Designing for Professional Skiers

Designing Equipment for Professional Alpine Skiers and Freestyle skiers.

Yvonne Maria Rørvik
Department of Product Design Engineering
Norwegian University of Science and Technology (NTNU)

ABSTRACT

Products that are designed for professional athletes are products of high quality and endurance, since the athletes often rely on their equipment to be the best. To create these kind of products, designers must work with the best materials and test their products for improvement often to be able to get the best possible solution possible. In addition to this, there are rules and regulations that must be taken into consideration to make sure that the product is safe to use, and that it does not violate any laws or constrictions given by unions such as FIS (Fédération Internationale de Ski).

This paper looks at the challenges and factors to take into consideration when designing for professional athletes, alpine skiers in particular. Since alpine ski racing is a sport with high risk of knee injuries, the focus for this article will be to look at safety and injury prevention. It will also be to look at the effectiveness of sponsorship, and will give guidelines to what a designer should take into consideration when designing for professional alpine skiers.

KEYWORDS: Athlete safety, Sponsorship, Users' need, Alpine skiing

1. INTRODUCTION

The author of this article has been skiing since the age of five, and skiing and snowboarding is still one of her favorite hobbies. As a side note, the author has also chronically injured both of her knees due to alpine skiing and snowboarding.

Technically speaking, being a professional athlete means to continuously strive for self-improvement. Professional athletes rely on their talents and skills to set new records and to win medals to become successful. Some athletes will go to the extreme extents for the sake of winning. As an example, the Olympian skier Steven Nyman uses applied physics, fluid dynamics and nutrition science to improve his athletic skills further. Other athletes may see a sport psychologist on a weekly basis to discuss their work-out tactics in order to keep their minds clear and focused during training and competition (Marlow, 2014).

From the designer's point of view, there is often an attempt to combine aesthetics, function, and technology when designing sport equipment. Therefore, a designer might ask; does the aesthetics matter much to the professional alpine skiers? And what do the professionals expect from their equipment during practice and competition?

The safety of the skiers is highly prioritized by the International Ski Federation (FIS), and it is believed to be an important factor for the athletes and their sponsors too. Through the FIS Injury Surveillance System (FIS ISS), the athletes can access evidence based research regarding ski injuries and prevention strategies (FIS, 2016). The risk of injury among World Cup skiers and snowboarders are relatively high as the nature of the sport often involves high speed and rapid movements, where their knees are at the highest risk of being injured. These issues demonstrate the importance of

taking factors such as safety in to consideration concerning the designing of the equipment of the professional alpine skiers and snowboarders (Flørenes, Bjørneboe, Andersen, Heir & Bahr 2011).

1.1 Goal

The main purpose of this article is to introduce challenges and issues which should be considered regarding the design of the equipment used by the professional alpine skiers and snowboarders. The FIS regulations regarding sponsoring contracts and preventative measures concerning the risk of injuries, as well as factors such as ergonomics, comfort, and usability will also be discussed throughout this paper.

1.2 Method

This article is based on reviewed literature on the topic "designing for professional skiers", as well as arranged semi-structured interviews with a professional freestyle skier and a semi-professional great slalom skier. During the interviews the author managed to get a thorough overview of the needs and requests of the professional skiers.

1.3 Structure

The article gives an introduction to the professional's main requirements regarding customized and adapted designed sports equipment. This is based on safety and injury preventions. The article also explains what kind of injuries professional alpine skiers are prone to, and aims to provide solutions on how to avoid these injuries in the future. The second part of the article introduces the concept of sponsorship and the main FIS regulations which must be taken into account. Additionally, the design process which should be used when designing for professional athletes, and why this process is well suited are also covered in this paper. A short interview with the freestyle skier Marte H. Gjefsen, and the semi-professional slalom and giant slalom alpinist Sandra Rørvik, will give a broader insight on what professional skiers might find attractive regarding their equipment.

2. BACKGROUND

The background information for this article are the regulations made by FIS to prevent injuries and regulations regarding sponsorship. It is also safety regarding alpine skiing, and preventative measures with the alpine equipment.

