CHALMERS

Development of women skis

Including the total line-up of skis for two brands

Master of Science Thesis in the Master Degree Program, Industrial Design Engineering

SOFIA FRIBERG

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2016

Department of Product- and Production Development
Division of Design & Human Factors

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Abstract

When it comes to the world of skiing, it is mainly dominated by men. Many ski brands do skis specifically for women today, but the number of skis are distinguishly smaller than for men. Faction want to fill this gap by developing their women skis product line according to what the users want, as well as for Roxy, for which Faction makes the ski design.

The purpose of this thesis was to investigate what skis that the female buyers of Roxy and Faction want to have and how Faction can develop their women line and Roxy's line of skis in order to meet these requirements. The starting point was the existing skis that the two brands have today and the aim was to deliver a design suggestion of the full collection of skis for both product lines.

The approach of this project was to make an extensive user study, including interviews with both advanced professional skiers as well as average skiers, interviews with staff from ski shops and a survey regarding ski habits and preferences for skis. Other than that a major benchmarking was conducted to understand how other brands design their women skis. Additionally, testing a lot of skis from both Faction and Roxy but also other brands, contributed to the study and was made together with the users.

The result of this study showed that the female skiers prefer women specific skis. They also want more models and lengths to chose between. They are missing the high-technology skis that they find for men, which has resulted in that many female skiers chose to ski on men skis.

From the result of the thorough research concepts for both brands were created. Together with the company, decisions were made to make some changes in order to adapt to the existing moulds in the factory.

The project has shown that there is a lot of potential for women skis today, despite the small differences between men and women. The final design enhances this and takes these small differences into consideration, which makes the skis optimized for female skiers.

By offering a wider range of skis to chose from and by including high technology materials and constructions the demand from the users are fulfilled. However, the main focus in this project have been on user studies. This approach has made it possible to create a design that fits well together with the market demands. This, in its turn, will also lead to and be beneficial for both the company and the retailers.

In conclusion, this project has produced useful guidelines that the company could definitely implement in their further development of their women skis. It resulted in a concept for the full line-up of skis for both Roxy and Faction.

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1. Introduction

1.1 Background

In the world of skiing different divisions can be found. One of these is freeride/freestyle skiing. Faction skis produces skis for this category for both men and women. However, male skiers mostly dominate the society of freeride skiing today and therefore the focus on the development has also been mainly skis designed for and marketed towards men. However, more and more women are joining the world of freeride skiing. Most brands within the ski industry today have a specific women line, even though it is usually distinguished smaller than the one for men. This means that there are not that many skis especially for women on the market within this division. Many brands promote their other skis as unisex. Faction wants to fill this gap by developing their female skis product line according to what the users want. Skiing is a lot about an experience and in order to develop skis for a female freeride skier the question of what these users actually want and need has to be answered. Faction also do the women ski design for another company named Roxy. The two brands have a different image and are reaching out to different types of users and buyers. Roxy skis are aimed for both beginners and more advanced skiers, and do a lot of rental skis. The most common buyer of Roxy skis is an average good skier. The female buyers of Faction skis are more aware consumers, who have more knowledge about the characteristics of the skis. They are also more advanced skiers and ski more often than the Roxy buyers.

1.2 Purpose

The purpose of this thesis is to investigate what skis that the female buyers of Roxy and Faction want to have and how Faction can develop their women line and Roxy's line of skis in order to meet these requirements. The aim is to deliver a suggestion of how the product line should be designed in order to meet the requirements that the customers have.

1.3 Research questions

- How should Faction develop and design their line of women skis?
    - What is the difference between a male and a female skier?
    - What experience does the female customers of Faction skis want?
    - What experience does the customer of Roxy skis want?
    - How should Faction develop their skis and Roxy's skis in order to meet these requirements?

To be able to answer the main research questions, the following questions needs to be answered:

- How does the product line of other brands women skis look and how are they marketing it?
- What characteristics influence the performance of a ski?
- How do the material choice influence the characteristics and performance of a ski?
- What characteristics of a ski fit what kind of skier?

1.4 Limitations

Since this project covers the design of the full line-up of skis for two brands, Faction and Roxy, and therefore is a very extensive project, less focus will be put on the details of the skis and manufacturing but rather to create a design suggestion. The final design will not include the graphic design of the skis.

The existing moulds in the factory will be restrictive regarding the shape of the skis, because of the huge cost for creating new moulds. However, when developing new ideas the company asks to disregard this in a first place to see what the result would be and to then adjust this according to the moulds.

2. Glossary

Within the area of skiing, there are a lot of words and expressions, which may not be known to everyone. This chapter will therefore explain some of the expressions that will be used later in this report.

2.1 The skis

2.1.1 Binding

The binding is where the ski boot is connected to the ski. The binding is mounted on the ski.

2.1.2 Mounting point

The place on the ski where the binding is mounted is called mounting point. There is a recommended mounting point from the ski manufacturer marked on the ski. It is usually between 44-50% of the length from the tail. For a freestyle ski to ski with in the park and make tricks the mounting point is in the center of the ski. For a freeride ski, to ski off-piste and in deeper snow with the mounting point is further back. (Sannes, 2016)

2.1.3 Tip and tail

The front part of the ski is called tip, the back part of the ski is called tail.

2.2 Construction

Most skis are designed with a ”sandwich-construction”, which means that it is built up by layers of different materials (see figure 1).

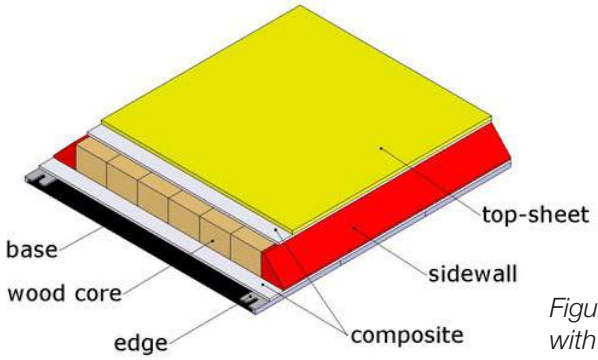


Figure 1. The construction of a ski with the different layers

2.2.1 Base material and edges

The ski base is made from UHMWPE (ultra-high molecular weight polyethylene). The properties of this thin sheet of plastic makes it bond well with epoxy and easily absorbs wax (Skibuilders, Base preparation, 2016).

2.2.2 Core

The main part of the ski is the core. It can be made from wood or foam (plastics). Wood is the most common material to use. The reason for this is that it is more durable and creates a more responsive feel in the ski. If wood is used, the type of wood is a great factor for the properties of the ski (see figure 2). It is common to combine different types of wood by vertically laminating strips to obtain the right properties. (Skibuilders, materials, 2016)

Figure 2. The softness of different types of wood

2.2.3 Epoxy

Epoxy is used to glue the layers together. It consists of resins and hardeners (Skibuilders, materials, 2016).

2.2.4 Reinforcement layer/Composites

On top of and bellow the wood core there is at least one layer of composites, which could be either fiberglass, kevlar or carbon fiber. The composites material is very strong along the direction of its fibers and a combination of fibers with different direction is ideal. The reinforcement layers can thereby create the torsional stiffness required. (Skibuilders, materials, 2016)

2.2.5 Sidewall

The sidewalls (see figure 3) serve as a protection for the wood core from humidity and impacts. They are most often made out of ABS-plastic (Skibuilders, materials, 2016). Some ski models have full cap (see figure 4) or a combination of the two called semi cap instead of sidewall. The sidewall is more expensive (Freeskier, Gearwise: Skis, 2015), but it transmits pressure to the edges, increases the torsional stiffness of the ski and give a better grip to the edge. The cap construction is lighter and makes the ski more durable to damages from crossing skis. (Mechanics of Sport, Ski construction, 2016)

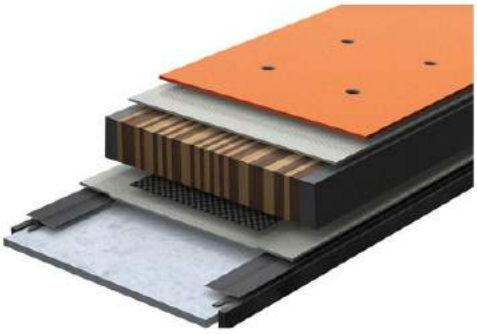


Figure 3. Sidewalls

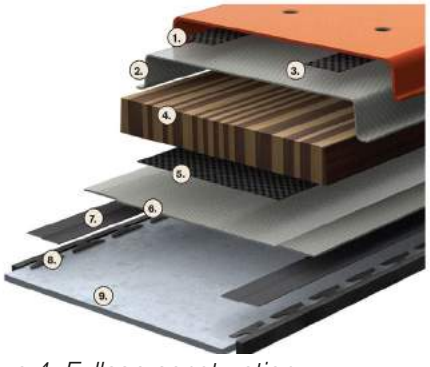


Figure 4. Fullcap construction

2.3 Characteristics

2.3.1 Camber

Camber is an arch in the ski profile under the foot (see figure 5). A lot of camber is good for hard-packed, icy conditions. It gives a good edge grip and distributes the force evenly over the ski. Therefore it uses the whole skis capacity. (Slopepro, Skidor, 2016)

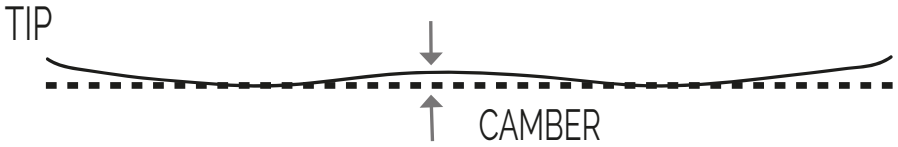


Figure 5. The camber of the ski is the arch under the foot

2.3.2 Flat tail

A flat tail (figure 6) means that the tail do not rise but is parallell to the ground. This kind of ski is good for high speeds, but require more effort from the skier to be able to exit a turn (Skis, 2016).

Figure 6. The camber of the ski is the arch under the foot

2.3.3 Rocker

A rocker is a rise in the skis tip and/or tail (see figure 7). This provides float, and makes the turn easier, in deep snow (Slopepro, Skidor, 2016).

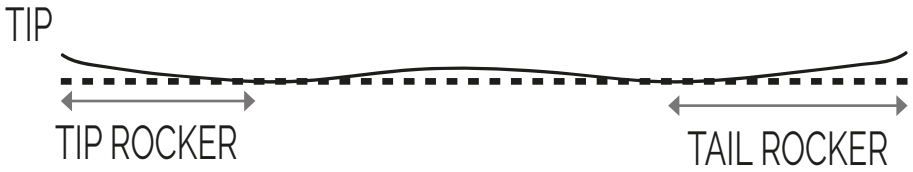


Figure 7. The rocker of the ski is the rise in the tip and tail of the ski

2.3.4 Sidecut

The sidecut is the shape of the ski, including the radius (see figure 8).

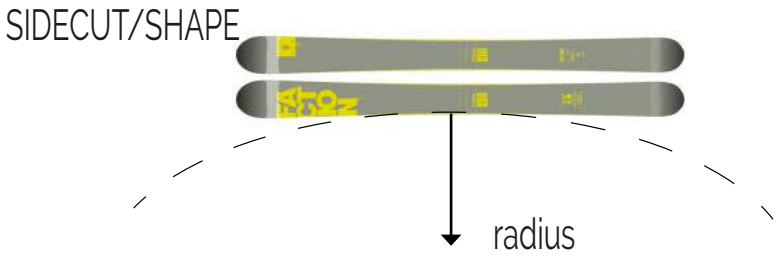


Figure 8. The sidecut including the radius of the ski.

2.3.5 Ski flex

The flex of the ski can be divided into bending strength and torsional strength. How much bending strength you need in a ski depends on how heavy you are and also how aggressive you are as a skier. A heavy and aggressive skier need a stiffer ski, while a light and less aggressive skier needs a softer ski. The stiffness of the ski can vary over the ski profile. High torsional strength gives good edge grip and is good in hard packed snow. Low torsional strength is better for beginners and adapts easily to the base. (Slopepro, Skidor, 2016)

2.3.6 Taper

Taper is when the ski is getting thinner again towards the ends (see figure 9). Skis that are developed for free skiing often has a tapered tip and sometimes also tail. This means that the effective length of the ski is shorter than the actual length of the ski. To avoid hooking in the snow, the widest point is also moved towards the middle (Freeskier, Gearwise: Skis, 2015).

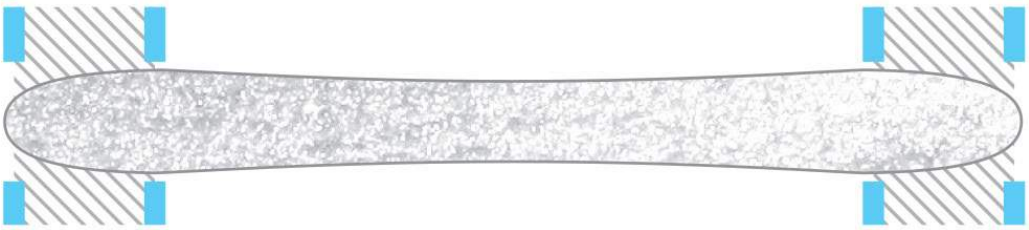


Figure 9. The taper is shown here in the tip and tail

2.3.7 Twintip

This means that both the tip and the tail are rised (see figure 10) which enables the skier to ski both forward and backwards (Skis, 2016).

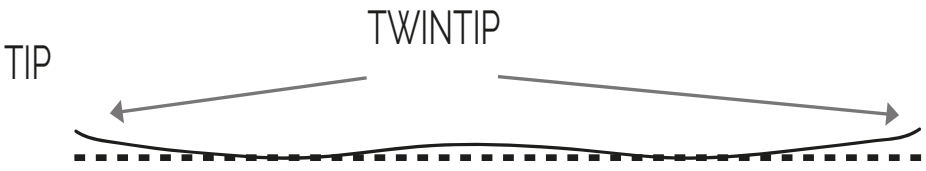


Figure 10. The rocker of the ski is the rise in the tip and tail of the ski

3. Methods

This chapter explains the methods used in this project. The theory of the methods are explained as well as the way of use in this particular project.

3.1 Litterature studies

In order to understand the technology behind skis and how they work a literature study regarding ski technology will be made. A literature study consists of reading and studying previous publications done within the same field of products/design project (Boeijen et al, 2013).

3.2 Persona

Personas are created as a representation of the users. It can be used to gain better understanding of the users and usually consists of a descriptive text and pictures and sometimes different sorts of mood- and/or expression boards, (Bohgard et. al., 2008) In this project Personas will be used to distinguish the users of Faction skis and Roxy skis and to communicate their needs.

3.3 Interviews

Interviews are a fundamental method when it comes to gaining insight of how the users think and what are their opinions. It gives qualitative data and could be structured, semi structured or unstructured. In this study, semi structured interviews will be made, which consists of open questions in combination with probing. (Boeijen et al, 2013)

Interviews will be held with female skiers, both professionals and average, to get their opinion about what skis they want to ski on and what factors they appreciate in a ski. Interviews will also be held with store personnel to understand the process of buying skis.

3.4 Observations

Observations will be made of how the meeting between store personnel and customers work. This is to see what skis store personnel recommend and how much influence the customer themselves have over the choice of which skis to buy or how much they rely on the sales personnel. User observation could be open, where the user is aware of it or closed. It could be direct, that it is carried out in front of the observer, or indirect. It could also be natural, in the actual environment, or unnatural, for example in a lab. (Boeijen et al, 2013)

3.5 Benchmarking

The idea behind benchmarking is to analyze companies in the same business or businesses closely related to the subject for the design project. (Boeijen et al, 2013) In this project benchmarking will be performed in order to understand how other brands market their skis and what kind of skis they have, especially regarding women skis.

3.6 Questionnaire

A questionnaire is used to generate new insights and can give both qualitative data, from open questions, and quantitative data, from closed questions. The questions should arise from the research questions of the project and is handed out to participants for example on a forum. (Boeijen et al, 2013)

A questionnaire will be used in this project to better understand the customers and how they think and proceed when choosing which skis to buy, as well as which characteristics that they find most important of a ski.

3.7 KJ-analysis

KJ-analysis is used in order to structure the information gained from interviews. The quotes from the interviews are clustered into different themes and from that conclusions can be drawn regarding important data to take into further consideration. The KJ-analysis helps to find the main issues. (Boeijen et al, 2013)

In this project the KJ-analysis will be used to structure information from both interviews and questionnaire, so that the main problem areas can be found.

3.8 List of requirements

A list of requirements is a detailed description of the criteria's that the product needs to fulfil in order to be successful. This information serves as a double purpose. It is the base for the product development. The list of requirements should be updated during the project as more and new knowledge is gained. (Boeijen et al, 2013)

The list of requirement will be used in this project to establish which requirement the users have on the line-up of skis that Faction and Roxy should have.

3.9 Morphological chart

This is a systematic method for idea generation. The designer searches for different solutions to each sub-function and then combine them to full solutions or concepts. (Boeijen et al, 2013) This will be used to help create the concepts and for ideation.

3.10 Co-creation

Co-creation is a way of making use of the users, who can be seen as experts within the field. This is often an efficient method to create novel ideas. (Boeijen et al, 2013). In this project the aim is to engage the users and to test skis with them to create a discussion about new ideas for the ski design.

3.11 Study visit

In this project a study visit will be made to one of the factories to gain knowledge and information about the manufacturing of skis.

3.12 Reversed brainstorming

This is a method were the participants use an object and tries to answer the question “Why is it xxx?”. The purpose is to then use these answers to create How-to-do-it suggestions/ideas, Possible answers are noted, preferably in a How-Why mind-map by going down in the function tree from Why to How. (Soderberg, 2014).

Reversed-brainstorming was a method used to try to establish what the users prefer and why. It was used when testing skis to try to understand what the test participants liked and disliked about different skis and to come up with new ideas on how to design the skis.

4. Research and analysis

To understand the requirements that the users have for women skis a thorough research where made. Literature studies where used to understand who the user is and how the market looks today. Also the differences between men and women in skiing where studied. Interviews where made with 29 persons. This included 5 professional female Faction skiers, 4 people working in ski stores and 20 other female skiers. A survey was conducted to collect data on the behavior and habits the users have, as well as which skis and other gear they use. The survey was sent to ski networks/groups on Facebook and on forums on the internet. It gave 145 responses, including both men and women. 40% of the respondents where women. The result from the interviews and survey where analyzed with a KJ-analysis (see figure 11). The full interview guide and survey can be found in appendix 1 and 2.

Figure 11. Making the KJ analysis

4.1 Context analysis

There are different stakeholders involved in the life of a ski (see figure 12). The main product is the ski, which the end user, the skier will use. The producing company in this case is Faction skis, which develop and produce skis for Roxy as well. The factories, Sporten and Nobile, make the skis, which are then sold by retail stores.

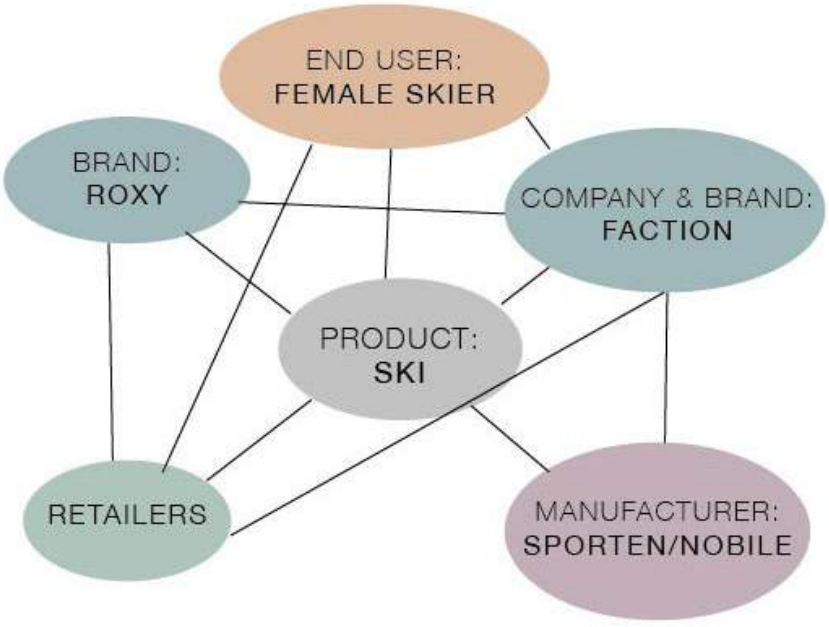


Figure 12. An illustration of all the stakeholders in the process of making the skis

4.2 Differences between men and women in skiing

To understand what skis that suits a female skier it is important to understand the differences between men and women when it comes to skiing. These differences are average differences and may not be correct in every case. There are a lot that differs between individuals as well. Although, when designing skis for women, the characteristics that is common for women should be taken into consideration.

First of all, there is physical differences. Women tend to have short achilles tendons and more vigorous and longer calf muscles (Åka skidor, Tjejskidor, 2009). Women have a bigger bum, which puts the weight more backwards, and have less upper body strength (Ski my best, gender and skiing, 2016). Because of the wide hips (Ski my best, gender and skiing, 2016), the angle of the bones makes the knees more exposed for injuries.

Other differences are technical. For women, it is important to ski as efficiently as possible, to conserve strength. Men, on the other hand, can get by on strength when skiing. (The Guardian, Female in tuition: ski coaching for women, 2011)

When it comes to the psychological aspects, according to one theory, is that women ski more within their technical ability, then add speed. Men add speed, and worry about technical "details" later. Women also tend to have a stronger self-preservation instinct. (The Guardian, Female in tuition: ski coaching for women, 2011)

4.3 Who is the female skier

Of all skiers, women constitute 40 % (SIA, 2014). The market of women skis are becoming bigger and bigger. Women skis went up 15% in units in the US in 2012 (SIA, 2013) and 13% in units in 2014 (SIA, 2015). The overall amount of skis on the market only increased with 1% at the same time.

Especially touring skis for women has increased a lot. In 2015 touring skis for women increased with 329% in dollars to $ 931.000. (SIA, 2014)

Freestyle skiing has become more popular for women as it between the year 2014 (SIA, 2014) and 2015 increased from 36,3% to 40,9% (SIA, 2015).

Female skiers are younger than men (see figure 13). Women peak at 25-34 years old, while men peak at 35-44 (SIA, 2013). There might therefore be an opportunity to try to reach this group of women.

