the skills leads to a coordination of movements that have no time for useless gesticulations. The result is balance in three dimensions that is a harmonious flow of movements. Mastery of this coordinative effort allows the skier to seek out diverse conditions found in the advanced skiing environment.

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Web Resources

General Interest

Powder Magazine
www.powdermag.com
This ski magazine with a younger spin offers exciting photos, amazing video of the latest tricks, news, gear reviews, resort guide, events, and readers' blogs.

SkiNet
www.skinet.com
This site links to *Ski*, *Skiing*, and *Snow* magazines. It offers general interest features, equipment reviews, travel and resort guides, real estate, history, and lots of photos and videos.

Ski Area Management
www.saminfo.com
Although this is a site for the mountain resort industry, it contains general ski area and resort news and issues facing the business of skiing. The key decision makers and influencers in this market are responsible for highly sophisticated lift systems, multimillion-dollar snow-making systems, fleets of modern slope-grooming equipment, ticketing systems, and comprehensive access control.

Ski Rebel
www.skirebel.com/magazine
This is a site with an edgy ambience containing middle-of-the-road information about international events and news along with travel information.

Backcountry
www.backcountrymagazine.com
This site for the backcountry skier or ski mountaineer offers articles on ultralight gear, backcountry gear tests, telemark skiing, avalanches, route finding, and mountain skills.

Travel

Ski Canada—Canadian Ski Resorts
www.j2ski.com/american_ski_resorts/Canada
Canadian Ski Resort pages include skiing facts, snow reports and forecasts for most major ski resorts, and local accommodation and online ski hire booking (where available) for 84 ski resorts in Canada.

Canada Ski Directory
www.ski-canada.biz
Provides a directory of Canada ski and snowboarding hills and cross-country ski areas.

Ski.com
www.ski.com
This full-service travel site for North America, Europe, and South America contains background information for all aspects of planning.

Competition

Fédération Internationale de Ski
www.fis-ski.com
This is the site of the International Ski Federation (Fédération Internationale de Ski). All international ski racing is sanctioned by FIS, including Olympic Games and world championships. Athlete biographies and rankings, past events, and upcoming events are listed. International ski news, statistics, ski history, and medical aspects such as doping and injury surveillance information are also offered.

United States Ski and Snowboard Association
http://ussa.org
The U.S. Ski and Snowboard Association provides opportunities for athletes in the most exciting Olympic action sports. USSA programs provide education, development, and competition opportunities for young athletes, from grassroots club programs up through national teams and the Olympic Games. The USSA is the national governing body for Olympic skiing and snowboarding and the parent organization for the U.S. Ski Team and U.S. Snowboarding. Programs are implemented through a national network of 400 USSA clubs. The USSA has 30,000 members, including over 22,000 athletes.

Alpine Canada Alpin
www.canski.org
This is the site of the Canadian Alpine ski team. Alpine Canada Alpin (ACA) is the governing body for ski racing in Canada. Founded in 1920 and accounting for close to 200,000 supporting members, the ACA represents coaches, officials, supporters, and athletes, including the elite racers of the Canadian Alpine Ski Team and the Canadian Para-Alpine Ski Team. The ACA seeks to put Canadian athletes on the top step of the podium through the commitment of financial, technical, and human resources. The ACA is also dedicated to promoting participation by Canada's four million recreational skiers. The site contains competition news and results along with ski team biographies.

Ski Racing
http://skiracing.com
This is the news web page of *Ski Racing*, the journal of snowsport competition worldwide. It provides up-to-date news reporting about North American and international ski racing.

NASTAR (NAtional STAndard Race)
www.nastar.com
The largest recreational ski and snowboard race program in the world is a fun, competitive, and easily accessible program that, through the development of a handicap system, allows racers of all ages and abilities to compare their race results with those of competitors across the United States.

Safety

National Ski Patrol
www.nsp.org
Established in 1938, the U.S. National Ski Patrol is the organization that originated ski rescue and ski safety. The site contains educational information about all aspects of outdoor winter safety, avalanche, helmets, dressing for foul weather, and preseason conditioning.