2.1 FIS organization

The International Skiing Commission was founded by 22 delegates from 10 countries in 1910 in Norway. During the first Olympic Winter Games in Chamonix, France in 1924, the commission became known as Fédération Internationale de Ski (FIS), or The International Ski Federation. A total of 123 Nation Ski Associations compromise the membership of FIS today (FIS, 2017). FIS arrange an average of 7000 international ski competitions a year, across all their disciplines (FIS, 2017). All FIS disciplines include cross-country, ski jumping, Nordic combined, alpine skiing, freestyle skiing and snowboarding (FIS, 2016).

2.2 What is alpine skiing?

Alpine skiing is a technique developed in the Alps in Europe, in the late 19th century (Augustyn, 2011). Within the alpine skiing discipline there are five different ways to ski: alpine combined, downhill, giant slalom, slalom and supergiant slalom (super-g). Alpine skiing will in this article refer to both slalom, giant slalom and freestyle skiing. Giant slalom involves skiing with higher distance between poles, resulting in fast speeds and wide turns. The slopes used for giant slalom are often long distance. In slalom the distance between the poles are less than in giant slalom.

Freestyle skiing is one of the newest disciplines. Freestyle skiing consist of mogul skiing, cross, half-pipe, slopestyle, aerial skiing and ski cross. The interviewee later on in this article, Marte H. Gjefsen, competes mostly in ski cross (Olympic Games, 2014). Ski cross is a timed racing event.

3. SAFETY IN ALPINE SKIING

Among the Olympic winter sport disciplines, alpine skiing has the highest injury risk (Spörri, Kröll, Gilgien & Müller, 2017). The risk for severe injuries is particularly high for freestyle skiers (Flørenes, Bjørneboe, Andersen, Heir & Bahr, 2011). As earlier stated, the knee is the most exposed body part with 62,3 % of the injuries being rupture of the anterior cruciate ligament for skiers. Amongst these injuries, 83 % happens when the skier is skiing in the slopes. The anterior cruciate ligament (ACL) is located in the middle part of the knee, between the femur and the tibia, and prevents the shin bone from sliding backwards. ACL is one of the most common and frequent orthopedic sports related injuries (Ochi M. et al, 2016).

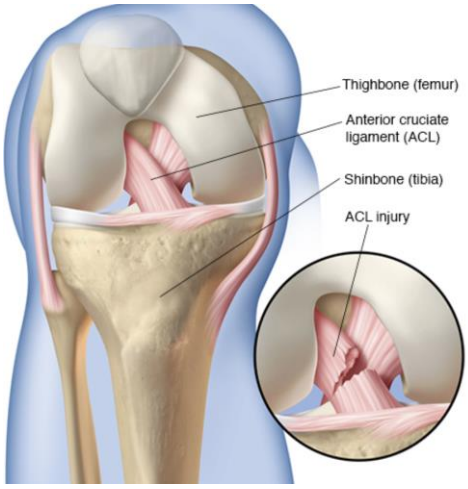

Figure 2 Shows a healthy knee, and a ACL injury. (Mayo Foundation for Medical Education and Research)

What type of skies the athlete uses is linked to how safe the skies are, but this can have an impact on the speed. By taking three basic geometric variables into consideration, length, width and sidecut radius, the Ski Racing Suppliers Association were able to identify which characteristics which lead to the most dangerous skiing behavior, also known as "aggressive skiing behavior" (Kröll et al, 2015).

Aggressive skiing behavior and out-of-balance happens when direct force pushes between the snow and the skies, resulting in the ski edges to carve. As a result of this, the ski moves uncontrollably and makes it challenging for the skier to get off the edge, and is almost impossible to control for the athlete. This phenomenon is called an out-of-balance situation, and is one of the main risk factors for severe knee injuries (Kröll et al, 2015).

3.1 The FIS Injury Surveillance System

The FIS ISS together with Oslo Sports Trauma Research Center was founded right before the 2006/2007 winter season. Their task is mainly to record injury patterns of the disciplines alpine skiing, freestyle skiing, snowboarding, and Telemark skiing. By mapping these injury patterns, FIS aimed to identify how preventive measures could be used to reduce the risk of injuries in the future. The mapping procedure was accomplished by collecting specific information on the injuries by interviewing former injured World Cup athletes as well as their coaches and the medical staff. Important questions such as where and when the injury took place, which part and side of the body which were injured was asked during these interviews. The key findings of the research showed that as many as 168 knee injuries and 64 ACL ruptures per 1000 runs in the World Cup competitions (FIS & Oslo Sports Trauma Research Center, 2016). Though, no discussion or conclusion on how injuries might be prevented in the future were provided in this report. However, the report provided an overview of the most common injuries caused by alpine skiing (FIS & Oslo Sports Trauma Research Center, 2016).