When it comes to income, the differences between female and male skiers are small (SIA, 2013). There is more women in the "middle sector" (see figure 14).

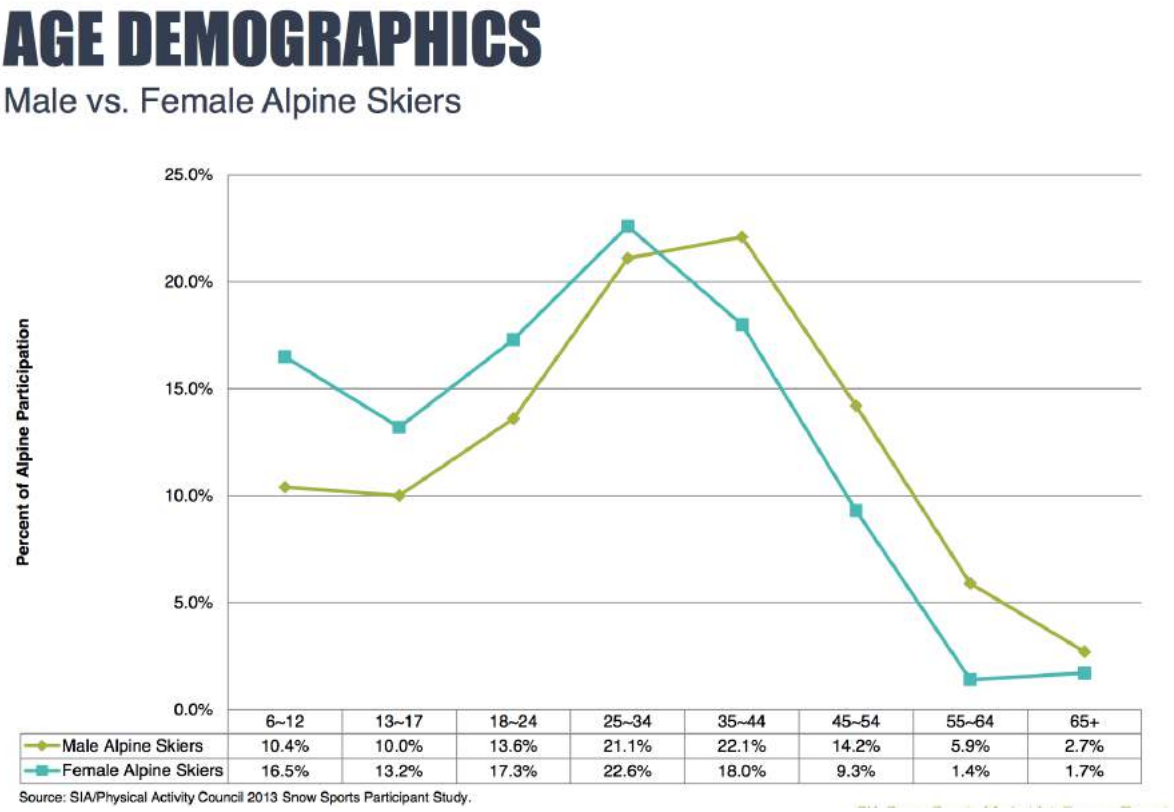


Figure 13. A diagram over the age ranges of female and male skiers

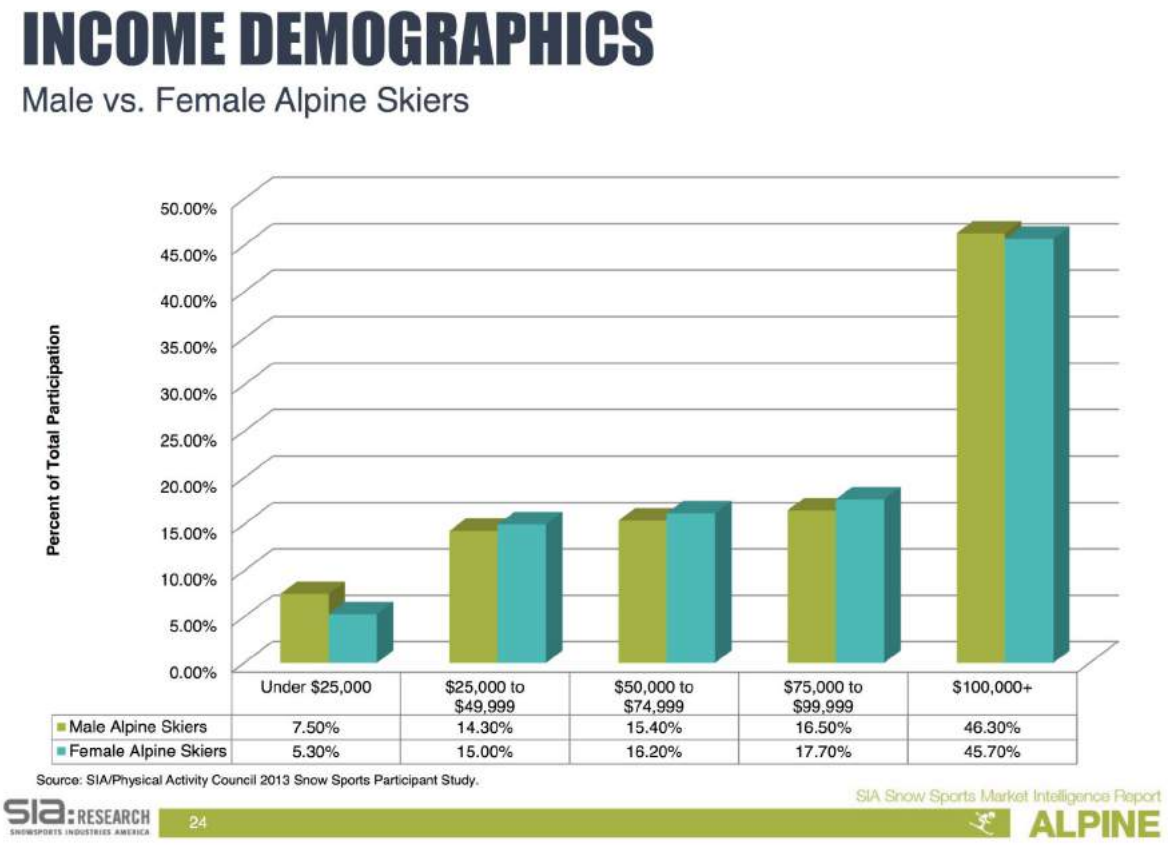


Figure 14. A diagram over the differences in income between female and male skiers.

4.4 Faction skis today

Faction divide their skis into different product groups (see figure 15). In the product line of 2015/2016, the men side is divided into the Core series, the Candide Thovex series, the Standard Series and the Escape series (Faction, 2016). The Core series consists of the basic line of skis, made from a more traditional core of poplar and ash. They span from freestyle, to all-mountain, freeride and more back-country skis. The Candide Thovex series is a more premium line and is slightly lighter than the Core series. The twin tip construction makes them more freestyle oriented as well. Two of the models have a core made from balsa wood. They have a longer rocker profile and less camber. In this line, the widest ski is found, which has a waist width of 122mm. The Standard series has a flat tail and suits a good and aggressive skier. The Escape series consists of lightweight skis for touring.

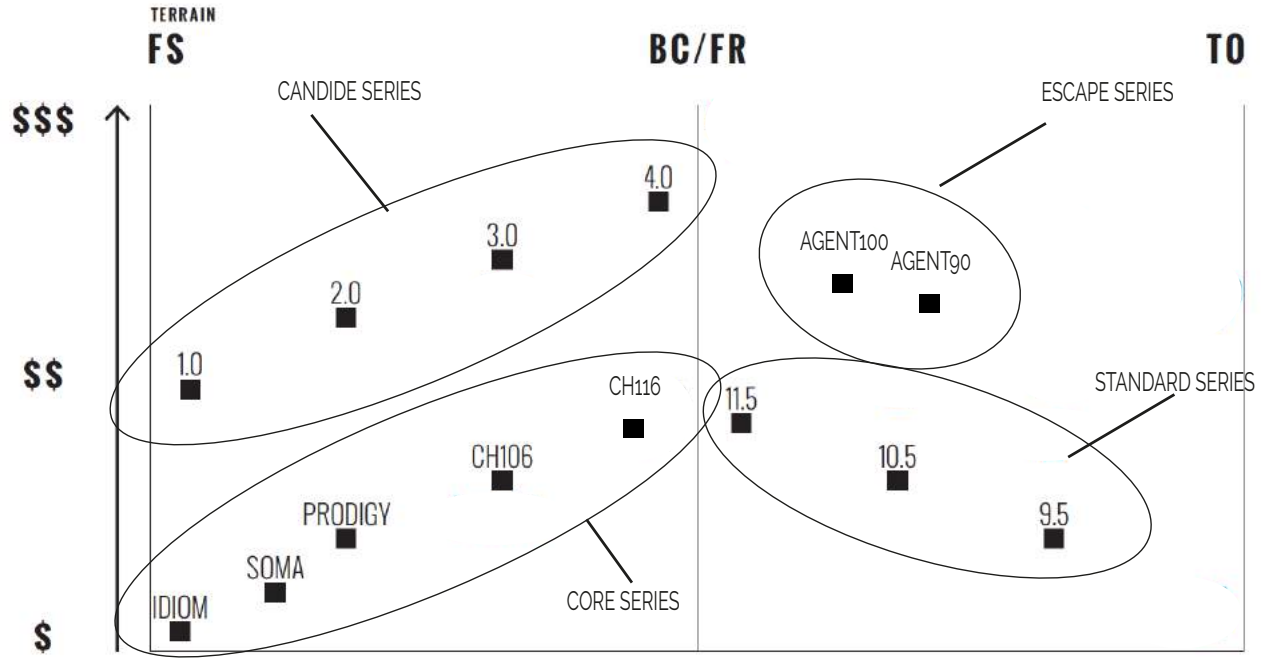


Figure 15. The existing line-up of skis for Faction men skis

The women skis consists of one line, with three models that correspond to skis from the Core series, two models that correspond to the Escape series and one model with influences from the Candide Thovex series made with a balsa wood core (see figure 16).

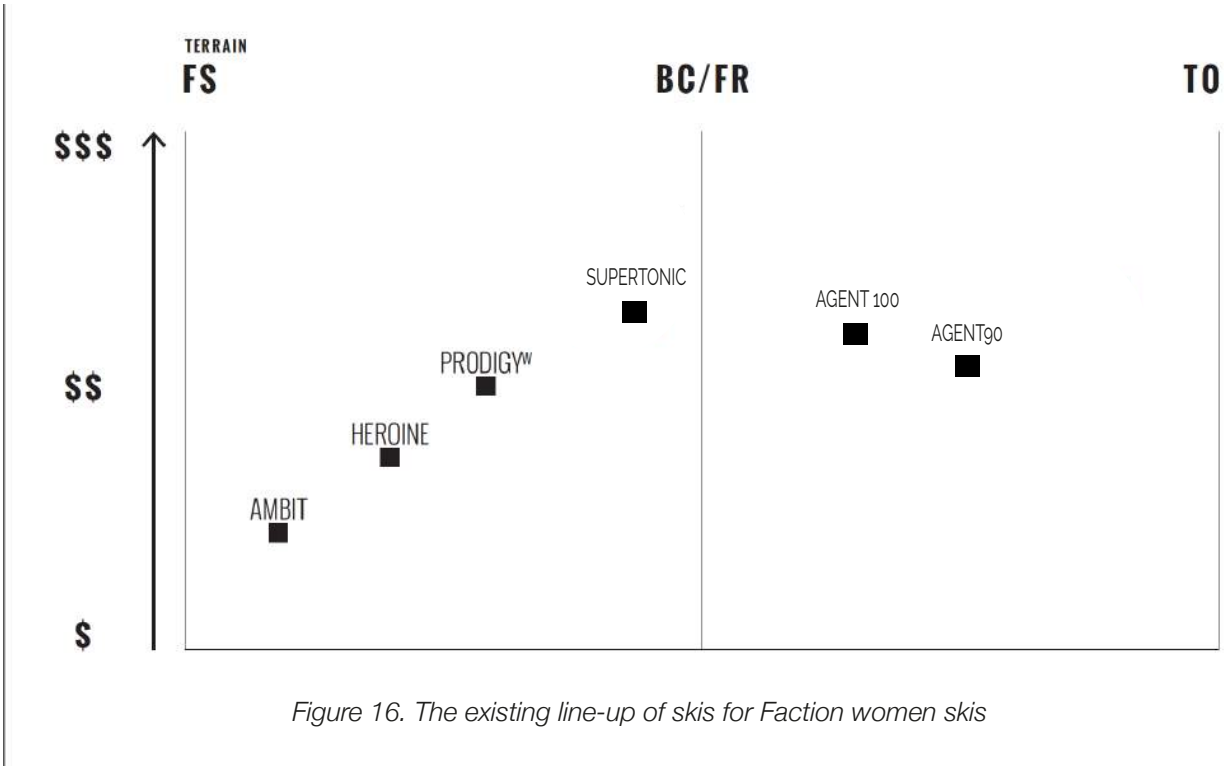


Figure 16. The existing line-up of skis for Faction women skis

4.5 Roxy skis today

The line-up of Roxy skis consists of two all-mountain models, one made from a polyfly foam core and the other one made from a poplar/birch wood core, one freeride ski that corresponds to one of the skis in the Core series of Faction, one junior ski and one children ski (see figure 17).

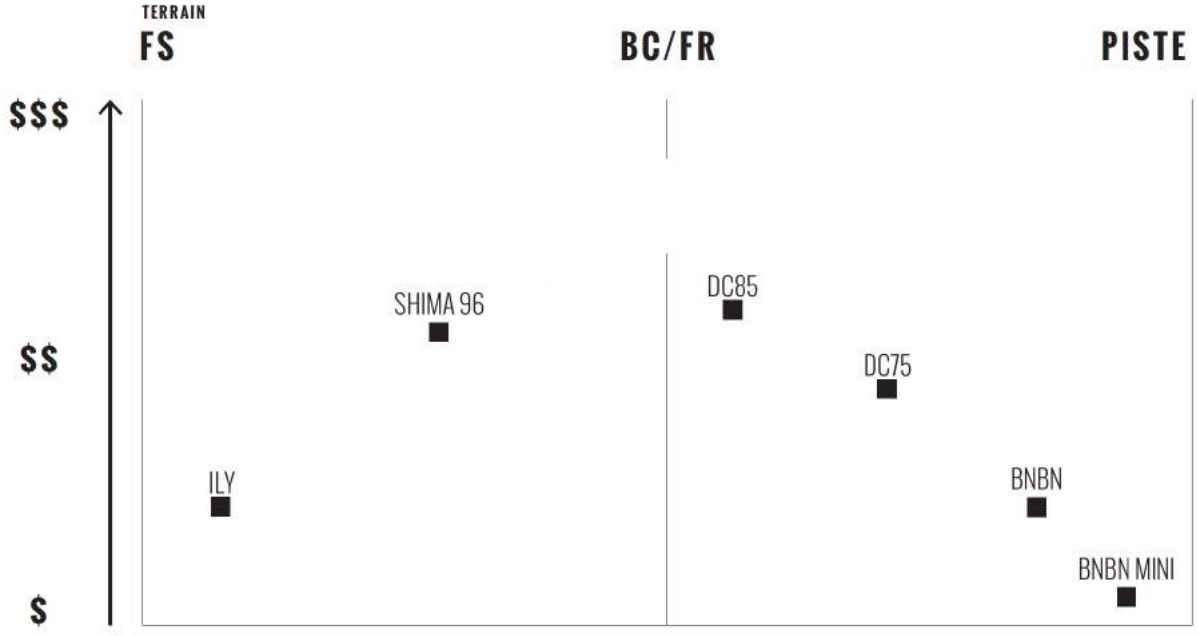


Figure 17. The existing line-up of skis for Roxy skis

4.6 Analysis of the market

This benchmarking compares Faction and Roxy with nine other brands that compete within the same field of users. A full analysis of each brand can be found in appendix 3.

4.6.1 Characteristics

The analysis of these nine brands show that the distribution between men and women models is uneven (see figure 18). No brand make as many models for women as for their men/unisex line. The amount of Faction women ski models are 36% of the amount of men models. This puts Faction in the middle sector as some brands have up to 63% as many women models and some not more than 20%.

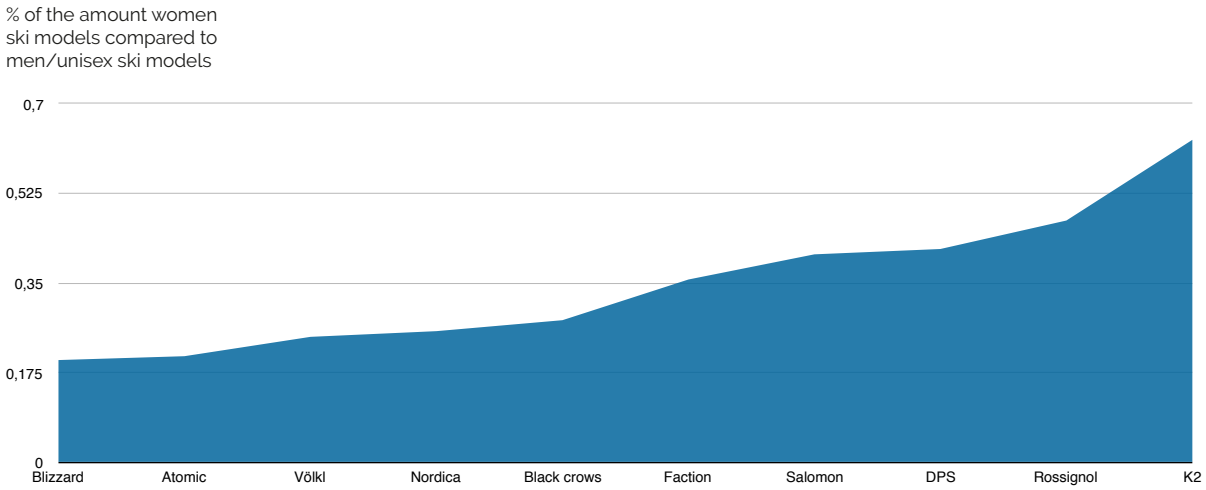


Figure 18. Amount in percentage of women ski models compared to men /unisex

Many brands have their women skis corresponding to the mens skis. Usually they have the same sidecuts and sometimes even the exact same construction. The construction sometimes differs with a more light core. Many brands use paulownia and poplar for the cores of their women skis.

As for the prices, there are more expensive skis for men (see figure 19). The more exclusive ski models, which has better and newer technology and higher quality materials are usually not a part of the women ski line for the companies.

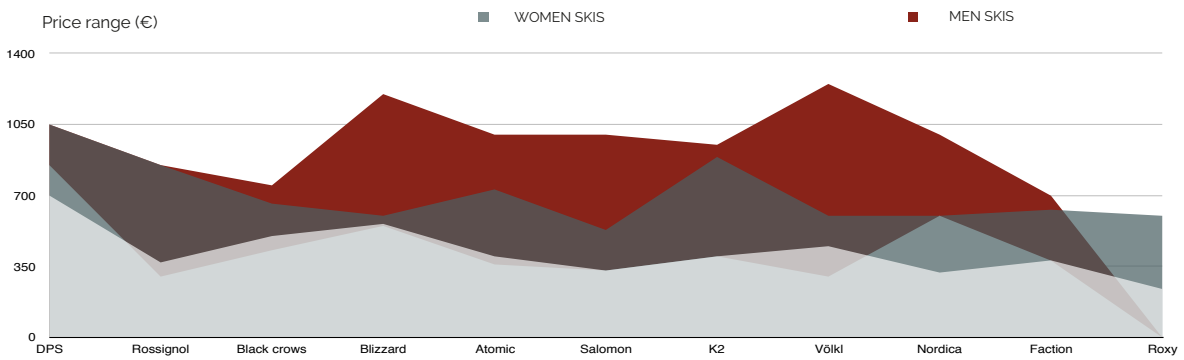


Figure 19. Price range for the skis for men and women

Most brands have radiuses around 16-19 meters on their women skis (see figure 20). The brands that have a very wide range of radiuses have piste-oriented skis as well as skis for outside the piste. The radiuses on ski models for women are overall shorter than for men.

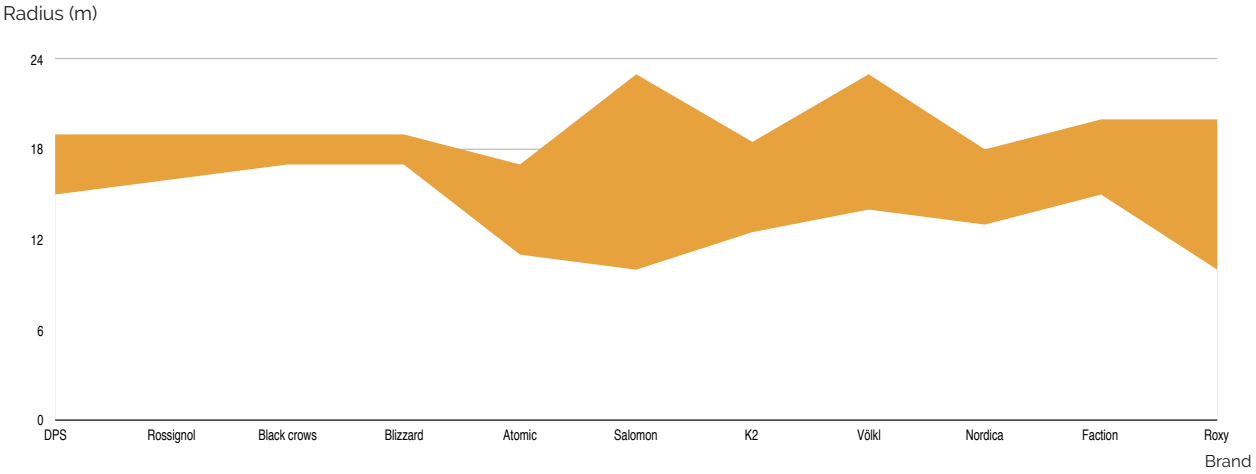


Figure 20. Radiuses on different brands women skis

None of the investigated brands do full cap on their women models. All brands have either sidewall or semi-cap. Some of the skis are shown in figure 21.