American Avalanche Institute
www.americanavalancheinstitute.com
The American Avalanche Institute, founded 1974 in Silverton, Colorado, and Jackson, Wyoming, teaches avalanche awareness and hazard evaluation courses. It conducts courses in 10 other states and has educated over 8,000 outdoor enthusiasts and professionals.

Conditioning and Nutrition

Skier's Edge
www.skiersedge.com
This site for the Skier's Edge, a home fitness machine, contains information about ski conditioning and training.

Accelerade Sport Drink
http://pacifichealthlabs.com/Accelerade-Research.asp
The only company that has used Alpine skiing in its hydration studies, Accelerade runs clinical studies using a carbohydrate and protein sport drink.

Equipment

Nordica
www.nordica.com
This ski site presents the Nordica line of boots and skis. Extras include explanations of the many ski types along with boot and ski technology.

America's Best Bootfitters
www.bootfitters.com
This is where shop employees go to become certified boot fitters. The site contains boot-fitting tips, current boot reviews, certified shops, and specifics on women's boots.

SkiHelmets.com
http://skihelmets.com
This site offers helmet reviews, news, and information on shopping, sizing, picking a helmet, finding a helmet for your personal style, wearing a helmet, and cleaning a helmet.

Marker
www.markerusa.com
This company site for bindings, helmets, goggles, and ski apparel provides lots of extra information and tips about products.

Tognar
http://tognar.com
This site includes many helpful hints on ski maintenance along with a catalogue of tools for purchase.

Success Checks

Chapter 1

1. Skiing is older than the wheel.
   a. true
   b. false
2. Which division of the U.S. Army had ski troops during World War II?
   a. 10th Mountain
   b. Chasseurs Alpins
   c. Alpini
   d. Blue Devils
3. Where is the birthplace of skiing?
   a. Lillehammer, Norway
   b. Bloke Plateau, Slovenia
   c. Telemark, Norway
   d. Hoting, Sweden
4. What was the first type of skiing?
   a. Nordic
   b. freestyle
   c. snowboarding
   d. Alpine
5. People with disabilities cannot ski.
   a. true
   b. false
6. How many skiers can a platter lift support?
   a. 1
   b. 2
   c. 6-8
   d. 200
7. What country is famous for heli-skiing?
   a. Algeria
   b. Canada
   c. France
   d. Switzerland

8. What is a T-bar used for?
   a. putting on tire chains
   b. après-ski
   c. holding a golf ball
   d. getting up the ski hill
9. Night skiing is popular near population centers.
   a. true
   b. false
10. What is another term for Alpine?
   a. telemark
   b. jumping
   c. downhill
   d. park and pipe

Chapter 2

1. How many calories can an Alpine skier burn per hour?
   a. 12
   b. 20
   c. 75
   d. 350
2. For balance, the semicircular canals in the ears are arranged in how many planes?
   a. 2
   b. 3
   c. 4
   d. 5
3. Since skiing is performed in a snowy environment, hydration is inconsequential.
   a. true
   b. false
4. If you use SPF 15 at sea level, what SPF would you need at Sunshine Village in Canada, a 2,440-meter elevation, to attain the same effectiveness?
   a. 15
   b. 20
   c. 30
   d. 45
5. What component of fitness does Alpine skiing require?
   a. cardiorespiratory endurance
   b. muscular strength and endurance
   c. flexibility
   d. all of the above

6. Stretching to increase range of motion is a good method of recovery after skiing.
   a. true
   b. false
7. What type of activity can be continuously performed for over 20 minutes?
   a. cardiorespiratory
   b. muscular strength
   c. 1RM lifting
   d. all of the above
8. What is the estimated maximum heart rate for a 25-year-old female?
   a. 150 bpm
   b. 165 bpm
   c. 180 bpm
   d. 195 bpm
9. If a person executes three sets of 10 reps, what type of training is this?
   a. cardiorespiratory endurance
   b. muscular strength
   c. flexibility
   d. all of the above
10. If fatigue is the reason you cannot finish skiing a 30-second mogul run, but you can ski all day, what should you work on?
    a. cardiorespiratory endurance
    b. muscular endurance
    c. muscular strength
    d. flexibility