3.2 Preventing injuries / What causes injuries?

"*The Development and implementation of effective prevention measures are essential actions for protecting athlete's' health*"
– (Spörri, Kröll, Gilgien & Müller, 2017).

As mentioned earlier, aggressive skiing behavior is the state in which friction from snow penetration forces the ski into traverse, causing the skier to unwillingly turn/slide. This again will result in friction to the front of the ski. The deeper the reverse camber is, the faster the ski will turn. This is due to the more

pronounced self-steering effect (Kröll, Spörri, Gilgien, Schwameder & Müller, 2015).

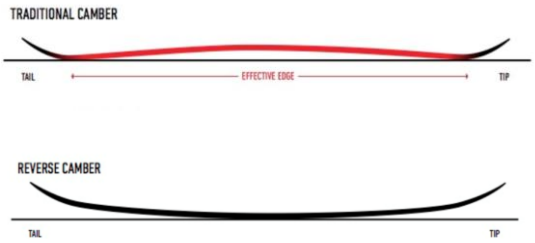

Figure 2 Ski Camber vs. ski rocker (Wagner Custom Skis)

As shown in Figure 2, the traditional skies make contact with the surface at the tip and on the tail of the ski, while the center is above the ground. The Traditional race skis have broader camber to help the skier turn faster (Wagner Customs, 2017).

To prevent injuries, it is vital to look at what movement which is most often causing the knee injuries. Both The Fédération Internationale de Football Association (FIFA) and FIS recognizes their responsibilities towards the athlete's safety, and this therefore highly prioritized by these organizations (Spörri, Kröll, Gilgien & Müller, 2017). It is believed to be necessary to understand what causes the injuries in order to take preventative measures. When it comes to alpine ski racing, 80 % off the injuries occurs when the skier is turning, and 19 % of the injuries occur when the skier is landing from a jump. On the positive side however, injuries due to collision with safety nets are rare. Most of the injuries befalls in the last quarter of the race, possibly due to the increased risky behavior of the athletes (Spörri et al, 2017). Since 19 % of the injuries arises when the skier is landing, one might argue that jumping is related to injuries. This suggests that constructions of jumps or snow bumps should be made appropriately and to the advantage of the skiers, even though it might increase the time of preparation. The World Cup skiers win the race when they are the fastest down the prepared slope, but rapid speed reduces the skier's time of reaction which might therefore contribute to the occurrence of accidents.

Increased awareness on how accidents and injuries can be prevented, has shown to decrease knee injuries by 62 %. Additionally, warmer racing suits can prevent injuries, as the body is more exposed under colder temperatures (Spörri, Kröll, Gilgien & Müller, 2017). By combining highly shaped, short and wide skis can also increase the risk of injuries. The designer can choose to design the skies differently than what is known to cause ACL. By preventing the skies from having these characteristics, the risk of injuries can be reduced.

Skis with lower torsional stiffness are believed to easier get off the edge when the ski is carving. In addition, softer boots can help protect the skiers from injuries as they are less in direct contact with the transmission force, resulting in the interaction between the skies and the snow to be less aggressive. On the downside, this can influence the athletes in a negative manner concerning their performance. Skies with reduced width profile are also less likely to cause knee injuries (Spörri, Kröll, Gilgien & Müller, 2017). Protective gears are believed to have a great impact on other injuries, such as hand and arm protectors, back protectors, and airbag systems. All these must be implemented and approved by the FIS regulations. It is also important that injuries are being reported for further research.