Figure 21. Skis from ither brands with sidewall or semicap

The skis for women are made in shorter lengths than the ones for men. Most brands do three different lengths per model and they go up to around 170 centimeters. Some brands have a few longer lengths, including Faction. All the other brands have a woman ski with a waist around 100.

Only two brands have touring skis for women. The other brands have touring skis for men or a unisex touring line. There is not many freestyle skis for women.

4.6.2 Positioning

Figure 22 and 23 show how Faction position their models and Roxy's models on the market when taking into consideration the type of skiing intended and the price. For Faction, the skis are divided into either Freestyle (FS), Backcountry/Freeride (BC/FR) or Touring (TO). For Roxy they are divided into Freestyle (FS), Backcountry/Freeride (BC/FR) and Piste (PISTE).

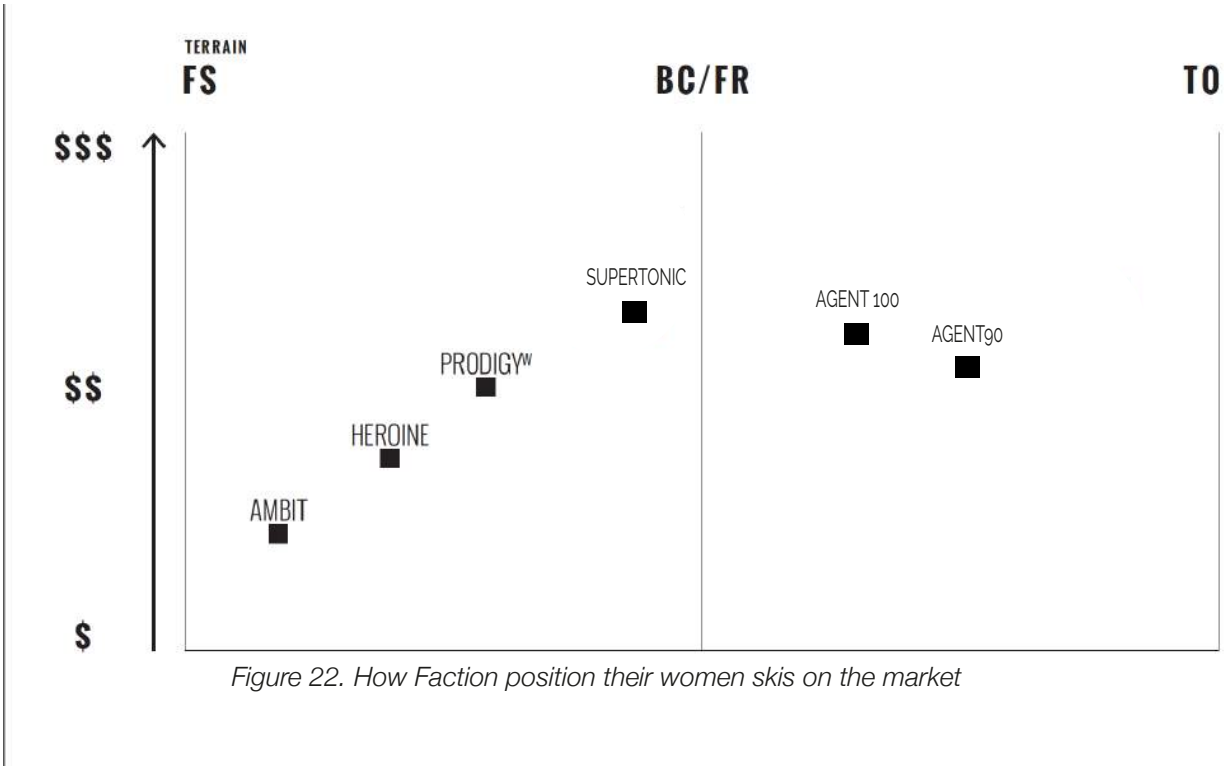


Figure 22. How Faction position their women skis on the market

Figure 23. How Roxy position their women skis on the market

When investigating how other brands are positioned on the same map the common trend could be found. One map was first created for each investigated brand. These can all be found in appendix 3. A compilation of these was thereafter made which can be found in figure 24 and 25. The darkness of the blue colour shows the amount of ski brands that have skis in that specific area.

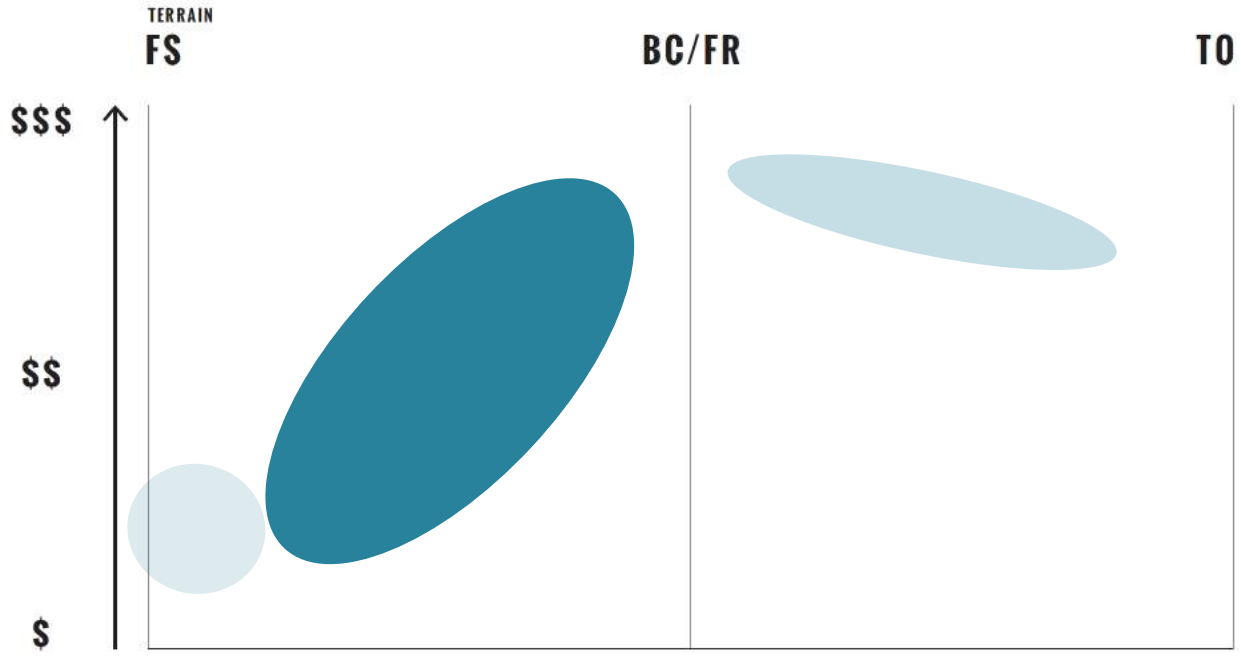


Figure 24. The positioning of other brands women skis that compares to Faction women skis. The darkness represent the frequency of the representation of that type of ski.

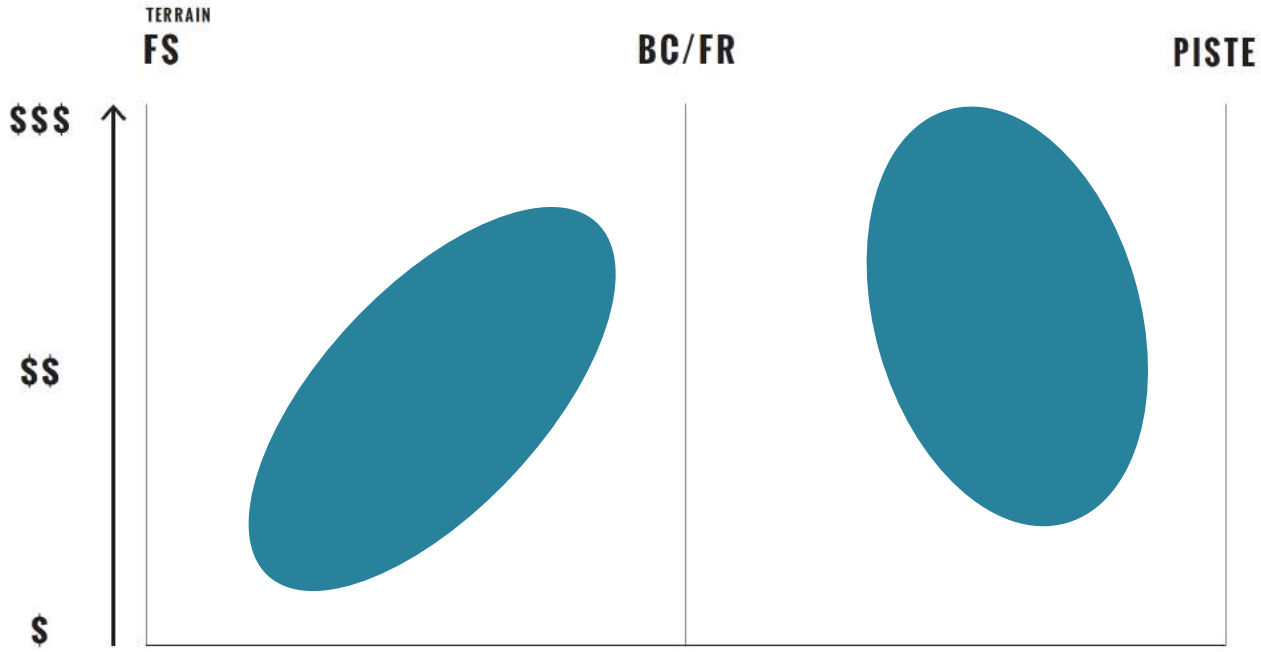


Figure 25. The positioning of other brands women skis that compares to Roxy skis. The darkness represent the frequency of the representation of that type of ski.

4.6.3 The user

From getting to know the company and learning about the intended users for the products, two personas where created for Faction, and two for Roxy.

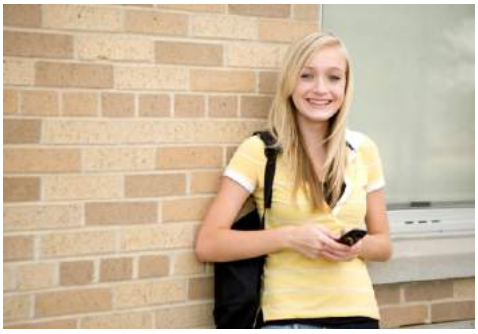
FACTION

Age:	23
Occupation:	Sales woman
Marital status:	Single
Placement:	Åre, Sweden
Ski experience:	Skis Freestyle and Freeride (30-70) Skis every weekend or more A lot of influences from friends/idols Has some knowledge about what she wants in a ski (length, waist, radius) Lives at a ski resort Parents buy the ski 173cm tall

Age:	29
Occupation:	Marketing
Marital status:	Boyfriend
Placement:	Annecy, France
Ski experience:	Skis most Freeride and some Piste (70-30) Good skier Skis every third weekend Has some knowledge about the skis Don't want to be too girly but cares about the looks Skis a lot with guys Buys the skis herself but listens to recommendations from friends and store personnel 164cm tall

ROXY

Age:	22
Occupation:	Waitress
Marital status:	Boyfriend
Placement:	US, small town in CA
Ski experience:	Piste and some freeride Skis two weeks a year Cares about performance Parents influence More loyal to the brand Already knows the brand from surfing 154cm tall



Age:	16
Occupation:	Student
Marital status:	Single
Placement:	Lives at home with family
Ski experience:	Only piste skiing Skis one week a year Don't have any knowledge about the skis Only looks matter Parents buys the skis Low price - important 168cm tall

4.7 What women want

The survey showed that 70% of the women that answered do not ski on women specific skis (men or unisex skis). Since women constitute 40% of the skiers, this means that 28% of the buyers, who could be choosing women skis, are choosing not to. Only 41% of the ones that ski on women skis, which means 12,3% of the female respondents believe that skiing on women skis will benefit their skiing. There are several reasons for this, which can be found below.

4.7.1 Knowledge

When asked about the important characteristics in a ski, the female respondents of the survey answered according to figure 26. It was possible to check more than one alternative.

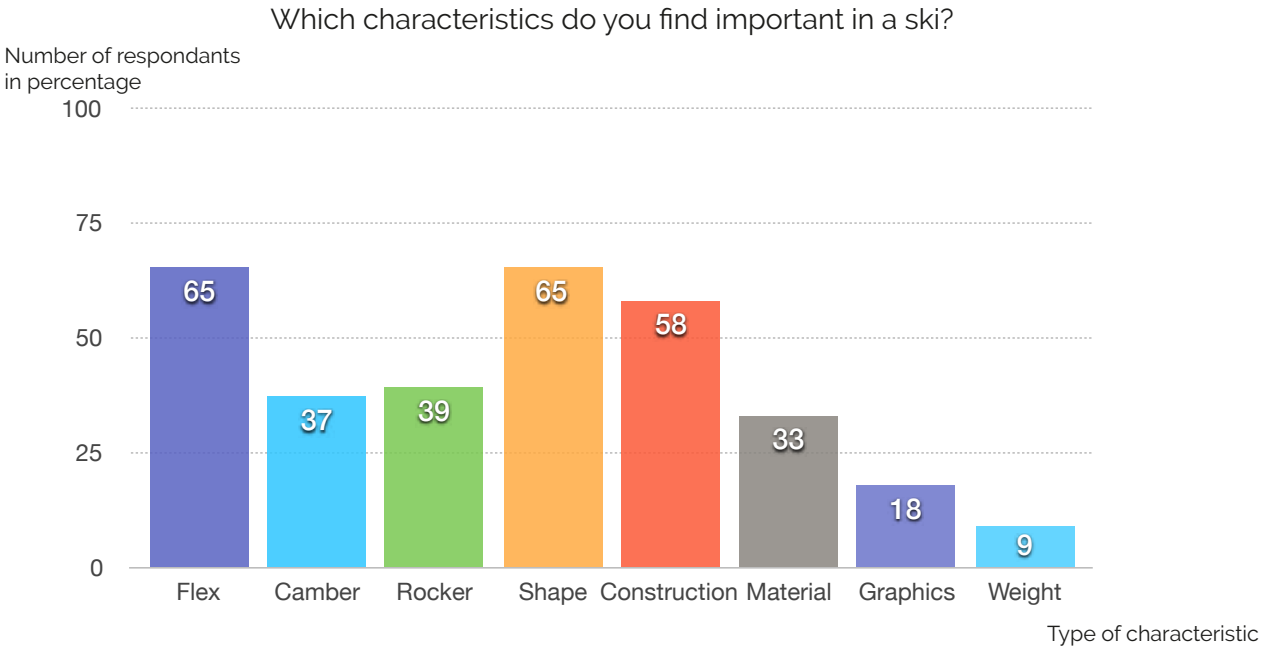


Figure 26. Responses from survey regarding important characteristics

Among the respondents 65% find the shape and the flex important in a ski. 58% believe that the construction is important. Similarly, the result of the interviews show that most women want to know more about the technical aspects of a ski and wish for more high technology products. One respondent said: ”I think that the skis should sell on the functionality rather than the fact that it’s got flowers on it. That would be amazing!”. Another one expressed that ”I would love to know more about what effects what in the skis. How will the sidecut effect my skiing? How do I notice the difference?”. A third respondent said ”By informing girls, it would make them feel more important. Aah, Faction is talking technical to me, that’s the first time that happened.”

When asked about what knowledge the respondents themselves believe that they have of their skis the result differed between the men and women (see figure 27).

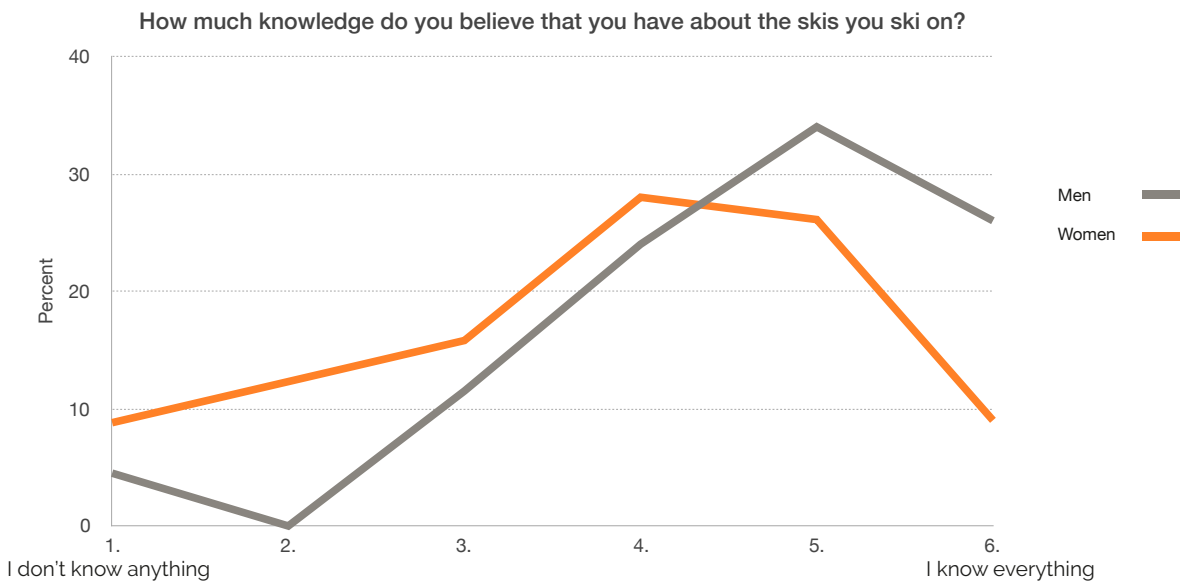


Figure 27. Responses from survey regarding the perceived grade of knowledge that women and men have about their skis.

According to the survey men believe that they know more about the skis than the women, which also is an indicator of that more knowledge could be communicated to the female buyers of skis. All this shows that there is a demand for educating the buyers of women skis and also for more high technology products.

4.7.2 Pride

One very important factor to why women do not want to ski on women skis are, according to both the interviews and survey, the pride that the women have when comparing with the men. One respondent in the interviews said ”I can ski just as hard as a boy, and they all have guys skis. I don’t see why I can’t ski the same one.”, while another one answered ”It’s a lot about street cred. We are always comparing ourselves with the boys, and the ultimate goal is to ski like a boy!”.

This shows that women do not want to be seen as something less than the men. One of the professional skiers for Faction said ”When I meet a girl and she has a girl ski, before I ski with her, I instantly judge that she is not that aggressive as a skier.”

In conclusion, the female skiers want as much to chose from as the men and as good products.

4.7.3 Lengths

Figure 28 shows the lengths that the respondents in the survey stated that they ski compared to the orders that have been made for Faction and Roxy for the coming year divided into different length intervalls. The base orders are made from stores that buy the skis and not the end consumers.

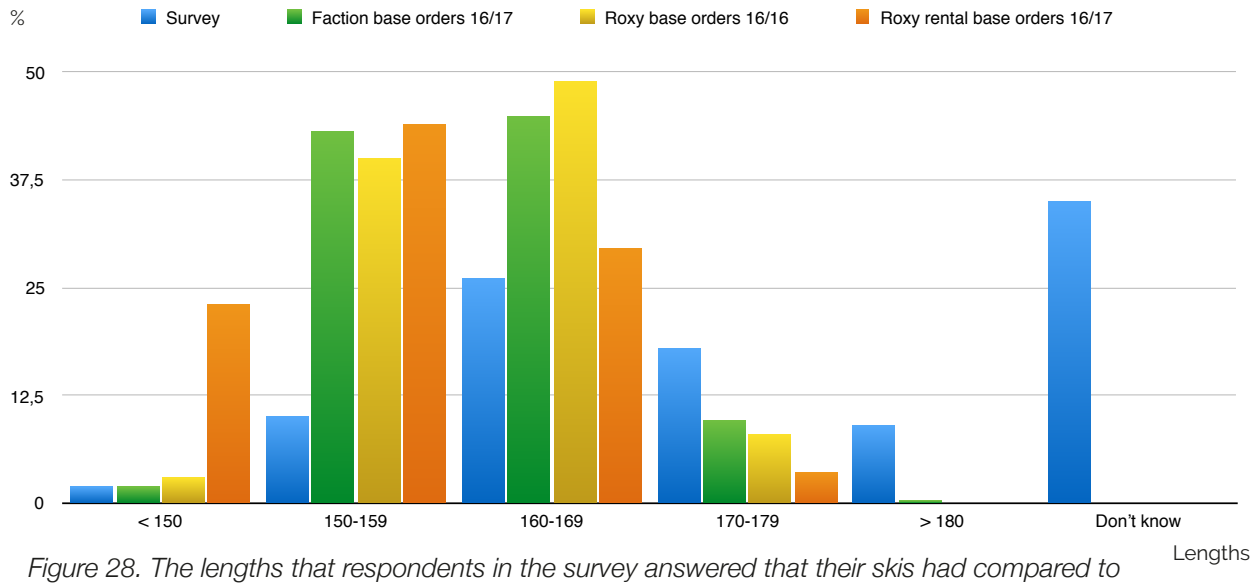


Figure 28. The lengths that respondents in the survey answered that their skis had compared to the base order of Faction skis from the stores for the coming season.

According to the result from the survey there is a demand for longer lengths. However, from interviews the conclusion can be drawn that also shorter lengths are needed, as some respondents wants to buy skis for men because of their performance, but are missing the shorter lengths.

4.7.4 Graphics

One of the factors that do differ between skis for men and women is usually the graphics. From the benchmarking it was found that many brands make a women version of some of their men skis but change it to a lighter construction and a different graphic. This can be contradictory to the result of the survey, in which only 18% find the graphic important and weight is mentioned by 9%.The overall result of the survey, including both men and women, shows that 31% find the graphic important.

According to the survey, 72% of the female respondents would chose women specific graphics, 10% would prefer the graphic for men and 18% do not care weather the graphic is made for a certain gender or not.

When talking to the store staff they answered that 60-70% of the men that are buying a pair of skis knows what they want and ask about the technical aspects of the skis. Only 20% of the women does the same, while the rest only care about the graphics on the ski.

From the interviewed female skiers there is an opinion that a lot of graphics for women are pink. One interviewee said ”As long as it’s not pink!”. Another one said ”You can still appeal to girls without being horrendous”.