Chapter 3

1. What is the latest innovation in skis?
   a. twin tips
   b. telemark backcountry skis
   c. exaggerated sidecut
   d. telescoping ski poles
2. What determines the type of ski chosen?
   a. metal edges
   b. binding placement
   c. twin tip
   d. task
3. A beginner will have a longer ski compared with an advanced skier.
   a. true
   b. false

4. What does the radius of the ski refer to?
   a. sidecut
   b. the tightness of turns it will carve
   c. the width dimensions of the ski
   d. all of the above
5. What will happen if a ski base is tuned too flat?
   a. It will be hard to bevel.
   b. It will get hung up when rotated.
   c. It will have a more acute side bevel.
   d. Nothing—that is what you want.
6. What is your most important piece of skiing equipment?
   a. skis
   b. bindings
   c. boots
   d. poles
7. What should you do if you see a runaway ski?
   a. Try to stop it.
   b. Ski and try to catch it.
   c. Yell "Ski!"
   d. Report it to the ski patrol.
8. Adjusting your own bindings daily is recommended.
   a. true
   b. false
9. What determines pole length?
   a. type of ski
   b. age
   c. ski ability
   d. skier height
10. Ski goggles and glasses lenses should provide 99 to 100 percent UV protection, which is the same thing as UV absorption up to 400 nm.
    a. true
    b. false

Chapter 4

1. Ski areas rate slopes by
   a. signs
   b. size of the moguls
   c. grooming the night before
   d. difficulty

2. If you are on a green run, it is
   a. very difficult
   b. difficult
   c. moderate
   d. easy
3. Where is the visibility best during a whiteout?
   a. powder bowl
   b. mogul run
   c. groomed slope
   d. glade
4. On recreational slopes, moguls are formed by snow cats at night.
   a. true
   b. false
5. What is the most likely slope angle for a snow avalanche?
   a. 10 to 25 degrees
   b. 20 to 30 degrees
   c. 35 to 50 degrees
   d. 50 to 75 degrees
6. In case of an avalanche, you should always carry a transceiver in your backpack along with a shovel.
   a. true
   b. false
7. The skier's responsibility code is a code of conduct based on etiquette, courtesy, and a defensive attitude on the ski slope.
   a. true
   b. false
8. An example of the skier's responsibility code is that people ahead of you have the right-of-way.
   a. true
   b. false
9. If it is a powder day and the 1-meter rule is in effect, it is okay to go past closed-area signs.
   a. true
   b. false
10. Skiers take their pole straps off in the trees to prevent upper-extremity injuries.
    a. true
    b. false

Chapter 5

1. What is the most important component for learning?
   a. feedback
   b. ski length
   c. practice
   d. certification level of the instructor
2. Ski lessons are only for beginners.
   a. true
   b. false
3. How do drills facilitate learning?
   a. They make you uncomfortable.
   b. They encourage perfect technique.
   c. They tease out deficiencies while exaggerating proficient movements.
   d. They force movements by repetition.
4. Some learning styles are better than others.
   a. true
   b. false
5. Students should adapt their learning styles to the teaching style of their instructor.
   a. true
   b. false
6. It is best to take a lesson at the start of the ski vacation.
   a. true
   b. false
7. It is best to leave the ski lesson with some homework.
   a. true
   b. false
8. The most important component of a child's ski lesson is fun.
   a. true
   b. false
9. Ski lessons from acquaintances are only illegal if money is exchanged.
   a. true
   b. false
10. Ski ability refers to the level you want to achieve by the end of the ski lesson.
    a. true
    b. false