4. SPONSORSHIP

Sport sponsorship is one of the most common and most cost-effective methods for marketing brands to reach potential consumers, making it possible for the brand to reach a wide variety of viewers. Sponsorship as a way of marketing has been explained to be an effective way of creating new customers due to its creation of an indirect need for the product (Dees, Bennett & Villegas, 2008). Sponsorship often contributes financially by funding events, competitions, and the athletes. Goodwill on the other side, is the positive attitude consumers create towards a sponsored event, athlete, or team (Meenaghan, 2001). Although positive thoughts regarding the sponsors are important factors of sponsorship, goodwill may

be one of the main motives for creating loyal customers (Dees, Bennett & Villegas, 2008). Although this theory has been taken from a research study made primarily for elite soccer teams, presumptions have been made that these ideas are appropriate for other sport disciplines too.

It is important for the designers to have a good knowledge about the athlete's sport equipment in order to create a brand or a product that will be successful on both the professional market and the "regular" user marked. In this way the product will not only look attractive to the athlete but also for other potential consumers. For the sponsorship to be as effective as possible, it should therefore look pleasing to use for other potential new buyers.

4.1 FIS sponsoring regulations

Pursuant to FIS regulations, there are certain rules on how sponsorships can be visually exposed. Some of these regulations are purely created to increase the safety of the athletes, by for instance preventing stickers on goggle-glasses to ensure clear sight. Other regulations have been implemented to create equality among the athletes to reduce noise and other disturbances during races and competitions. Through the FIS homepage, designers can find a visual guide on how commercial markings on clothing and equipment should be located based on their regulations (FIS, 2017). In the guide, there are regulations on different equipment, such as arm and leg protection (gloves), goggles, racing suit, and skis. This guide provides the designer with an overview on how commercial markings should be placed. As an example, goggles cannot contain commercial markings from a manufacturer with more than a surface area of 15cm², and the straps must not be wider than 4 cm. The athletes are not allowed to have any form of advertisement on their goggle lenses.

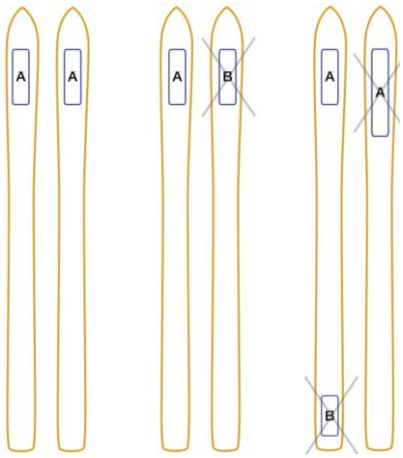

Figure 3 FIS Commercial Markings on skies (FIS, 2017)

Regarding the use of professional alpine skis during a competition, the maximum sponsor area is limited to one marking per ski and must not be any larger wthan 120cm², and shall be identical on both skis as shown on figure 1 (FIS, 2017).

5. THE ATHLETES VIEW

No clear textbook answers can be found in the literature on how to design for professional athletes. Finding out which process is best suited for the designer or the designteam is very individual. Normally, a design process is a repeatable approach to creating designs. To design for professional alpine skiers, understanding the user and what the user needs should be important. Therefore, two interviews/conversations were conducted with two different alpine skiers in this research. The first interview was made with Norwegian freestyle skier Marte Høie Gjefsen. Gjefsen, who represented the Norwegian team at the Winter Olympics in Vancouver in 2010, managed to take 1st place in the World Cup in Ski Cross. The second interview was made with the slalom and great slalom skier Sandra Rørvik. She competed in the 2009/2010 Winter season for Newfound Regional High School in New Hampshire, USA where she came in 5th during this season.

Based on the freestyle skier Marte H. Gjefsen, professional alpine skiers do not necessarily care too much about the looks of their equipment. Slalom and Great slalom skier,

Sandra Rørvik also confirmed this statement. Neither of them cared too much about what brand they were representing or sponsored by. Although, Rørvik specified the importance of the quality of the sponsored equipment. Rørvik expected her skies to be of great quality regardless of what brand she was using. However, when not competing, the athletes say that the aesthetics and looks of the equipment matter more than it does during competition and practice.