This result regarding the graphics of the female skis can have different possible reasons:
- It matters, but women don’t want to admit it
- The girls don’t dare asking other questions
- They don’t have enough information/knowledge to ask about other things
- They believe that the salesmen know more/they trust them
- They feel that the only thing they can have an opinion about is the graphics
- The salesman take for granted that the girls only cares about the looks

4.7.5 Weights

6 of the interviewed describe how they would wish for lighter skis. ”If someone gave me two skis, and the only difference would be the weight, I would definitely take the lighter one”

4.7.6 Mounting point

From the interviews it was found that five of the female skiers prefer a more forward mounted binding on the ski than what it usually is on skis for men. ”Moving the binding 2 cm forward makes me ski so much better”. The others did not know or said that they always mount on the recommended mounting point.

4.7.7 Sidewall

When asked about sidewalls, all respondents expressed that this does not matter for them. ”I wouldn't care if there is a sidewall or fullcap, it doesn't make a difference to me”.

4.8 Flex testing

To enable testing the flex (bending strength) of the skis, a flex testing construction were built (see figure 29). The flex measuring was made together with testing the skis to understand what differences the different flexes made on the ski performance.

Figure 29. Testing the flex of the skis with a flex rig that was built for this project

The testing rig consisted of a base construction in steel. A weight of 40kg was added to the ski. Afterwards the distance in 0,1mm that the ski was flexing down was measured with a digital measurement. The same procedure was made on every 20cm of the ski, which resulted in a graph for each ski over the flex profile.

The conclusion from the flex measuring and testing the skis is that the flex on a ski for women and men needs to be different. Not only do the skis for women need to be softer than the men's, the flex profile over the path of the ski should be different. This resulted in a suggested flex pattern according to the one shown in figure 30. The rest of the graphs that this test resulted in can be found in appendix 4.

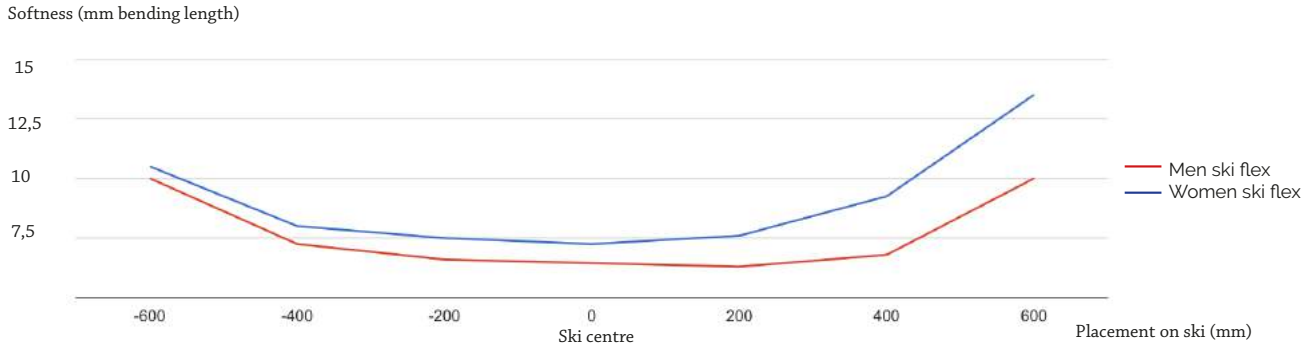


Figure 30. The result of the flex testing shows that women need a different flex than men

The men have more weight forward and can therefore have a more stiff ski forward, while it is hard for a woman to control a ski that is very stiff in the tip. They will however benefit from a bit more stiff flex in the tail.

A comparison was made between the flex of Faction and Roxy and other brands. The result is shown in figure 31.

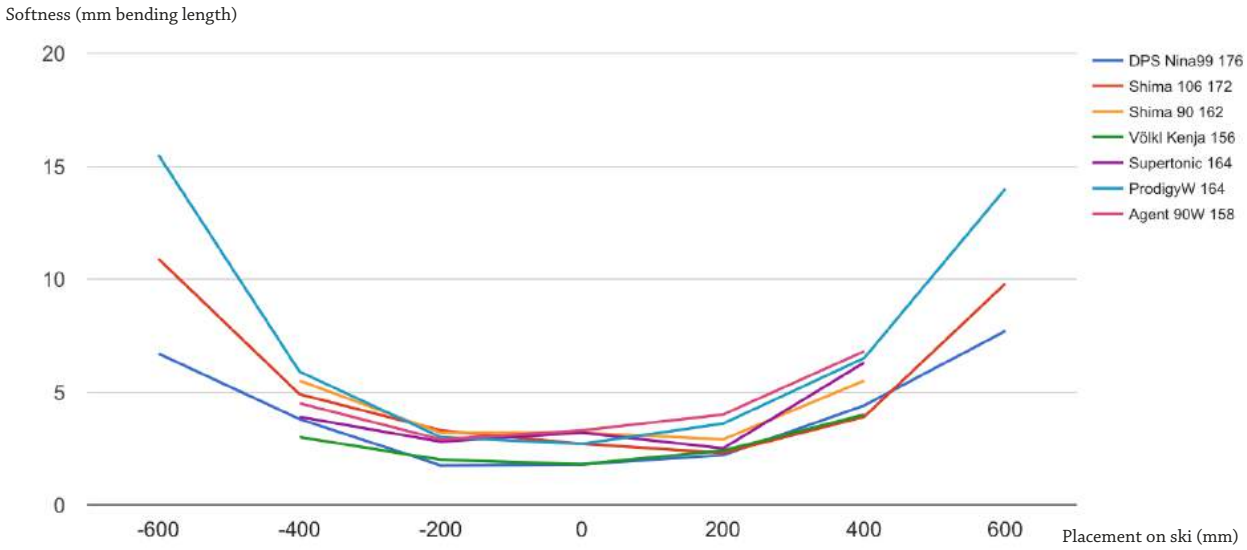


Figure 31. The measured flex of Faction and Roxy skis compared with other brands

When testing Shima106, it was difficult to control it. Hard to initiate the turn. According to the flex measuring it is soft in the tail but stiff in the tip.

The ProdigyW has a more balanced curve which also shows in the testing. It is easy to turn and responds to your movements. The Supertonic is soft in the middle according to the flex curve. This is because of a fault at one of the factories, Nobile, and it should remind more of the other curves.

4.9 Marketing

When it comes to the marketing aspect, it was found that although many brands are talking about their skis as unisex and women specific, they market them as men and women on their websites (see figure 32). This includes Faction (see figure 33).

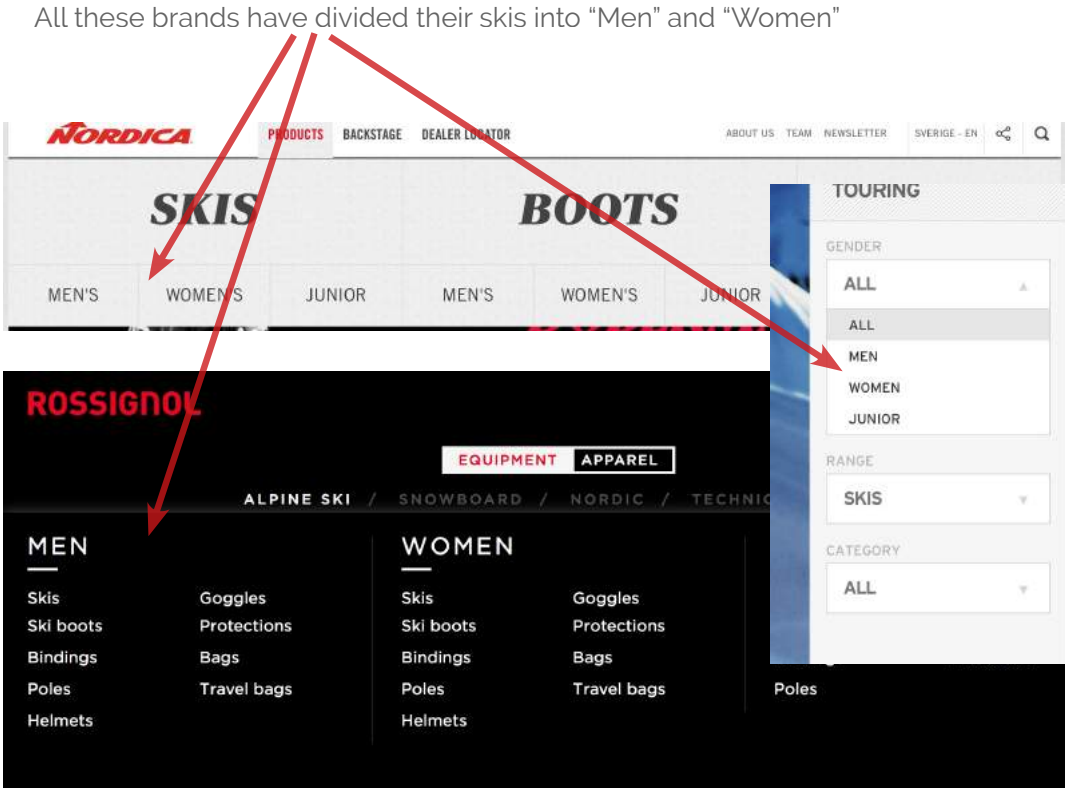


Figure 32. Brands who market their skis as men and women skis

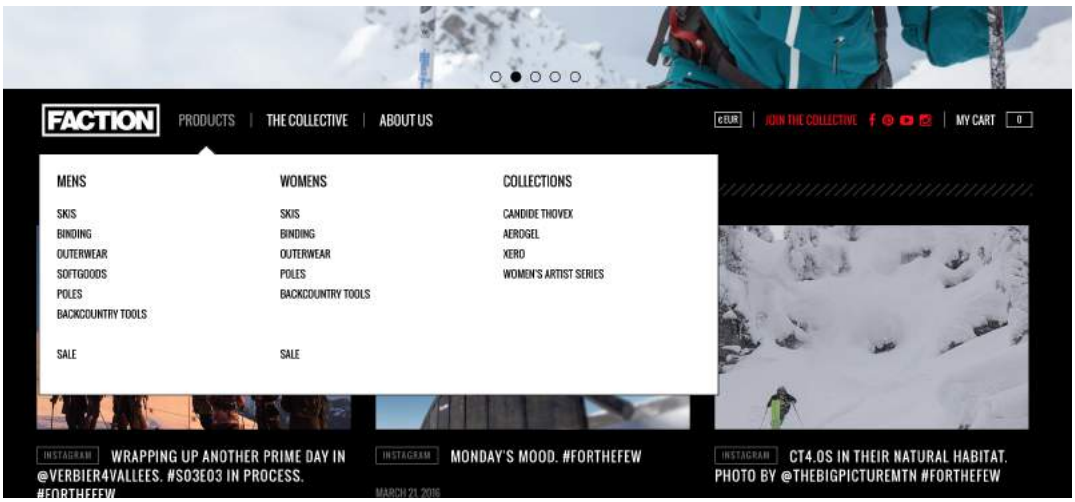


Figure 33. Faction also divide their skis into men and women

Three of the investigated brands did however show all their skis without a specific gender and their women skis as one of the product groups (see figure 34)

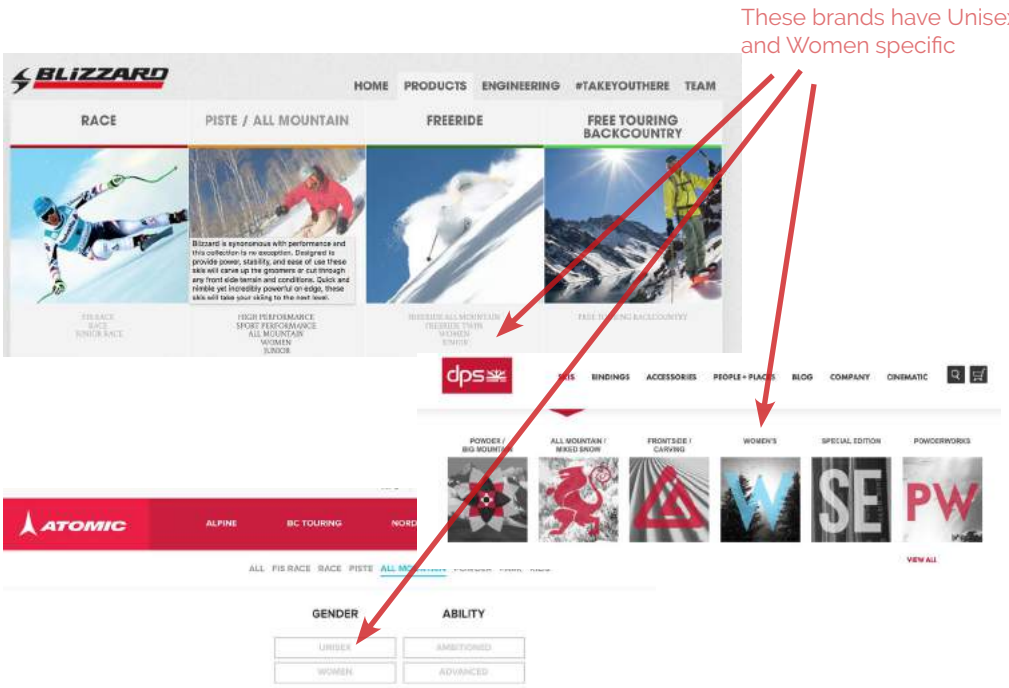


Figure 34. Brands who show their women skis as a product group and the rest as unisex

4.10 Special requirements

When talking to the interviewees some special requests became clear. These requests differ however between the very experienced professional skiers and the average skiers.

VERY GOOD FEMALE SKIERS WANT:

- More to chose between
- Women specific graphics
- More information about the technology
- Wider skis
- Longer skis
- Forward mounted (0,5-1% more forward than the men skis)
- Stiffer skis than the existing women skis

AVERAGE FEMALE SKIERS WANT:

- More to chose between
- Good looking graphics
- More information (What characteristics influences what in the ski performance)
- Light skis (15-20% lighter than the men skis)
- Softer skis than the men skis

5. Guidelines

From the research guidelines for Roxy and Faction could be established. These are found below.

5.1 Recommendations for Faction

•There is potential for women skis. Women prefer women specific skis if they include the kind of ski that they want to have.

•Include longer lengths

•More wider skis for women as well

•Enable female skiers to gain information about the skis

•Different mounting point than for men

•No brand really do develop their women line independently of the men's. Faction could do this and show that they care about the women skis.

•Women want simple clean graphics, not too pink and girly. It can be more similar to the men graphic. The fact that Faction have different logos will anyway differentiate the men and women skis.

5.2 Recommendations for Roxy

•Roxy can, in their marketing, make use of the fact that they are a brand for women.

•Roxy should be communicating the technology for Roxy skis

•Keep the DCs and Bonbon, but focus on developing the more advanced skis as well

•Include lightweigth skis

•Include touring skis

•The Shimas 106 are too stiff, the roxy buyer want softer skis

6. Requirements

From the research some requirements where found, which needs to be taken into consideration in order to create a line-up of skis that suits the end users demands. These can be found beneath in figure 35.

List of requirements	Requirement	Specification
1. The product line		
1.1.	Increase the number of choices	for women
1.2.	Include different types of skis	wider, touring, lightweight,
1.3.	Be developed for skiers of different height	skiers between 150-180cm
1.4.	Be developed for skiers of different weight	40-80kg
1.5.	Include lightweight skis	for both Roxy and Faction skis
2. Cultural		
2.1.	Spread knowledge	about the technical aspects of the skis
3. The skis		
3.1.	Should be light	<1600g/ski
3.2.	Should have a flex profile that suits female skiers	acc to diagram
3.3.	Should have a mounting point further forward than for men	0,5-1% more forward
4. Company		
4.1.	Be reasonably priced	<700€

Figure 35. List of requirements

7. Ideation

The ideation phase consisted of different methods. Co-creation was used to generate new ideas. Brainstorming was another method used to try to establish what the users prefer and why. Additionally, to ideate new ideas, reversed brainstorming and morphological charts was used.

By sking together with other female skiers (figure 36) and discussing the subject ideas for the new design was generated. This included testing different models from Faction and Roxy, but also from other brands.

The testing procedure was to ski a certain part together and then discuss the experience of the ski. Then the group continued to ski together for a new part and again discussed the experience. After 2 to 3 runs there was a change of skis. After every run there was a more thorough discussion about what was good and bad with that particular ski. New ideas came up during the test which could be used in the concept generation.

Brainstorming was used to collect and sketch (see figure 37) the ideas from the previous steps.

Figure 36. Testing skis with other female skiers

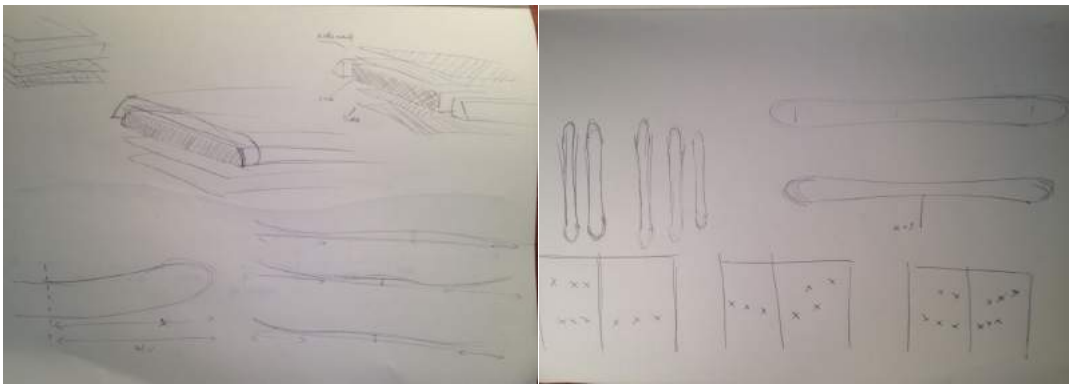


Figure 37. Brainstorming sketches

The next step was to generate concepts for the new line-up of skis. The different possible directions are stated below;

1: Have a smaller selection of women skis than men (see figure 38). Women can buy a pair of women skis if they find a pair that fits them, otherwise they can chose from the men skis. This is the case today.

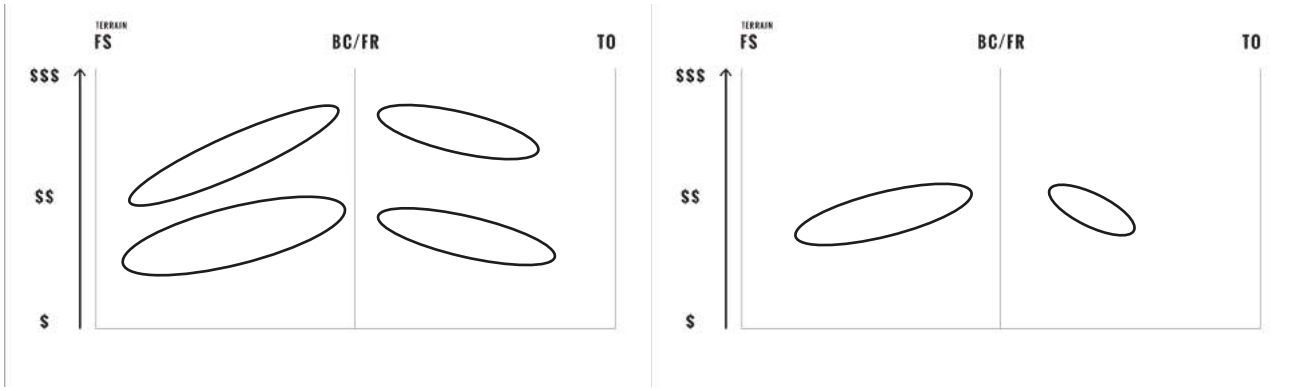


Figure 38. One possible direction to continue with. To have a smaller selection of women skis than men skis.

2: Aim to provide an independent women line that will have the women buy only the women skis (see figure 39).

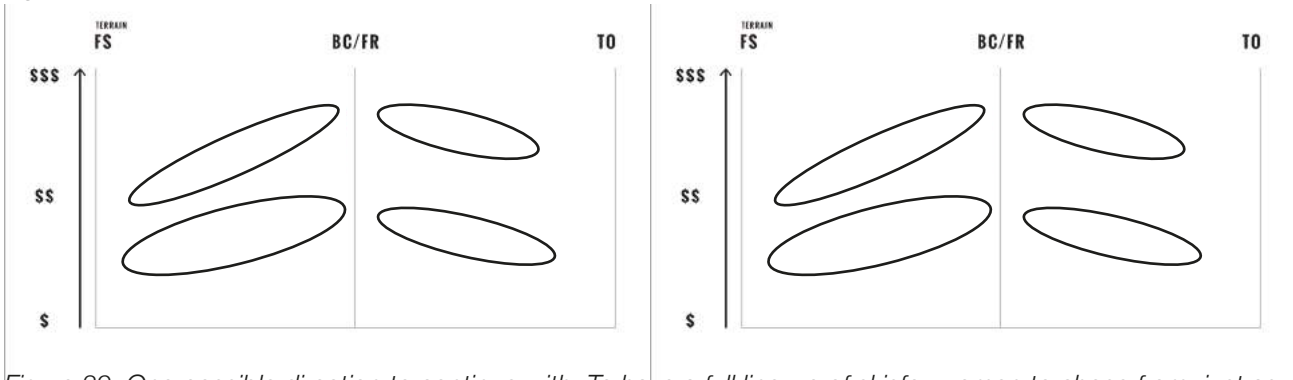


Figure 39. One possible direction to continue with. To have a full line-up of skisfor women to chose from, just as for men.