Chapter 6

1. Ski areas are totally automated so that vacationers do not have to plan before they show up.
   a. true
   b. false
2. Who might be eligible for a discounted lift ticket?
   a. seniors
   b. military
   c. children
   d. all of the above
3. Day areas only have skiing during the day.
   a. true
   b. false
4. Berms or ridges on the ski slope should be viewed as
   a. a reason not to go to that ski area
   b. something to blame if you have a bad run
   c. a challenge
   d. grounds to get your lift-ticket money back
5. Packing for a two-day trip may be as involved as packing for two weeks.
   a. true
   b. false
6. Discounts at ski areas are easier to find during holidays.
   a. true
   b. false
7. The only eating options at a destination ski resort are fancy restaurants.
   a. true
   b. false
8. Ski-in, ski-out accommodations could present transportation problems at the end of the day.
   a. true
   b. false
9. Traveling should be
   a. shunned
   b. memorable
   c. avoided
   d. never planned
10. Ski racks and rocket boxes improve fuel economy while driving.
    a. true
    b. false

Chapter 7

1. In crowded areas, it is recommended that you carry your skis on your shoulder.
   a. true
   b. false
2. The plastic of ski boots is thermal sensitive. This means it becomes stiffer when it is cold.
   a. true
   b. false
3. Once your ski boots are buckled, you shouldn't touch them again all day.
   a. true
   b. false
4. The fall line is
   a. where you fall
   b. a demarcation on the unloading ramp of the chairlift
   c. the path a ball would take if allowed to roll down the hill
   d. slang for the DIN setting
5. The basic skiing stance is with skis about hip-width apart, knees over toes, and weight distributed evenly between the two skis.
   a. true
   b. false
6. A stance that has a reference of correctness will give a skier a posture to come back to after encountering a balance challenge.
   a. true
   b. false
7. Learning can happen even if you can't see it.
   a. true
   b. false
8. Why bother to position the knees toward the hill during a side step?
   a. because knees are important in skiing
   b. because knees should always be bent or flexed in a basic ski stance
   c. so the edge of the ski will penetrate the snow
   d. to determine the fall line
9. What will happen if the knees are together during the wedge?
   a. The skis will flatten.
   b. The skis will increase their edge angle.
   c. Nothing will happen.
   d. One ski will turn more than the other.

10. To stop from a gliding wedge
    a. let the skis run across the flats or uphill
    b. push the tails out more
    c. both of the above
    d. none of the above

Chapter 8

1. What are the three skills of skiing?
    a. balance, gliding, wedge
    b. straight run, wedge, turning
    c. equilibrium, movement, stance
    d. rotary, edging, pressure
2. How do you turn in a wedge position?
    a. increased rotation of one leg
    b. increased pressure to one ski
    c. increased edging to one ski
    d. all of the above
3. When a ski is on edge
    a. it will be easier to rotate
    b. it cannot go sideways
    c. it will be difficult to pressure
    d. it will be difficult to rotate
4. What is a left-footed turn?
    a. a left turn
    b. a turn on the left edge
    c. a turn in which the left foot is dominant
    d. a turn in which the left foot matches
5. What is angulation?
    a. the edge angle of the ski
    b. the angle of the *V*, wedge, or stem
    c. the comma or *C* shape formed with the body
    d. the angle of the ankle flexion
6. If you are in a wedge trying to turn by rotating the leg and ski but are unsuccessful, what could you try?
    a. moving the knee out over the ski
    b. decreasing the size of the wedge
    c. checking your overall stance
    d. all of the above

7. What would cause a skier to end up facing uphill at the end of the turn?
   a. too much pressure to the outside ski
   b. upper-body rotation in the turning direction
   c. holding the hands too low
   d. decreased edging at the end of the turn
8. Only advanced turns have a blend of skills.
   a. true
   b. false
9. What features on the ski allow it to turn?
   a. tips and bindings
   b. flex and sidecut
   c. edge and pressure
   d. tips and tails
10. If you drop your pole or lose a ski while loading the chairlift, jump off to the side immediately.
    a. true
    b. false

Chapter 9

1. Skidding is an outdated method of turning. Modern skiing is all about carving.
   a. true
   b. false
2. Balance is achieved when the skier's center of mass is over or in line with the base of support.
   a. true
   b. false
3. What is the most biomechanically efficient way to edge the skis?
   a. tipping the entire body
   b. bending sideways at the spine
   c. flexing the pelvis
   d. tipping the knees medially
4. The spine with all its bones has a large range of motion.
   a. true
   b. false
5. What is the most difficult aspect of going from a wedge christie to a christie?
   a. transferring weight
   b. flattening the inside ski
   c. keeping a high edge angle
   d. internally rotating the inside ski