One could therefore argue that the quality is of high importance, and should therefore be a priority. The functionality of the equipment should also be in focus regarding the design. The user should be involved throughout the entire designing process to detect and cover the most important elements. The quality and functionality of the equipment will most likely impact the outcome of a competition and the user is therefore very dependent on the functionality and quality as it can be vital for the result in a competition. The statement cited below supports the view of the interviewees that most alpine skiers assume that the sponsored equipment is of high quality:
"*Experiential marketing assumes that customers take functional features, benefits and product quality as a given*" – Marc Hassenzahl (Hazzenzahl, 2013).

In the modern society, not only professionals aim for the best equipment on the market. It is believed that many so-called amateurs desire to buy the best equipment on the market. Therefore, the targeted user is not only professional skiers but also "regular/unprofessional" skiers too.

6. FINAL REMARKS

As a final conclusion, the safety of the athletes is of high priority to the FIS, and will most likely become an even higher importance in the future. By mapping injury patterns, organizations like FIS can detect which preventative measures which will result in reduced risk of injuries (FIS & Oslo Sports Trauma Research Center, 2016). Further research on how to prevent injuries should be made by FIS, and should include what safety regulations which might impact the outcome of a race during competitions.

Nevertheless, further research regarding the importance of the aesthetics through interviews within the elite alpinists should also be considered in the future. Although professional alpine skiers trust that their equipment is of high quality, and expect that it meets their expectations, further research might help to discover which qualities which are mostly valued and appreciated. In regards of the sport equipment, the main focus should be on ergonomics (to establish high speed), comfort, and usability to create a design which is best suited for the user regardless of their professional level. The functionality of the equipment should be prioritized regarding the design, as it is something which is expected by the athletes.

REFRENCES

Augustyn, A. (2011). Alpine Skiing. Britannica Academic.

Dees, W., Bennett, G., & Villegas, J. (2008). Measuring the effectiveness of sponsorship of an elite intercollegiate football program. Sport Marketing Quarterly, 17(2), 79

FIS (2017). Commercial Markings on Clothing and Equipment – A Visual Guide

FIS, Oslo Sports Trauma Research Center (2016). FIS Injury Surveillance System 2006-2016.

FIS (2016). On the Snow. [Online] Available at: http://www.fis-ski.com/news-multimedia/news/article=the-snow-91454.html

FIS (2017). About FIS – FIS History. [Online] Available at: http://www.fis-ski.com/inside-fis/about/fis-history/history/index.html

FIS (2017). Inside FIS – About FIS. [Online] Available at: http://www.fis-ski.com/inside-fis/about/by-the-president/index.html

Flørenes, T., Bjørneboe, J., Andersen, T. E., Heir, S., & Bahr, R. (2011). What is more dangerous–football, skiing or snowboarding?. British journal of sports medicine, 45(4), 348-348.

Hassenzahl, M. (2003). The thing and I: understanding the relationship between user and product. In Funology (pp. 31-42). Springer Netherlands.

Kröll, J., Spörri, J., Gilgien, M., Schwameder, H., & Müller, E. (2015). Effect of ski geometry on aggressive ski behaviour and visual aesthetics: equipment designed to reduce risk of severe traumatic knee injuries in alpine giant slalom ski racing. Br J Sports Med, bjsports-2015.

Marlow, J. (2014). How Science Turned a Struggling Pro Skier into an Olympic Medal Contender. [online] Available at: https://www.wired.com/2014/02/ski-run-nyman-sochi-olympics/

Mayo Clinic (2017). ACL Injury. [Online] Available at: https://www.mayoclinic.org/diseases-conditions/acl-injury/symptoms-causes/syc-20350738

Meenaghan, T. (2001). Understanding sponsorship effects. Psychology and Marketing, 18(2), 95-122.

Ochi, M., Shino, K., Yasuda, K. & Kurosaka, M. (2016). ACL Injury and Its Treatment. Springer, Japan.

Olympic Games (2014). All You Need to Know About Freestyle Skiing. [Online] Available at: https://www.olympic.org/news/all-you-need-to-know-about-freestyle-skiing

Spörri, J., Kröll, J., Gilgien, M., & Müller, E. (2017). How to prevent injuries in alpine ski racing: what do we know and where do we go from here?. Sports medicine, 47(4), 599-614.

Wagner Custom (2017). Ski Camber vs. Rocker: A Skier´s Guide. [Online] Available at: https://www.wagnerskis.com/journal/ski-camber-vs-rocker-skiers-guide/