3. Do not make women specific skis but include the female buyers in a unisex line (see figure 40).

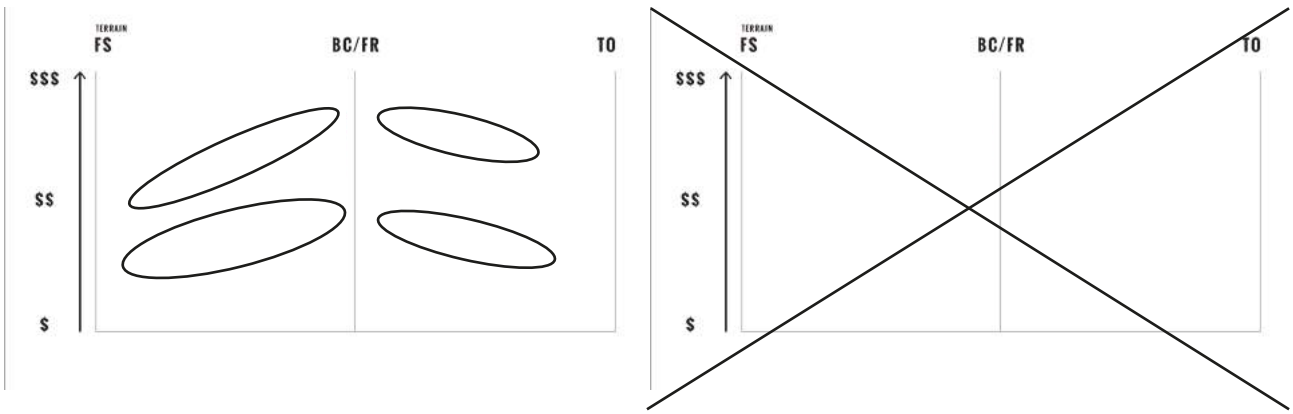


Figure 40. One possible direction to continue with. To have a full line-up of skisfor women to chose from, just as for men.

An evaluation of these direction was made in order to make a decision for the further design work (see figure 41). When taking into account that it should suit the company philosophy and image, fulfil the users needs and be feasible, a decisions was made to create a full line of skis for women, to make women independent of the men skis.

	Direction 1	Direction 2	Direction 3
Suit company philosophy and image	1	3	2
Fulfill user needs	2	3	1
Feasibility	3	2	1
Result	**6**	**8**	**4**

Figure 41. Evaluation of the different directions for further design

To generate concepts all input from the former steps were established in a morphological chart for every series that correspond to the men line. All charts can be found in appendix 5. In figure 42 the morphological chart for the Shima series are shown.

Shima				
	Today	Alt 1	Alt 2	Alt 3
Width	96	**90, 96, 102**	90, 96	96, 102
Material core	**Beech/poplar**	Poulawnia	Ash	Balsa
Radius	12-20m	**12-24m**	12-22m	14-22m
Boot centre	45,8-46,3%	46,6%	47%	**46,8 %**
Sidewall/cap	Sidewall	Fullcap	**Semicap**	
Flex tail to tip (to fit women flex profile)	10,9 4,9 3,3 2,7 2,3 3,9 9,8	9,8 3,9 2,3 2,7 3,3 4,9 10,9	**8,9 4,3 2,5 2,7 3,4 4,9 11,8**	
Rocker (tip height, tip length, tail length, tail height)	**60 350 250 35**	60 320 210 35	60 300 250 40	
Camber	**1,5**	2	1	2,5
Lengths	5 lengths: 154, 158, 164, 168, 174	**5 lengths: 154-178**	4 lengths: 154-178	3 lengths: 158-178
				More widths to chose from + different types of skiing
				Beech/poplar as before
				Adding longer radius for wider ski
				Moving the mounting point forward
				Semicap - cheaper than full sidewall, still gives an exclusive impression
				Change flex to more soft in the front and stiffer in the back
				Keep rocker profile from before
				Changing lengths to add 178cm

Figure 42. Morphological chart for Shima

The idea of making the morphological charts was to find a way to design the skis in order to meet the requirements of both the full line-up but also each individual ski. The final chosen concept is highlighted on each row.

For the decisions different aspects were taken into consideration. These were that they should compile with the existing skis of Faction and Roxy, the knowledge gained from the research and also the ideas were discussed with the company. Thereafter a concept for each brand was created which will be explained in the coming chapter.

8. Concept development

The ideas that generated from the ideation phase was compared with the research and the testing of the skis, existing skis as well as the coming skis for season 2016/1017. From this a concept was created for both Faction Women and Roxy skis. These are presented below for each brand.

8.1 Concept Faction

With origin in the existing line-up for Faction women skis, a new concept regarding the line-up was created, which can be found in figure 43. The first addition is to add a more charging series, that corresponds to the Standards series, for women too. This goes well with what the more expert users want. It would however be more soft in the flex than the Standard series. Each model will include longer lengths.

Faction is already going to introduce a new touring line for women. This shows that Faction wants to give the girls the high technology as well and is included in the concept line-up. Another factor in the concept is a division between a freeride line and an all-mountain line. The all-mountain line will include skis for a more average skier, while the freeride series should include new materials and wider skis to ski on deeper snow. Testing of the existing Faction skis together with other female skiers showed that many advanced skiers preferred the Candide Thovex 3.0 more than all the women skis. This showed on a demand for a ski that is ligther, wider and with a higher tail. Therefore a freeride twin series is added with influences from the Candide Thovex series.

A more detailed specification for each series can be found in figure 44.

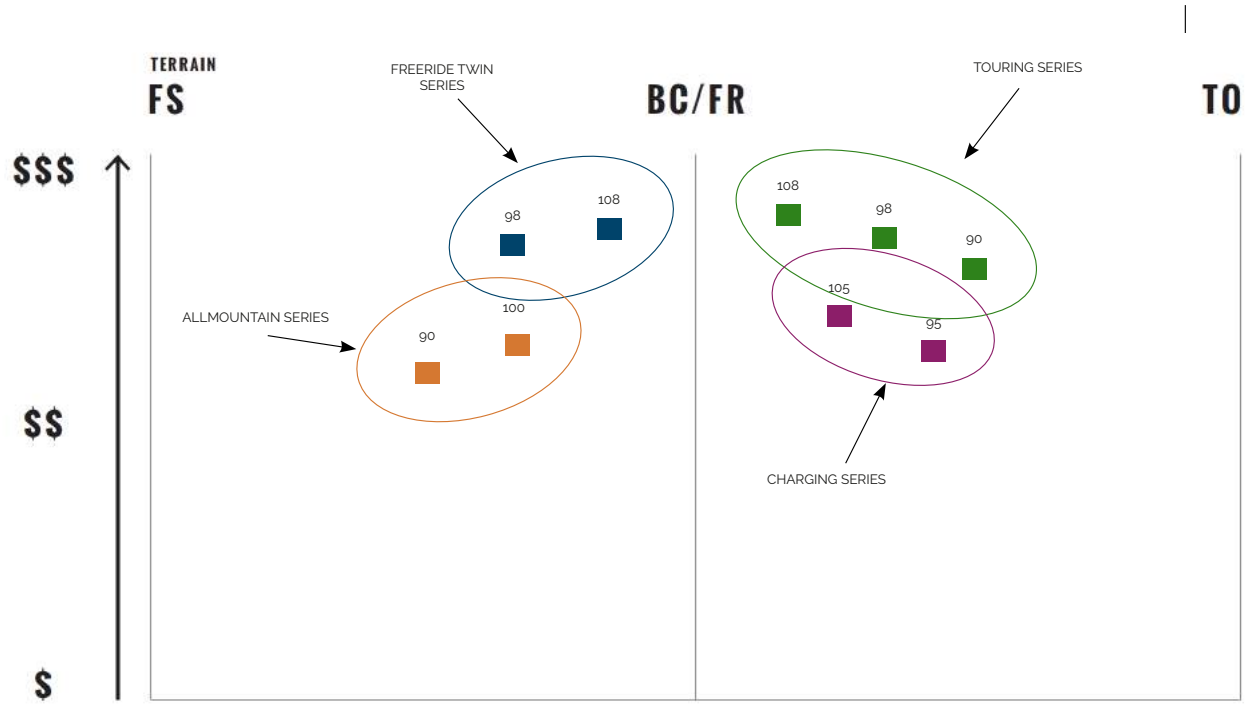


Figure 43. Conceptual line-up for Faction women skis. It includes four series of skis for different types of skiing.

FREERIDE TWIN SERIES

Waist 98 & 108
Radius ~23m
Lots of rocker tip/tail
Small camber (2mm)
Semicap
Weigth 1700

Lengths: 158, 166, 174, 182

ALLMOUNTAIN SERIES

Waist 90 & 100
Radius ~ 17-19m
Some rocker
Low tail
Soft flex
Semicap under foot

Lengths: 158, 164, 170, 176

TOURING SERIES

Waist 88, 98, 108
Radius ~ 18
Lots of rocker tip/tail
Small camber (2mm)
Full sidewall
Flat tail
Weigth 1200-1400g

Lengths: 158, 166, 174, 182

CHARGING SERIES

Waist 95 & 105
Radius ~ 19-23
Flat tail
Tapered tip
Rocker tip/tail
Small camber
Full sidewall
Weigth 1700-1900
Just a little bit softer than the standards, update flex profile

Lengths: 164, 172, 180

Figure 44. Detailed constructional design for the different series of Faction women skis

8.2 Concept Roxy

The conceptual line-up for Roxy skis can be found in figure 45. There is two all-mountain skis that will stay the way they are designed today. The more freeride oriented model needs a softer flex in the front to suit the female skiers.

According to the benchmarking not many brands have a ski with a waist width smaller than 85mm. Therefore, the all-mountain series could be a bit wider. This will result in a ski that is less piste oriented and more all-mountain.

The junior skis will stay but needs a softer flex than the existing model. Another addition to the line-up of today is a touring/ligthweight ski that also works well in the piste. This is shown in the upper right corner of the figure.

A more detailed specification for each series can be found in figure 46.

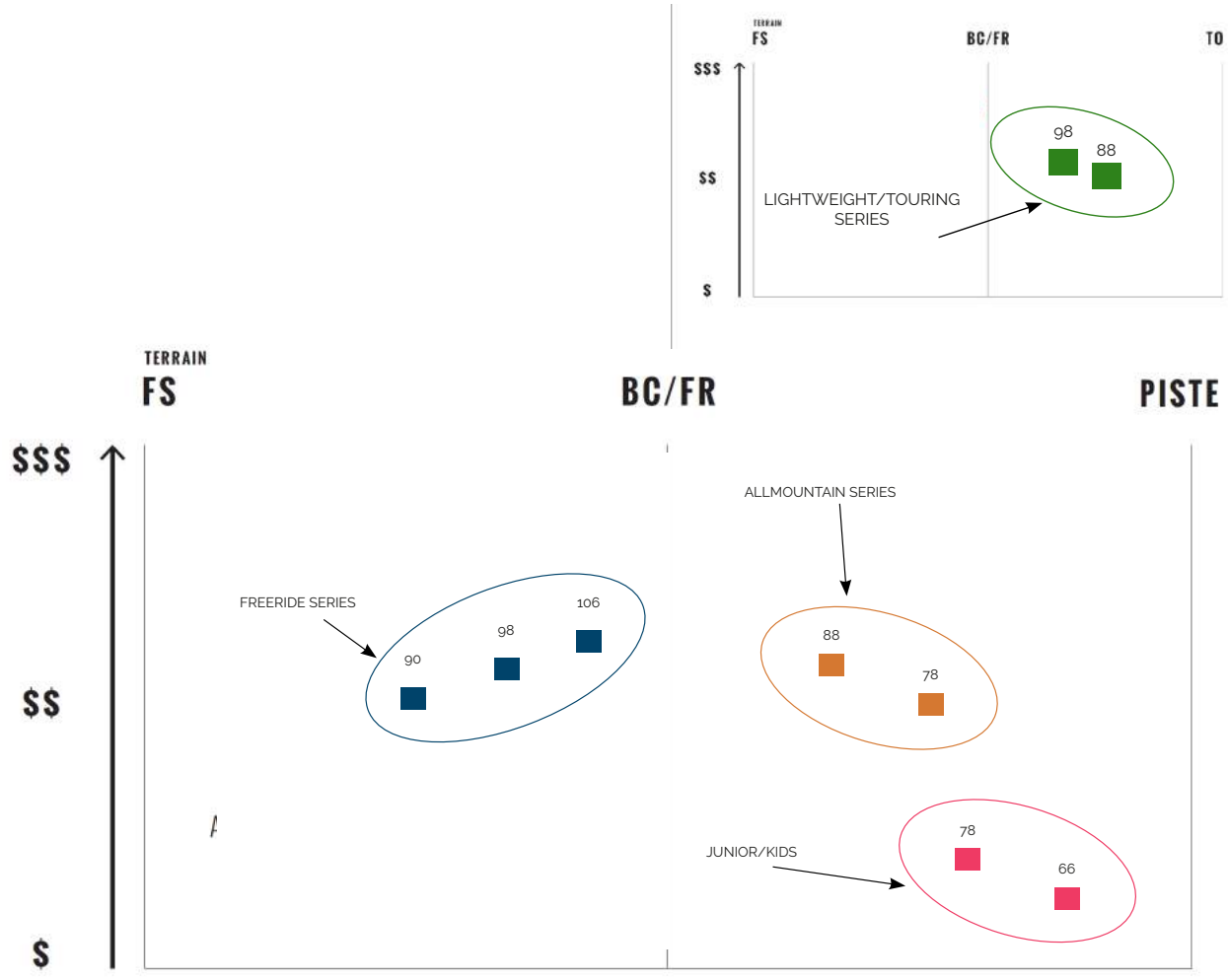


Figure 45. Conceptual line-up for Roxy skis. It includes four series of skis for different types of skiing.

FREERIDE SERIES

Waist 90, 98, 106
Radius ~ 16-18
Rocker tip and tail
Semicap
Softer flex on 106 than Chapter, especially in the tip
Keep flex on 90 and 96

Lengths: 158, 164, 170, 176, (180 for 106)

ALLMOUNTAIN SERIES

Waist 78 & 88
Radius ~ 14
Some rocker
Low tail
Soft flex
Semicap under foot

Lengths: 148, 156, 164, 172

TOURING SERIES

More Agent like
Waist 88, 98
Radius ~ 15-19
Lots of rocker tip/tail
Camber (~4mm)
Semicap
Flat tail
Weigth 1000-1200g

Lengths: 148, 158, 168, 178

Figure 46. Detailed constructional design for the different series of Roxy skis

8.3 Concept Evaluation

An evaluation of the concepts was made together with the company. Taking other aspects into consideration, such as existing moulds and amount of different models, some changes where made. The new line-ups are shown in figure 47 and 48. The changes are described below.

The conceptual line-up of Faction will not include a Charging series similar to the Standard series. The reason for this is that there is still several skis to chose from for a woman that wants a more stiff and heavy ski, for example Escape W, Prodigy W 102, and also the men Standard series. The waist widths differ a bit from the original concept due to that the company wants to use existing moulds for manufacturing.

For the same reasons as for the Faction Women lineup, existing molds restricts the possibilities for Roxy skis. The freeride series will be built from the Prodigy/Chapter molds. Therefore, the width will be of 96 and 102 mm.

The all-mountain skis can be produced in existing molds, with the widths of 78mm and 85 mm, and an additional 72mm ski. There might be room for a lightweight ski in the future, but financially this is not possible for the moment.

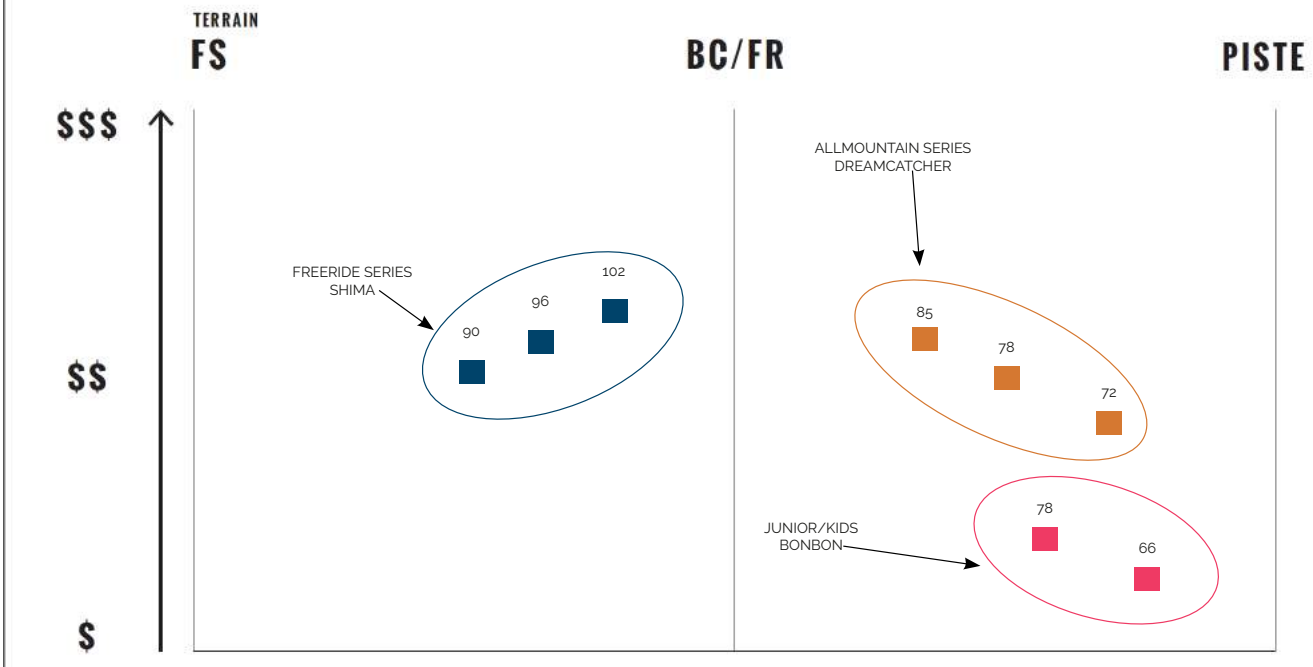


Figure 47. Concept for the line-up for Roxy skis after changes made together with the company

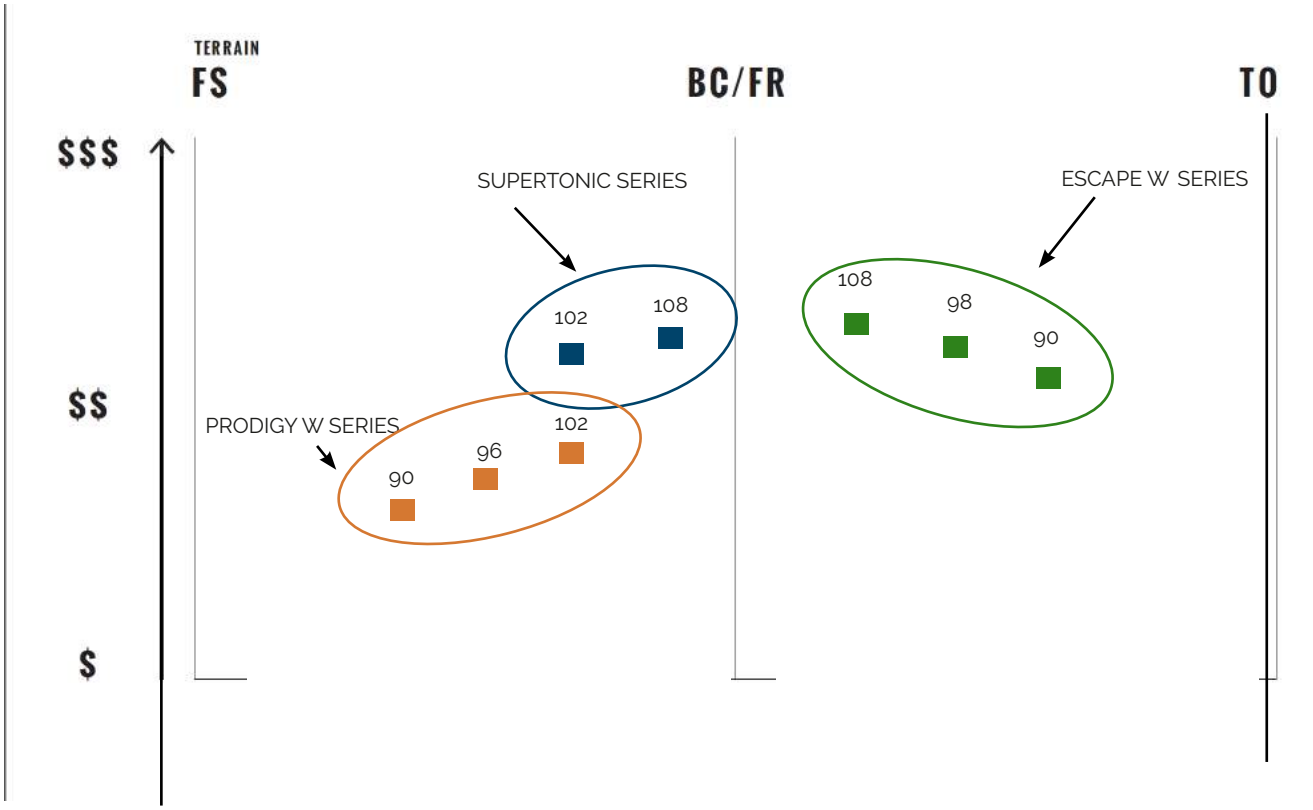


Figure 48. Concept for the line-up for Faction women skis after changes made together with the company

9. Finalization

The final design of the line-up of skis for Faction and Roxy are presented below. The detailed characteristics of the different skis are described as well as who the typical user will be for each model.

9.1 Faction Final design

The line-up of the future women skis developed in this project will consist of and be divided into three series (see figure 49). One serie with all mountain skis, Prodigy Women, which could be used by a skier on basic to advanced level. The second serie is a freeride serie, Supertonic, for a skier that enjoys skiing in deeper snow and mainly off-piste. The third serie is a touring serie for women, Escape Women. It is very lightweight to enable touring up the mountain but at the same time stable to suit an aggressive and charging skier.