6. The skill of skidding is essential to the christie.
   a. true
   b. false
7. What new skill is used to match the skis in the christie that was not present in the wedge?
   a. weight shift
   b. increased edging
   c. external rotation of the ski
   d. skiing on both inside edges
8. A goal of linking is to increase rhythm and decrease time between turns. How can this be promoted?
   a. tight moguls
   b. pole plants
   c. shorter turns on flatter terrain
   d. quick edge set between turns
9. What do you need to master if your goal is to match the skis before the fall line?
   a. edge hold at the end of the previous turn
   b. strong extension to the new outside ski
   c. releasing the new inside ski while the hip moves to the inside of the turn
   d. internal rotation of the inside ski
10. The ability to perform a successful christie is mostly dependent upon which skill?
    a. edging
    b. pressure
    c. rotary
    d. weight transfer

Chapter 10

1. Parallel skiing encompasses a broad range of skiing abilities.
   a. true
   b. false
2. Skiing is performed in three-dimensional space.
   a. true
   b. false
3. A skier in the backseat has moved too far in what plane?
   a. horizontal
   b. sagittal
   c. frontal
   d. none of the above

4. What plane are jumping jacks and flapping your arms in?
   a. horizontal
   b. sagittal
   c. frontal
   d. none of the above
5. Rotation is in the _____ plane, edging is in the _____ plane, and pressure is in the _____ plane.
   a. horizontal; sagittal; frontal
   b. horizontal; frontal; sagittal
   c. sagittal; frontal; horizontal
   d. frontal; horizontal; sagittal
6. Coordinative movements are when a skier moves in one plane at a time.
   a. true
   b. false
7. What ultimately determines ski lead?
   a. sidecut
   b. edge angle
   c. ankle flex
   d. snow conditions
8. During a ski turn, the ski lead will gradually decrease and then gradually increase.
   a. true
   b. false
9. Aligning the body in the frontal plane suggests that
   a. the inside hip is higher than the outside or downhill hip
   b. the inside shoulder is higher than the outside or downhill shoulder
   c. the inside hand is higher than the outside or downhill hand
   d. all of the above
10. Aligning the body in the sagittal plane suggests that
    a. the flexing and extending actions are the same amount at the ankle and knee
    b. the angle or lean of the lower leg and back are about parallel
    c. the body is in a perpendicular attitude with regard to the hill slope
    d. all of the above

Chapter 11

1. Dynamic parallel skiing contains the same rotary, edging, and pressure in the three planes that are fundamental to all skiing.
   a. true
   b. false

2. Speed control during carving is accomplished by skidding.
   a. true
   b. false
3. Great skiers only need to know how to carve.
   a. true
   b. false
4. Great skiers use the high back of the ski boot as they progress through the turn.
   a. true
   b. false
5. The angle of the wall is derived from
   a. tip lead
   b. ankle flex
   c. hip lead
   d. shoulder rotation
6. A directional movement is a result of which two *all* movements?
   a. tall and wall
   b. ball and fall
   c. call and tall
   d. ball and wall
7. What would cause the wall to be ineffective?
   a. unequal ankle flexion
   b. overrotation of the upper body
   c. overcountering or too much counterrotation
   d. all of the above
8. What would happen if a skier performed the *all* movements at the same time but the ball was not coincident with the rest of the movements?
   a. The skier would fall to the inside.
   b. The skier would overrotate.
   c. The skier would be overedged.
   d. The skier would be in the backseat.
9. You should initiate your turn _____ of a mogul from the _____ of your foot.
   a. in the trough; heel
   b. on the apex; ball
   c. on the side; ball
   d. on the side; center

10. What additional skill do big moguls require that is not mandatory in smaller moguls?
    a. absorption with flexion and extension
    b. pole plant coinciding with an edge set
    c. excellent ability to rotate and skid
    d. all of the above