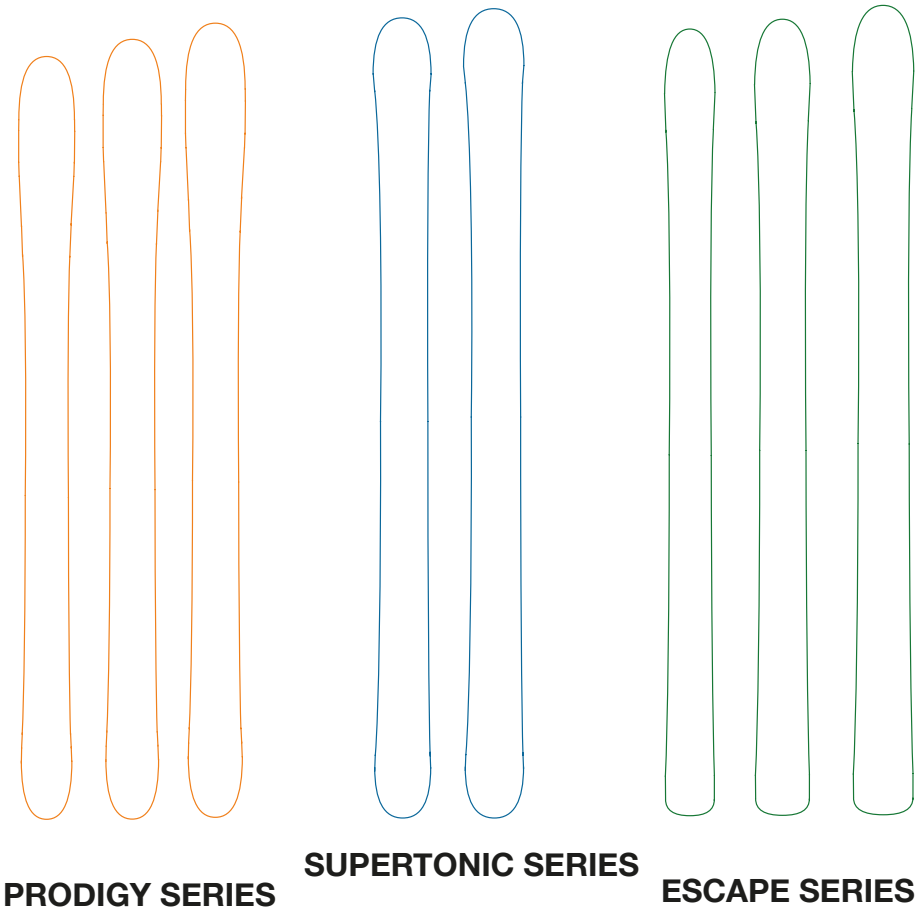


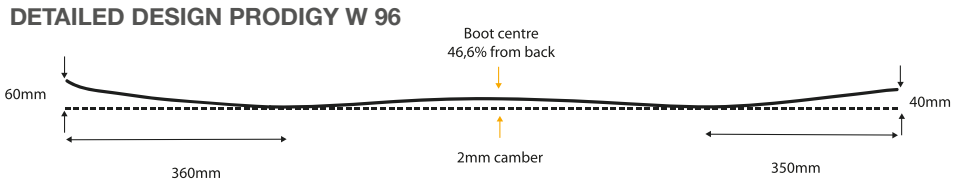
Figure 49. Drawings of the final design for Faction women skis, containing three series

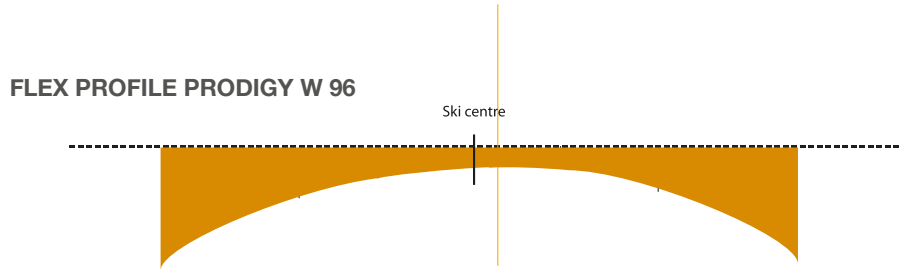
9.1.1 Prodigy Women Series

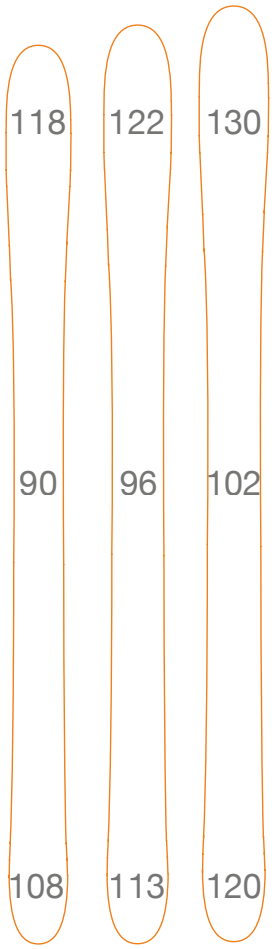
The prodigy ski (figure 50) is designed to fit skiers who want to enjoy both piste skiing and some off-piste skiing. The allmountain ski comes in three variations in waist width. The smallest waist is 90mm. This ski fits a beginner to average skier who spends most time in the piste. The rocker helps the ski to also float great outside the piste. The middle waist width is 96mm. This corresponds to the previous Prodigy model, although changes have been made in the flex pattern to fit a female skier better. This means that the flex has been softened in the tip and stiffened in back part behind the foot. A wide waist ski has been added to the series with a width of 102mm. This ski will ski well on any base and fits an average to advanced skier.

The skis have a low camber to create some grip in hard snow, while the long rocker enables floating in deeper powder snow. The mounting point is moved forward to create more force forward in the ski, due to the female center of gravity.

The skis come in different lengths for the different widths. The 90mm ski will come in a shorter length, 154cm, than the other two, as it is more of a beginner ski. It will however also be available in 176cm to fit taller women and more advanced skiers. All widths come in 4-5 lengths to ensure enough options for different skiers.







Prodigy W			
Waist	90	96	102
Lengths	154, 158, **164,** 170, 176	158, **164**, 170, 176	158, **164**, 170, 176, 182
Core material	Beech/Poplar	Beech/Poplar	Beech/Poplar
Rocker	60 300 270 40	60 360 350 40	60 370 360 40
Camber	2mm	2mm	2mm
Radius	14/16m	16/18m	16/18m
Sidecut	118-90-108	122-96-113	130-102-120
Weight	**1600g**	**1680g**	**1750g**
Sidewall/cap	Semicap	Semicap	Semicap
Boot centre	**46,6 %**	**46,6 %**	**46,6 %**

Figure 50. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

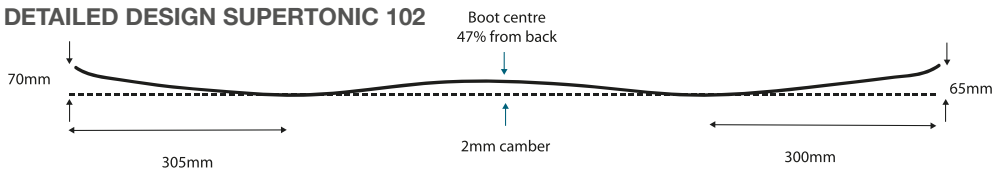
9.1.2 Supertonic Series

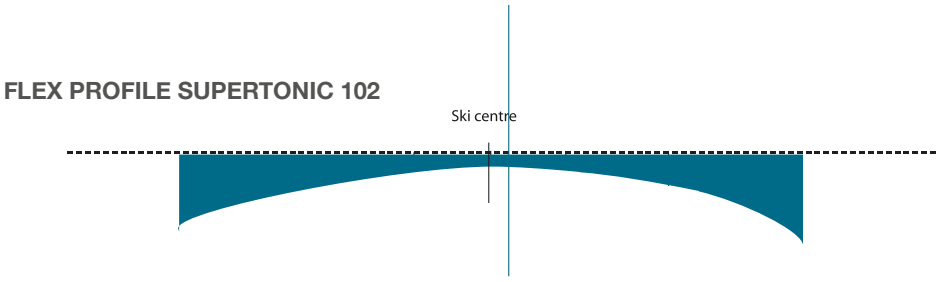
The Supertonic series (figure 51) is a freeride series inspired by the best selling Candide Thovex series. It comes in two variations. One with a waist width of 102mm and no pintail, which is designed to fit both piste, freestyle and off-piste skiing. The 108cm waist ski is more directed towards freeride skiing. It has a bigger radius and is made from balsa wood to make it light despite its big scale.

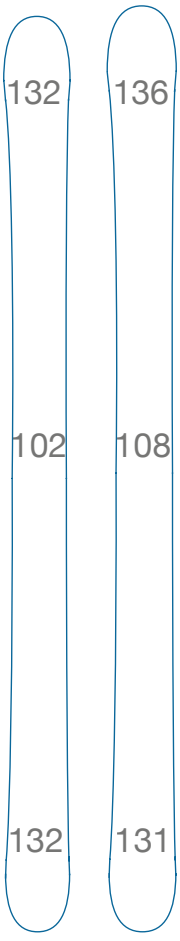
Both variations comes in 4 lengths, but the smaller has a shorter length of 158cm and the bigger has a longer length of 182cm to fit a more advanced and aggressive skier.

The flex of the ski corresponds to the Candide Thovex series with slight differences according to the research. The rocker is long since the ski is meant to be skied on in deep snow. It has a small camber and a twintip shape, which means that it is higher in the tail than the Prodigy series. Because of this, the ski is designed to fit perfect for a freestyle skier as well.

The typicsl user of the Supertonic skis is an experienced skier who skis in a playful way and mostly enjoys off-piste terrain. She is not affraid to jump from cliffs or make tricks in the park and wants a ski that fits for every type of skiing she does.







Supertonic		
Waist	102	108
Lengths	158-166-172-178	162-168-176-182
Core material	Poplar/Ash	Balsa
Rocker	70 305 300 65	70 310 300 65
Camber	2mm	2mm
Radius	14-18	18-22
Sidecut	132-102-132	136-108-131
Weight	**1700g**	**1750g**
Sidewall/cap	Sidewall	Sidewall
Boot centre	**47 %**	**47 %**

Figure 51. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

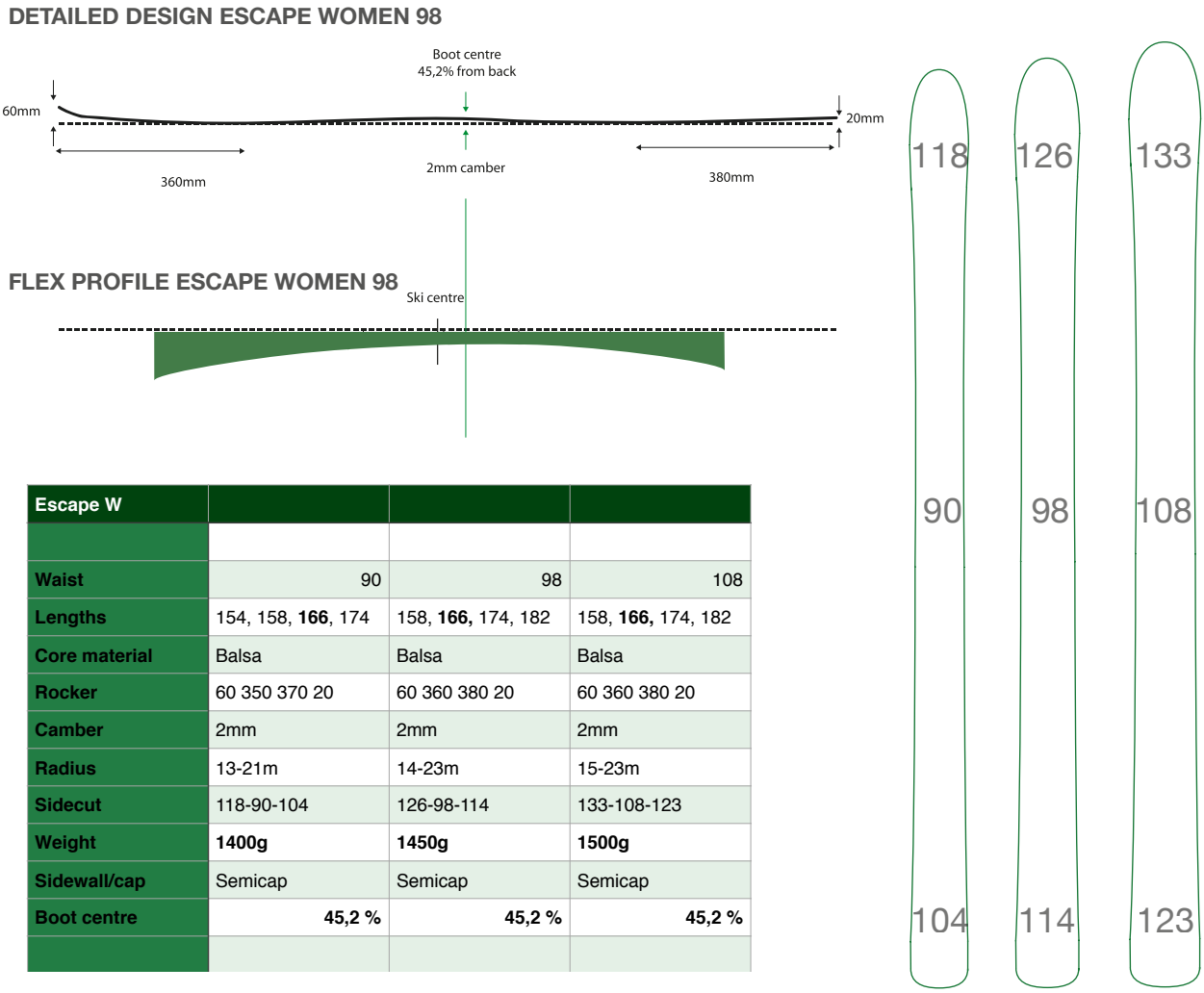
9.1.3 Escape Women Series

The Escape Women series (figure 52) is a high-tech ski-line with a very lightweight construction, that it is designed for touring up the mountain but also have a great performance downhill. This ski is for the adventurous skier who wants to experience other terrain than the easy accessible.

By the three variations of width, it provides the female skiers with a good choice of skis to ensure that there is a ski for everyone. The widest ski, with a waist of 108mm is for the more advanced skier who wants to enjoy deep snow on hidden parts of the mountain. The 90mm and 98mm waist is perfect for the ones who prioritize the walk up the mountain but still wants good performance on the way down.

The skis hava a flat tail with a quite stiff flex pattern and fits a skier who wants a more charging ski for high speeds. The long rocker in both tip and tail in combination with the low camber makes it float well in deeper snow.

It comes in 4 lengths per model. Both the 98mm waist and the 108 waist comes in a length of 182cm.



Escape W			
Waist	90	98	108
Lengths	154, 158, **166**, 174	158, **166,** 174, 182	158, **166,** 174, 182
Core material	Balsa	Balsa	Balsa
Rocker	60 350 370 20	60 360 380 20	60 360 380 20
Camber	2mm	2mm	2mm
Radius	13-21m	14-23m	15-23m
Sidecut	118-90-104	126-98-114	133-108-123
Weight	**1400g**	**1450g**	**1500g**
Sidewall/cap	Semicap	Semicap	Semicap
Boot centre	**45,2 %**	**45,2 %**	**45,2 %**

Figure 52. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

9.2 Roxy Final design

The Roxy line-up will consist of three series (see figure 53). One serie is an all mountain serie, Dreamcatcher, which is developed for average skiers and skis well in the piste but could also be used outside the piste. The second serie, Shima, is more freeride oriented. The third serie, Bonbon, is a junior serie for children and adolescents.

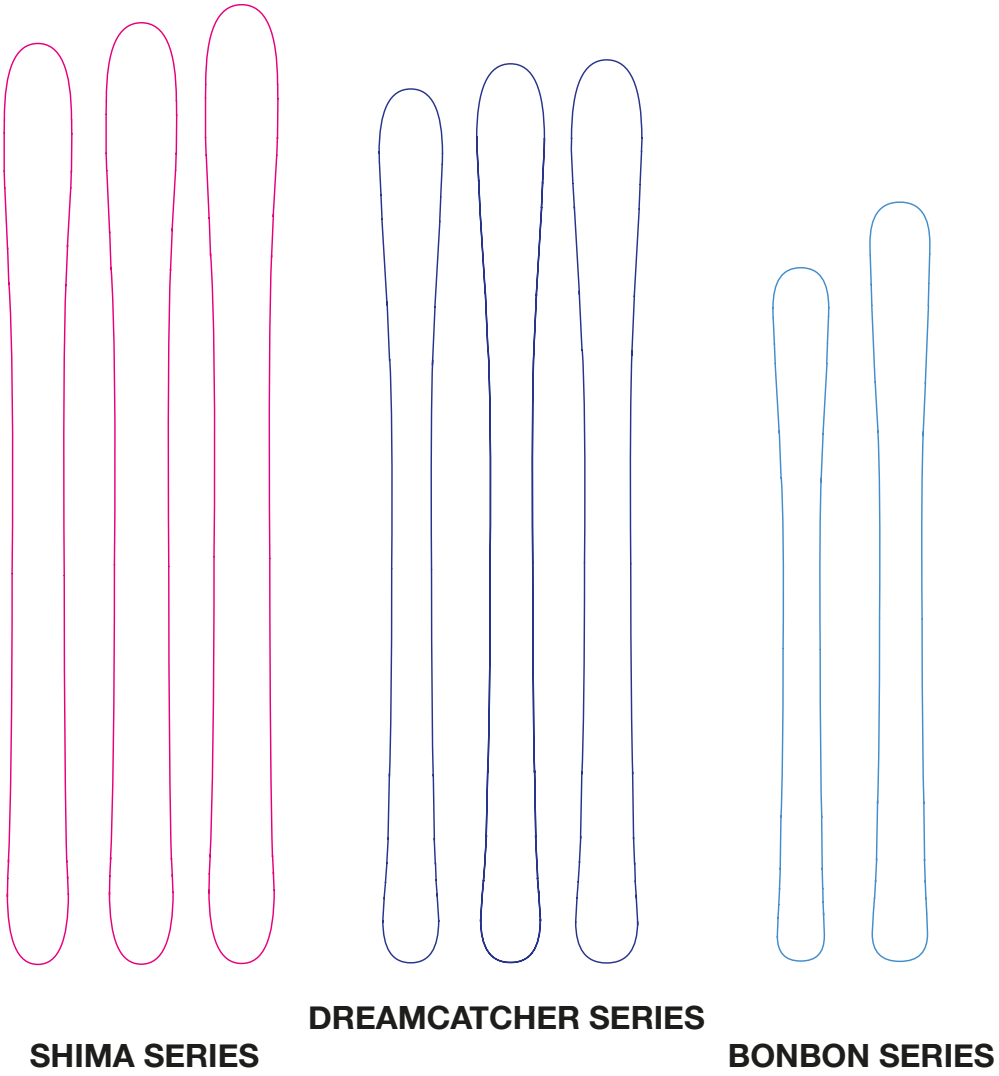


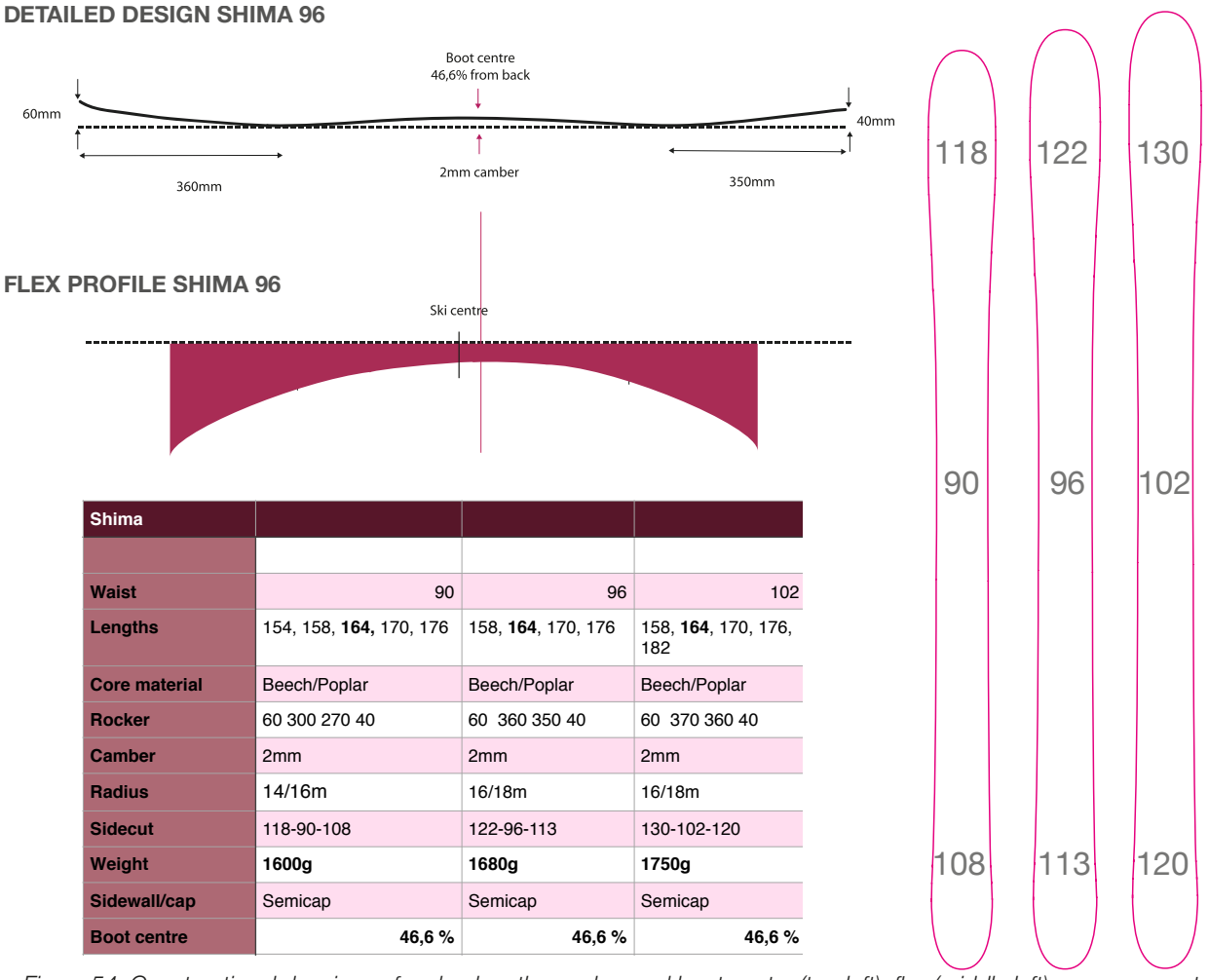
Figure 53. Drawings of the final design for Faction women skis, containing three series

9.2.1 Shima Series

The Shima series (figure 54) has the same shape and construction as the Prodigy Series for Faction skis. For the Roxy skis this is the most advanced skis. This allmountain ski is designed to fit all skiers who want to enjoy both piste skiing and some off-piste skiing. This is a perfect ski for the Roxy buyer and it comes in three variations in waist width. The smallest waist is 90mm. This ski fits a beginner to average skier who spends most time in the piste. The rocker helps the ski to also float great outside the piste. The middle waist width is 96mm. This corresponds to the previous Prodigy model, although changes have been made in the flex pattern to fit a female skier better. This means that the flex has been softened in the tip and stiffened in back part behind the foot. the widest ski in the series has a width of 102mm. This ski will ski well on any base and fits an average to advanced skier.

The skis have a low camber to create some grip in hard snow, while the long rocker enables floating in deeper powder snow. The mounting point is placed 46,6% of the length of the ski from the back, which is more forward than the Prodigy ski for men.

The skis come in the same lengths as the Prodigy Women. All widths come in 4-5 lengths to ensure enough options for different skiers.



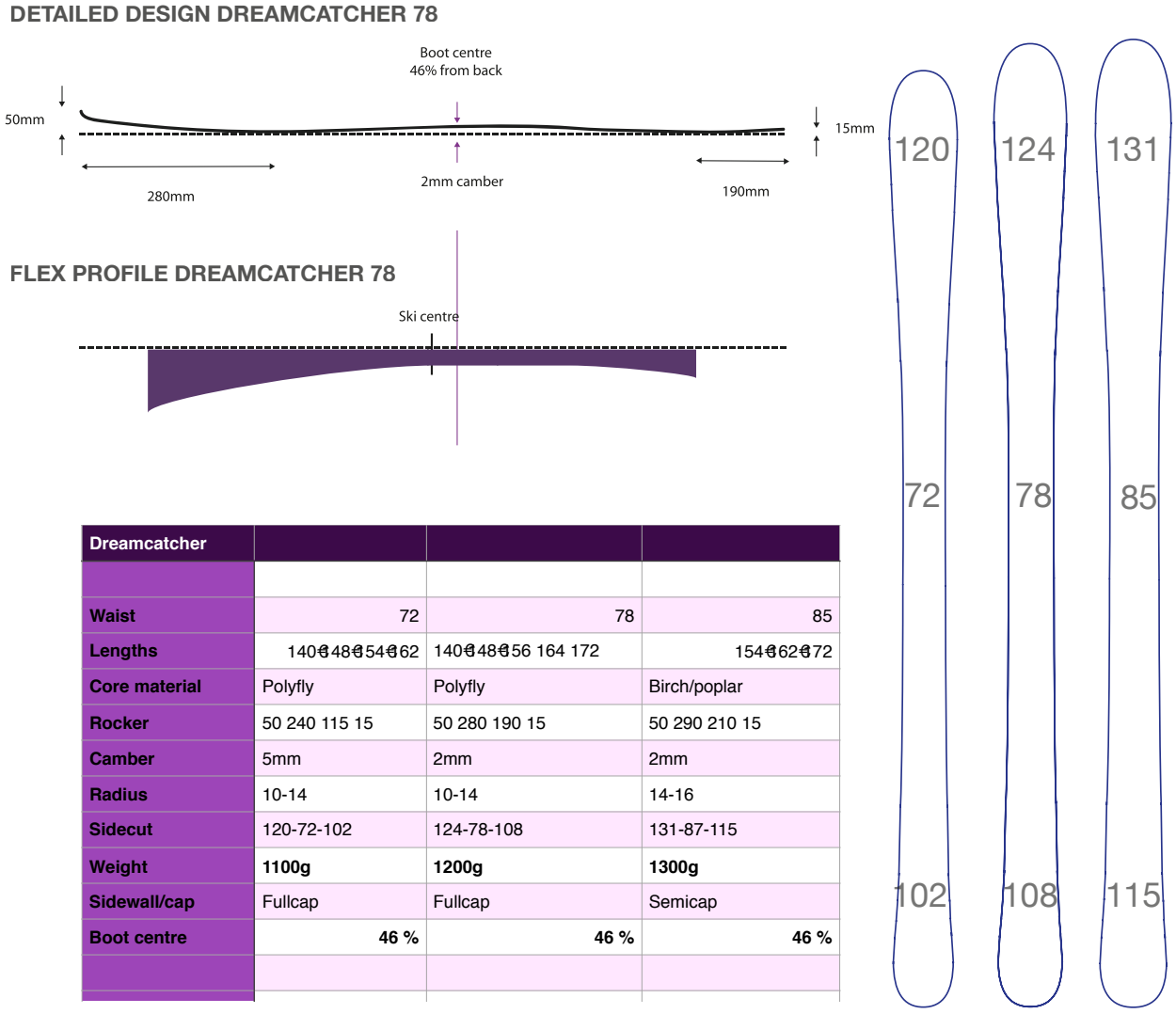
Shima			
Waist	90	96	102
Lengths	154, 158, **164,** 170, 176	158, **164**, 170, 176	158, **164**, 170, 176, 182
Core material	Beech/Poplar	Beech/Poplar	Beech/Poplar
Rocker	60 300 270 40	60 360 350 40	60 370 360 40
Camber	2mm	2mm	2mm
Radius	14/16m	16/18m	16/18m
Sidecut	118-90-108	122-96-113	130-102-120
Weight	**1600g**	**1680g**	**1750g**
Sidewall/cap	Semicap	Semicap	Semicap
Boot centre	**46,6 %**	**46,6 %**	**46,6 %**

Figure 54. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

9.2.2 Dreamcatcher Series

The Dreamcatchers (figure 55) are skis for a beginner to average skier who enjoys piste skiing the most. It has a smaller waist than the Shimas and shorter rocker. Still, there is some rocker and a low camber, which makes the ski more freeride oriented than a pure piste ski. The 72mm waist will have a camber of 5mm which is helpful to control the ski on harder snow, since it is more piste-oriented.

The 72mm and 78mm will be made out of polyfly material, which is a kind of foam, and therefore they also have a fullcap construction. The 85mm waist will be made out of birch/poplar. The short radiuses of the Dreamcatcher skis fits a skier who makes faster turns and it will come in various lengths, from 140cm for the 72mm and 78mm up to 172cm for the 85mm waist.



Dreamcatcher			
Waist	72	78	85
Lengths	140 148 154 162	140 148 156 164 172	154 162 172
Core material	Polyfly	Polyfly	Birch/poplar
Rocker	50 240 115 15	50 280 190 15	50 290 210 15
Camber	5mm	2mm	2mm
Radius	10-14	10-14	14-16
Sidecut	120-72-102	124-78-108	131-87-115
Weight	**1100g**	**1200g**	**1300g**
Sidewall/cap	Fullcap	Fullcap	Semicap
Boot centre	**46 %**	**46 %**	**46 %**

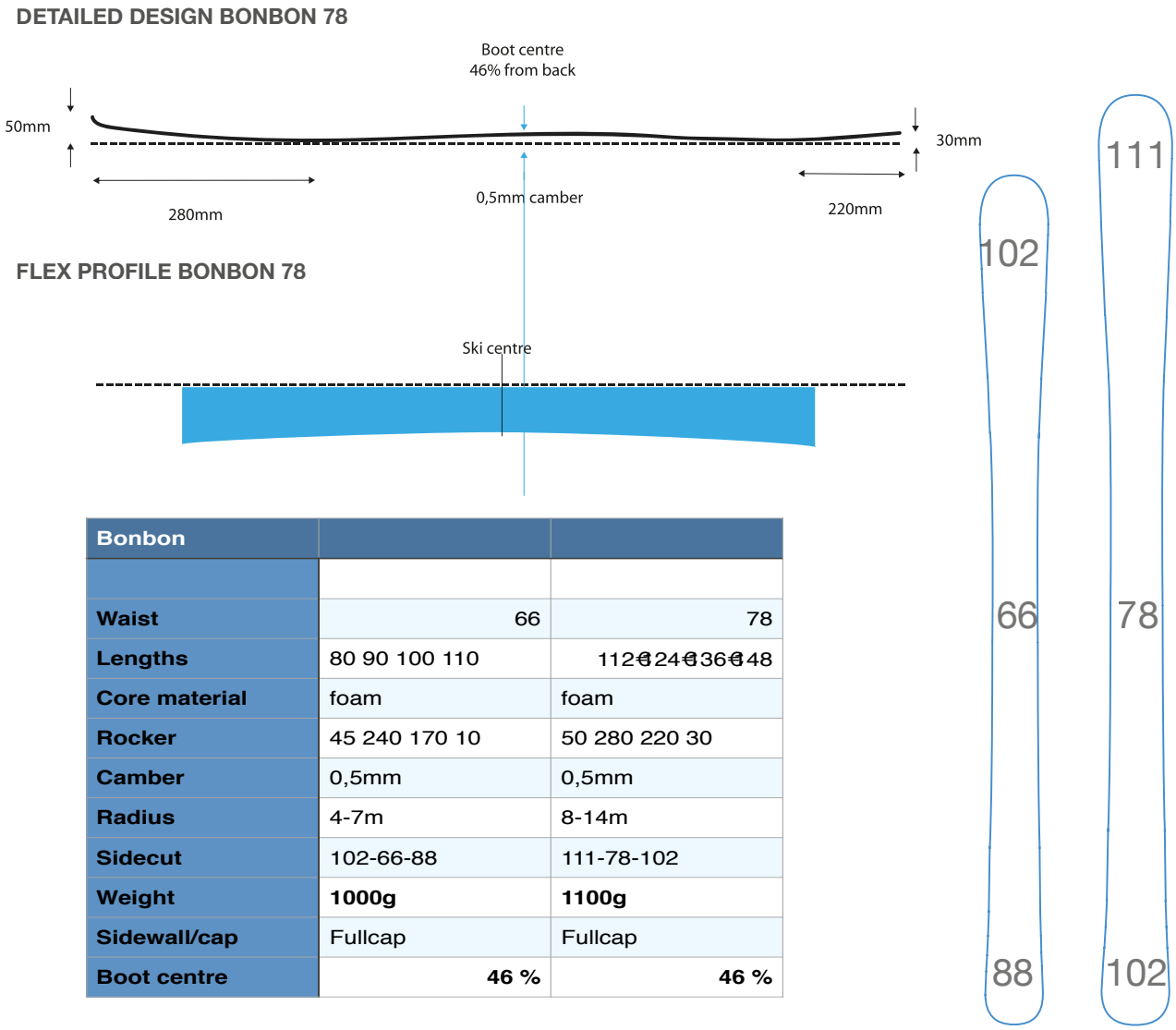
Figure 55. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

9.2.3 Bonbon series

The Bonbon junior skis (figure 56) is a development of the existing Bonbon skis for Roxy. The shape is the same as the old models but changes are made in the flex pattern and the boot centre is moved slightly forward. The flex is stiffer than the existaing and the flex is also moved a bit backwards, which means that the ski is stiffer in the back than in the front but overall stiffer than the old version.

The ski comes in 4 lengths per model and is made out of foam. It has a small camber of 0,5mm. A bigger camber is not needed for children since they don't add on that much force on the ski as an adult skier, but rather need the ski to apply the force even on the base layer for them.

The Bonbon skis suits a child to adolescent skier and is meant to ski in the piste, but works as an all-mountain ski as well.



Bonbon		
Waist	66	78
Lengths	80 90 100 110	112 124 136 148
Core material	foam	foam
Rocker	45 240 170 10	50 280 220 30
Camber	0,5mm	0,5mm
Radius	4-7m	8-14m
Sidecut	102-66-88	111-78-102
Weight	**1000g**	**1100g**
Sidewall/cap	Fullcap	Fullcap
Boot centre	**46 %**	**46 %**

Figure 56. Constructional drawings of rocker length, camber and boot centre (top left), flex (middle left), measurements (down left), constructional drawing of shape (right)

10. Discussion

In this project, a lot comes down to a gender perspective, where subjective opinions and attitudes are a part of the result. The differences between men and women in skiing are very small, and it would perhaps be reasonable to make skis for a specific kind of skier rather than to create women specific skis. However, the results of this study shows that women want women specific skis. The market trend shows that women prefer skis that are developed specifically for them. They buy men/unisex skis because they are missing the skis that they want on the women line. By providing a wider variety of skis for women to chose from and to provide the users with the more high technology products this demand will be fulfilled.

A great amount of time in this project was put into user studies. With an different approach, towards for example more manufacturing, the result would probably have been different. On the other hand, the main aim with this project was to establish the users needs. Therefore, the choices where made to put a lot of effort and time into this part. The limitations of the shape of the skis that were considered in a late stage of the project due to the mould restrictions is a fact that could and perhaps should have been taken into consideration earlier in the process. The positive aspects of the way the process progressed is though that no restrictions where made in what would be the ultimate concept for the line-ups. Thereafter the company where able to take stands in what changes where possible or not.

The result of the survey shows that 70% of the female skiers chose men/unisex skis. This number is not necessarily scientifically correct, since it is not for sure that the respondents correspond correctly to the varieties of female skiers there is. It is though a good indication of the market. The fact that the amount of women who took part in the survey was 40% shows that it is comparable with the SIA reports, which count the female skiers to be 40% of all skiers.

In the survey, 42% of the women answer that they do not know which length they ski today. According to the other 58% there is a demand for longer skis. Although, there is a possibility that the 42% who does not know could be skiing shorter lengths than the ones who answered. It is however reasonable that there is an interest for longer lengths on the market, especially on the freeride section.

Another result from the survey is that 18% of the women find the graphics important while 31% of the overall responses believe it is important. This indicated that men find it more important than the women. On the other hand, the store staff estimated that 80% of the women who comes in to buy a pair of skis only cares about the graphics of the ski. There are different possible reasons for this difference in perception of the reality, and it is probable that the reality is a combination on these. Anyhow, this shows the need for communication from the company's side both towards the users but also towards the retailers.

To make the survey in a later stage of the process, or making another one, when more insights where conducted would have been a good way to go even deeper in the understanding of the users. It would on the other hand have been very time consuming and generate more quantitative data for the study. Instead, further interviews where made, which added qualitative data to the results.

This design suggestion enables Faction to be the brand that have invested in a great women line-up. Since the study shows that women prefer women specific skis, there is potential on the market for women skis, Faction has therefore a great potential to reach out to these women who now choses to buy a ski for men. Adding on to this through communicating knowledge about the skis to women, Faction will be empowered as a brand for women. It also has the potential to increase the number of sold and produced women skis.

Since Roxy already is a brand only for women, they already have a benefit regarding marketing towards women. This design suggestion will however improve the performance of the ski and are developed to suit the user that Roxy skis have. This gives way for the empowering of Roxy as a brand for skis for women, especially if combined with a better communication of the characteristics of the skis from Roxy's side, just as for Faction.

This study has been focusing on the demands that the user have on the skis that Faction and Roxy produce. The users needs have been thoroughly analyzed and the concepts derive from these needs. The final design creates a wide variety of choices within each brand for the specific target group. It provides the female skiers with the same high technology materials and construction of the skis as for men, which will improve the products properties and hopefully trigger the curiosity among the female skiers to learn about ski technology and the aspects of a skis design. Changes in flex profiles has been made to correlate with the physical differences of a female body compared to the one of men. This, in addition to the more forward placed mounting point makes the skiing easier and less effort is needed to control the ski.

The final designs are specifically designed to suit female skiers. Additionally, it includes high technology materials and constructions. This opens up for communicating these properties to the women in the stores, which is also a necessity. A lot of responsibility do lay, and should lay on the retailers. This study showed that female skiers wants more knowledge about the skis. By providing the retailers with tools for communicating this knowledge, this will then also will benefit Faction as a company.

There are some aspects that would be taken into consideration in a further development of the project. The end users will benefit from the new line-up of skis, however to reach out to the end user and to succeed on the market the retailers needs to be involved in the process as well. Even though many users may not know the benefits of the new skis compared to the previous years models or other brands, the retailers will. One potential outcome of this is that by making a better ski, it will get better test results from trade tests. Consequently, more of the stores will want to buy it and thereby it will more easily reach the end user.

On the other hand, this argument is built on the fact that it will test better. Therefore, more thorough tests with the end users and the store retailers are an important next step in the further development of the skis. This demands prototyping of the final design and testing. However, throughout the project testing of skis with these different properties has been done, which is a good indication of the outcome of a final user test.

Prototyping of the skis is necessary before the final design is set and can be produced. However, time and costs have restricted this project. The next step for a further development of this project would therefore be to create prototypes and perform more user tests on these. This would probably generate in iterations of the development of the final concepts.

11. Conclusion

The project has shown that there is a lot of potential for women skis today. Even though the physical differences that influences the skiing are small between men and women, female skiers do prefer skis developed specifically for women. The final design in this project enhances this and takes these small differences into consideration, which makes the skis optimized for female skiers.

By offering a wider range of skis to chose from and by including high technology materials and constructions the demand from the users are fulfilled. Some restrictions where however made in cooperation with the company in order to meet cost requirements regarding especially manufacturing.

The fact that the result in this project is a series of products has in a way been constraining the detailed design of each ski. However, the main focus in this project have been on user studies. This approach has made it possible to create a design that fits well together with the market demands. This, in its turn, will also lead to and be beneficial for both the company and the retailers.

In conclusion, this project has produced useful guidelines that the company could definitely implement in their further development of their women skis.

References

Printed references

Boeijen, A., Daalhuizen, J., Zijlstra, J. and Schoor, R. (2013). Delft design guide.

Bohgard, M. Karlsson, S. Lovén, E. Mikaelsson, L-Å. Mårtensson, L. Osvalder, A-L. Rose, L.Ulfvengren, P. (2010) Arbete och teknik på människans villkor. 2 uppl. Stockholm: Prevent

SIA Snow Retail Data, produced by the NPD Group, Sports and Leisure Trends Division, (2013)SIA-report

SIA Snow Retail Data, produced by the NPD Group, Sports and Leisure Trends Division, (2014)SIA-report

SIA Snow Retail Data, produced by the NPD Group, Sports and Leisure Trends Division, (2015)SIA-repor

Digital references

The Guardian, Female in tuition: ski coaching for women, 2011
http://www.theguardian.com/travel/2011/feb/05/women-ski-coach-amanda-pirie
[Accessed 10 Mar. 2016]

Åka skidor, Tjejskidor, 2009
http://www.akaskidor.se/artiklar/artiklar/20091201/tjejskidor
[Accessed 22 Feb. 2016]

Ski my best, gender and skiing, 2016
http://www.skimybest.com/skiwomen.htm
[Accessed 5 Feb. 2016]

Mechanics of Sport, Ski construction, 2016
http://www.mechanicsofsport.com/skiing/equipment/skis/ski_construction.html
[Accessed 10 Mar. 2016]

Skibuilders, materials, 2016
http://www.skibuilders.com/howto/skicon/materials.shtml
[Accessed 21 Mar. 2016]

Skibuilders, Base preparation, 2016
http://www.skibuilders.com/phpBB2/viewtopic.php?t=407&postdays=0&postorder=asc&start=0
[Accessed 2 Mar. 2016]

Slopepro, Skidor, 2016
http://www.slopepro.com/sv/gear_skis_info
[Accessed 5 Apr. 2016]

Skibuilders, Ski design, 2016
http://www.skibuilders.com/howto/skicon/skidesign.shtml
[Accessed 5 Apr. 2016]

Freeskier, Gearwise: Skis, 2015.
http://freeskier.com/stories/gearwise-skis
[Accessed 22 Apr. 2016]

Faction, Skis, 2016
https://www.factionskis.com/skis/gender/mens-unisex-boys-kids-unisex
[Accessed 10 Mar. 2016]

Skis, Buying guide for skis, 2016
http://www.skis.com/Buying-Guide-for-Skis/buying-guide-1-12-2012,default,pg.html
[Accessed 13 Mar. 2016]

Appendices

Appendix 1. Interview guide

Interview guide

Interview skiers

What characteristics are important for you when choosing a ski?

How much knowledge do you want to have about a ski before you buy it?

What do you believe is the difference between a female and a male skier?

Do you usually buy a ski for women?

What is your view on skis for women today?

How important is the construction of a ski for you?

What about other technical aspects? Sidewall, shape..

Do you believe that women know the differences between the women specific and men's/unisex skis? Do you know?

Does it matter if they are different?

Should the graphic be different? Do you want a specific women graphics? Why/why not?

Interview store personnel

Can you describe the scenario of when a customer is coming in to buy a pair of skis?

What questions do you usually ask?

Do people want your help?

Do the customers usually have a lot of knowledge on beforehand? Have they done research before?

Do people want to try the skis first?

Is there a difference between men and women in how they behave in the store/the buying pattern?

What are the actual differences in how men and women ski?

Who are the female Faction buyers?

What is your opinion regarding men and women skis? Should they differ? How? Freeride skis vs. all mountain skis?

What characteristics of a ski fit what kind of skier?

How important is it for women that the ski they are looking at is designed especially for women?

What characteristics do you believe is the most important for a female buyer of an all mountain or a freeride ski?

What characteristics do you believe is the most important for a male buyer of an all mountain or a freeride ski?

Is it common that women buy men skis?

Appendix 2: Survey

1. How old are you? *

- -20
- 20-25
- 26-30
- 31-40
- 40+

2. What is your gender? *

- Female
- Male

3. How often do you usually go skiing? *

- Less than one week a year
- About one week a year
- Two to four weeks a year
- More than four weeks a year
- Once or twice a week
- On weekends
- Most days of the week
- Other...

4. What level are you skiing on? *

- Beginner
- Intermediate
- Advanced
- Pro

5. Which type of skiing do you prefer? *

- Only on-piste
- Mainly on-piste, sometimes off-piste
- As much on-piste as off-piste
- Mainly off-piste, sometimes on-piste
- Only off-piste
- Ski touring
- Cross-country skiing

6. What skis are you skiing on? (Brand, model and length or rental...) If more than one pair, please write down all

Long-answer text

7. What ski boots do you use? (Brand and model or rental... etc) If more than one pair, please write down all

Long-answer text

8. Which bindings do you use? (Brand and model or rental... etc) If more than one pair, please write down all

Long-answer text

9. How much knowledge do you believe that you have about the skis you ski on?

	1	2	3	4	5	6	
Almost no knowledge	○	○	○	○	○	○	I know every detail

10. What statements suit you? *

- It is important for me that my skis have the right shape
- It is important for me that my skis look good
- The materials in the skis are important to me
- The construction of the skis are important for me
- It is important for me that the skis have the right flex
- It is important that the skis have a good rocker-curve
- The camber line is important to me
- Other...