Answers

Chapter 1: 1. a; 2. a; 3. c; 4. a; 5. b; 6. a; 7. b; 8. d; 9. a; 10. c
Chapter 2: 1. d; 2. b; 3. b; 4. c; 5. d; 6. b; 7. a; 8. d; 9. b; 10. b
Chapter 3: 1. c; 2. d; 3. b; 4. d; 5. a; 6. c; 7. c; 8. b; 9. d; 10. a
Chapter 4: 1. d; 2. d; 3. d; 4. b; 5. c; 6. b; 7. a; 8. a; 9. b; 10. a
Chapter 5: 1. c; 2. b; 3. c; 4. b; 5. b; 6. a; 7. a; 8. b; 9. a; 10. b
Chapter 6: 1. b; 2. d; 3. b; 4. c; 5. a; 6. b; 7. b; 8. a; 9. b; 10. b
Chapter 7: 1. b; 2. a; 3. b; 4. c; 5. a; 6. a; 7. a; 8. c; 9. b; 10. c
Chapter 8: 1. d; 2. d; 3. d; 4. c; 5. c; 6. d; 7. b; 8. b; 9. b; 10. b
Chapter 9: 1. b; 2. a; 3. c; 4. b; 5. b; 6. a; 7. c; 8. c; 9. c; 10. a
Chapter 10: 1. a; 2. a; 3. b; 4. c; 5. b; 6. b; 7. c; 8. a; 9. d; 10. d
Chapter 11: 1. a; 2. b; 3. b; 4. b; 5. b; 6. b; 7. d; 8. d; 9. b; 10. d

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About the Author

Ronald W. Kipp is the Alpine sport education manager for the U.S. Ski and Snowboard Association (USSA). He did his PhD work in motor control at the University of Utah before working with the U.S. ski team's sport science department as director of athlete preparation. He has also coached and was the head physiologist with the U.S. ski team's men's Alpine world cup team and was assistant director of coaches education for the USSA. He has worked with the Norwegian men's Alpine national team as an on-hill coach and sport science consultant. He has been an examiner for PSIA (Professional Ski Instructors of America) for over 30 years, and for 5 years he was the education manager for PSIA Intermountain. Ron has written one other book on skiing and has authored or coauthored more than 50 scientific published papers on skiing. He has also given over 100 presentations nationally and internationally on skiing.

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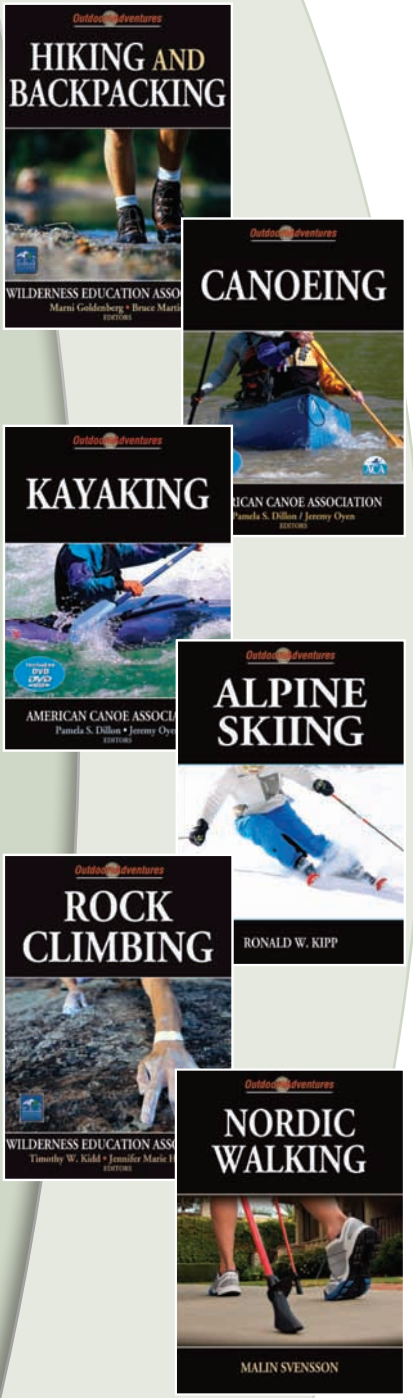

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