11. What characteristics are the most important for you when buying a ski? *

Long-answer text

12. Do you buy skis especially designed for men/women? *

- Yes
- No

Why/why not? *

Long-answer text

13. How do you choose which skis to buy/rent? *

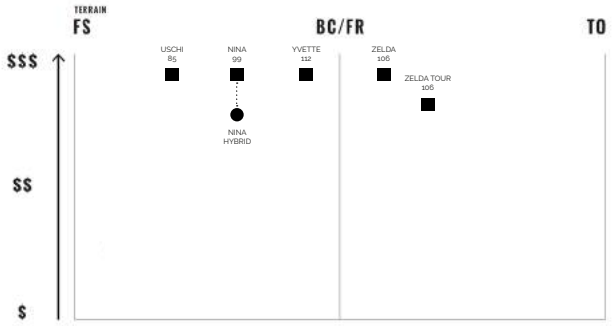
- Help/advise from friends
- Help by staff in shop
- Knowledge from before
- It doesn't matter that much
- From information online

14. Other comments

Long-answer text

Appendix 3: Complete brand analysis

DPS



DPS

Same ski, different colours

Aspen with carbon or Poplar with carbon strings

Waist: 85, 99, 106, 112

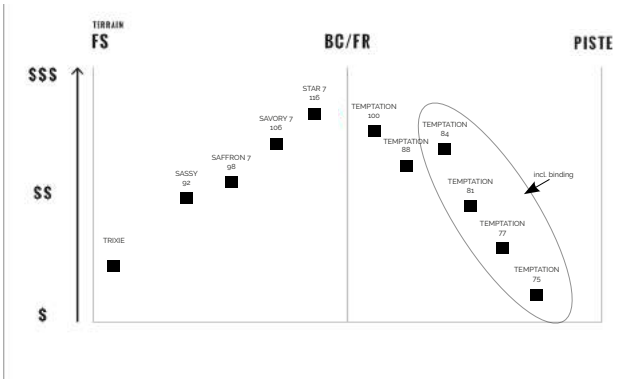
Lengths: 2-3 per model,

Radius: 15-19

Pintail: 14mm

Full sidewall

Rossignol



Very girly!

Long lenghts

Rossignol

Paulownia (heavy)

Waist: 92, 98, 106, 116

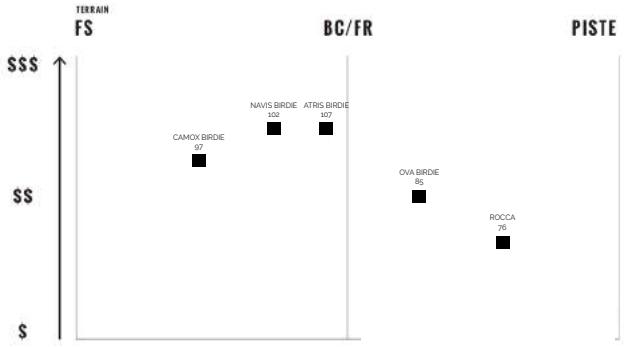
Lengths: up to 188

Radius: 16-19

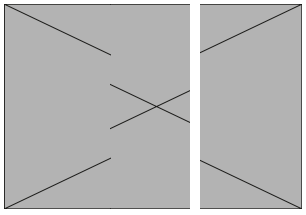
Pintail: 10mm

Semicap

Black crows



Birdie?



Black Crows

Same construction and core as men's, only two lengths

Poplar

Waist: 76, 85, 97, 102, 107

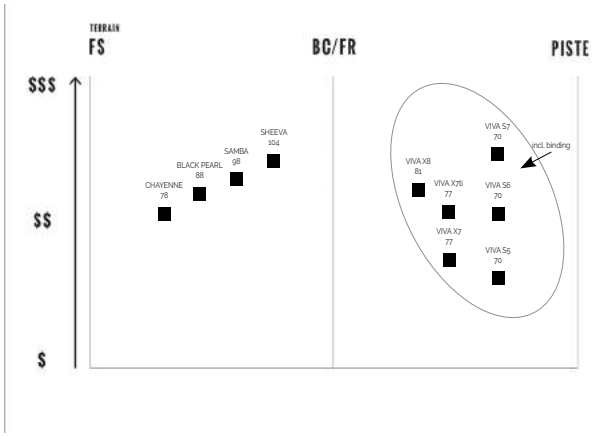
Lengths: 2 per model, ca 10 cm in between 169,179 Navis

Radius: 17-19

Pintail: 12-15mm

Semicap

Blizzard



Blizzard

No carbon for girls!

Less girly

Bamboo with poplar, paulownia, ISO-foam

Waist: 78, 88, 98, 104

Lengths: 4 per model,

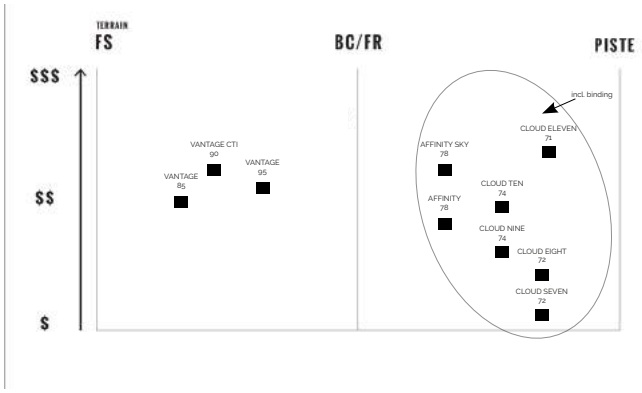
Weigth: 1400-1780

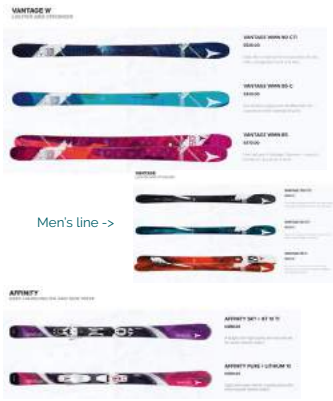
Radius: 17-19

Pintail: 15mm (10 Sheeva)

Full sidewall/small semicap

Atomic





Atomic

Different wood core - lighter
Big pintail & short lengths

Poplar + Titanal + Carbon

Waist: 74, 78, 84 - 85, 90, 95 - 71, 72, 74

Lengths: 3 per model,

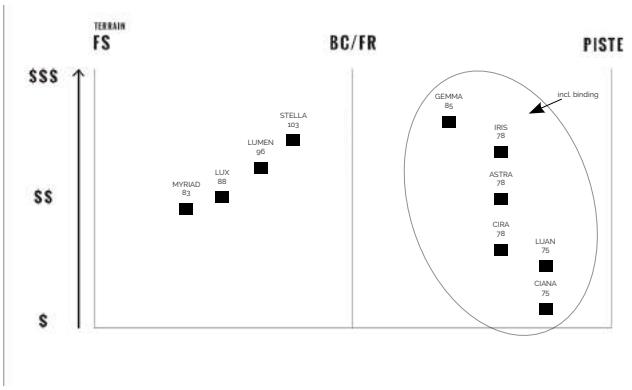
Weigth: 1600g

Radius: 11-17

Pintail: 15-17mm

Full sidewall/partial sidewall

Salomon



Salomon

On the women page on the website they have both women specific plus the others/mens - on mens page only the others/mens.

Same construction, smaller waist

Wood core

Waist: 83, 88, 96, 103

Lengths: 3 per model,

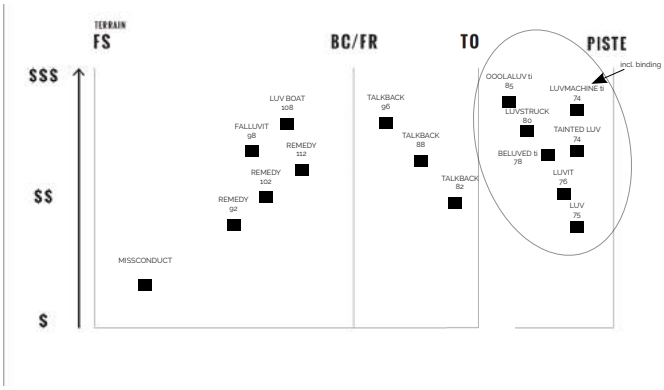
Weigth: 1400-1800g

Radius: 10-18, 23

Pintail: 8 (stella), 14-16mm

Partial sidewall

K2



Touring skis for women
Balsa/Flax

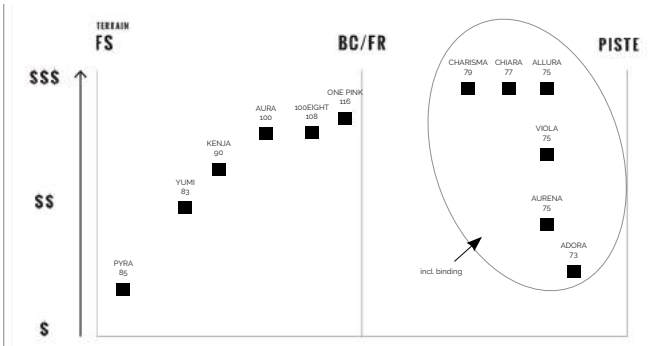
Metal laminate, a thin stripe of metal through the ski
Channel light core

Uses Balsa/Flax + 1000g/ski!

Calls it ECOre

Bioflex: Aspen + Paulownia + Bamboo
Balsa/Flax
Waist: 98, 108 (82, 88, 96)
Lengths: 3 per model,
163, 170, 177 (up to 170 for Talkback)
Radius: 17,5 18,5
Pintail: 12mm
Partial sidewall/semicap

Völkl



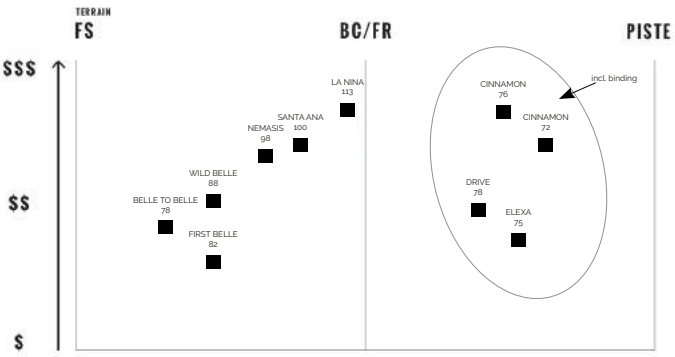
Same ski - same lengths (+186 on men's)

Very pink!

Skipped the high tech models

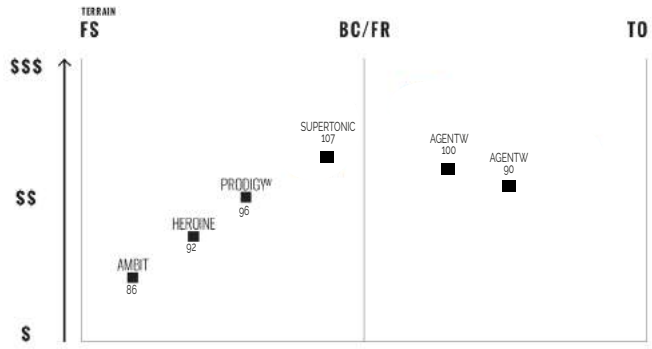
Wood core
Waist: 83, 90, 100, 108, 116
Lengths: 3-4 per model,
Radius: 14-19 (23 ONE)
Pintail: very different, 7-17
Semicap

Nordica



Balsa
Waist: 100, 113
Lengths: 4 per model,
Weigth: 1400-1800g
Radius: 13-18
Pintail: 11mm
Full sideall/semicap

Same but with balsa, wide waist



Faction

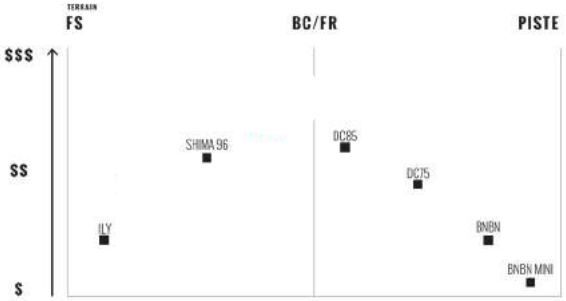
Freestyle & touring
Smaller pintail
Long lengths and many lengths
Compares to Foundation series for men (+escape)

Poplar/Ash & Balsa
Waist: 86, 92, 107, 92, 102
Lengths: 5 per model.
Weigth: 1540g (ST)
Radius: 15-20
Pintail: 10-11mm

Roxy

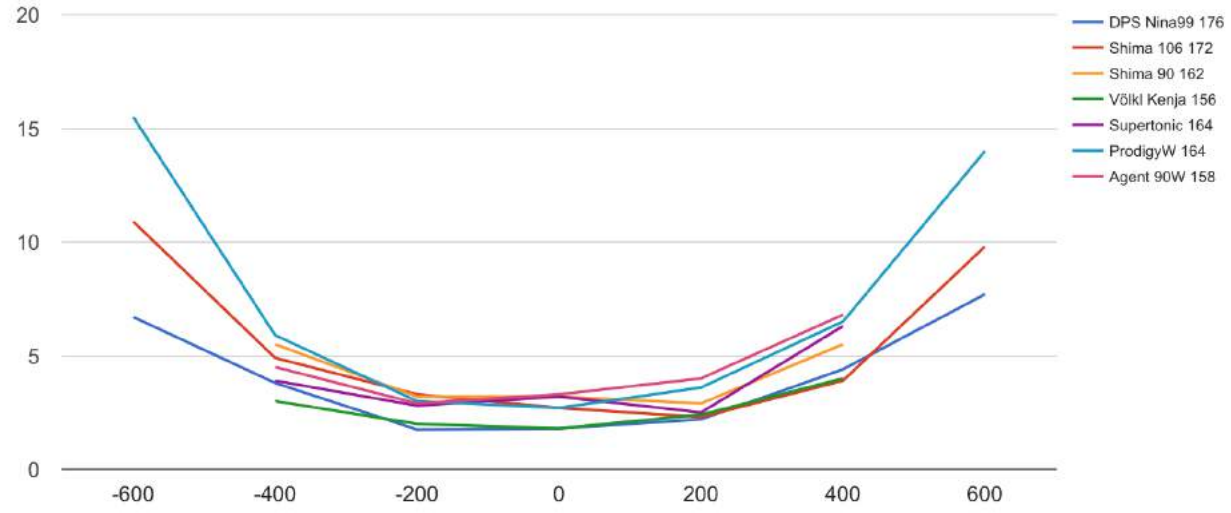
Double radiuses, small waist

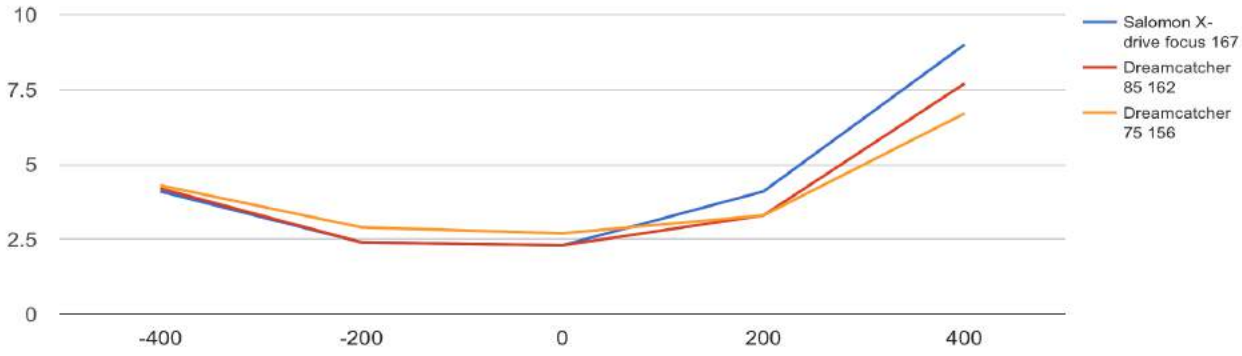
Similar to many other brands

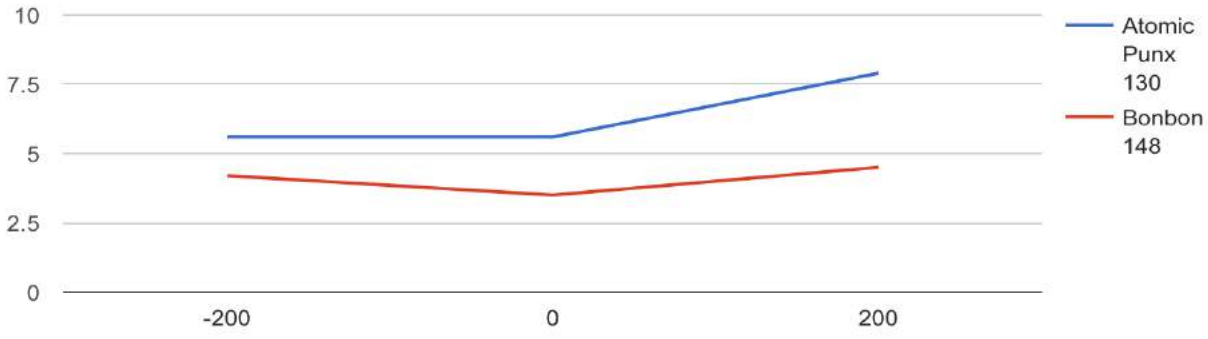


Poplar/Ash/Beech
Waist: (66), 72, 78, 82, 85, 90
Lengths: 3-4 per model.
Weigth: 1300-1500g
Radius: Shima 2 radiuses,
Pintail: 12-16mm

Appendix4: Flex graphs







Appendix 5: Morphological charts

ProdW series												
	Today		Alt 1		Alt 2		Alt 3					
Width		**96**		**90**		**102**		106				
Material core	**Beech/Poplar**		Poulawnia		Balsa		Ash					
Radius	**14/16m**		**16/18m**			16		18				
Boot centre		46,1-46,3%		47**%**		46,8**%**		**46,6 %**				
Sidewall/cap	Sidewall		Fullcap		**Semicap**							
Flex tail to tip (to fit women flex profile)	15,5-5,9-3,0-2,7-3,6-6,5-14,0		15,5-5,9-3,0-2,7-3,8-6,8-15,0		14,0-5,7-3,0-2,7-3,6-6,5-14,0		**14,0-5,9-3,0-2,7-3,8-6,8-15,0**					
Rocker (tip height, tip length, tail length, tail height)	**60 360 350 40**		-		-		-					
Camber		1,5		**2**		1		2,5				
Lengths	5 lengths: 154, 158, 164, 168, 174		**4 lengths: 158, 164, 170, 176**		4 lengths: 156, 162, 168, 174		3 lengths: 158, 168, 178					
							More widths to chose from + another wide ski for advanced freeride skiers					
							Beech/Poplar gives stability and still answers to the skiers force - active material					
							Dual radiuses, different for different widths					
							Semicap - cheaper than full sidewall, still gives an exclusive impression					
							Adjusting the flex by making a softer flex in the front but keeping the same flex in the tail.					
							A bit more camber to make the ski more stable on hard snow					
							gives 2 lengths >=170					

Shima					
	Today	Alt 1	Alt 2	Alt 3	
Width	96	**90, 96, 102**	90, 96	96, 102	
Material core	**Beech/poplar**	Poulawnia	Ash	Balsa	
Radius	12-20m	**12-24m**	12-22m	14-22m	
Boot centre	45,8-46,3%	46,6%	47%	**46,8 %**	
Sidewall/cap	Sidewall	Fullcap	**Semicap**		
Flex tail to tip (to fit women flex profile)	10,9 4,9 3,3 2,7 2,3 3,9 9,8	9,8 3,9 2,3 2,7 3,3 4,9 10,9	**8,9 4,3 2,5 2,7 3,4 4,9 11,8**		
Rocker (tip height, tip length, tail length, tail height)	**60 350 250 35**	60 320 210 35	60 300 250 40		
Camber	**1,5**	2	1	2,5	
Lengths	5 lengths: 154, 158, 164, 168, 174	**5 lengths: 154-178**	4 lengths: 154-178	3 lengths: 158-178	
				More widths to chose from + different types of skiing	
				Beech/poplar as before	
				Adding longer radius for wider ski	
				Moving the mounting point forward	
				Semicap - cheaper than full sidewall, still gives an exclusive impression	
				Change flex to more soft in the front and stiffer in the back	
				Keep rocker profile from before	
				Changing lengths to add 178cm	

Dreamcatcher					
	Today	Alt 1	Alt 2	Alt 3	
Width	75, 85	**72, 78, 88**	72, 85	75, 88	
Material core	**Birch/poplar**	**Polyfly**	Ash	Beech	
Radius	10-14m	**10-16m**	12-18m	10-18m	
Boot centre	45,8-46,3%	46,6%	47%	**46,8 %**	
Sidewall/cap	Sidewall	Fullcap	**Semicap**		
Flex tail to tip (to fit women flex profile)	4.2 2.4 2.3 3.3 7.7	**4.1 2.4 2.3 4.1 9**			
Rocker (tip height, tip length, tail length, tail height)	60 280 70 10	**50 240 110 15**	60 300 100 15		
Camber	**5**	3	**7**	6	
Lengths	**3&4 lengths: 154, 162, 172 / 142 150 158 166**	3&4 lengths: 142-172	4 lengths: 148, 156, 164, 172	5 lengths: 142-166	
				More widths to chose from + different types of skiing. Adding wider models.	
				Beech/poplar as before	
				Adding longer radius for wider ski	
				Moving the mounting point forward	
				Semicap/fullcap	
				Change flex to more soft in the front and stiffer in the back according to testing	
				Rocker profile adjusted to the result form the testing	
				Keeping lengths	
				More camber on the 72 and 78 (7mm), less on the 88 (5mm)	

EscapeW						
	Today (men version)	Alt 1	Alt 2	Alt 3		
Width	90, 98, 108, 118	90, 98	**90, 98, 108**	98, 108		
Material core	**Balsa**	Poulawnia	Ash	Poplar		
Radius	15-27m	14-24m	12-22m	**13-25m**		
Boot centre	44,7€%	45€%	**45,2 %**	45,7€%		
Sidewall/cap	Sidewall	Fullcap	**Semicap**			
Flex tail to tip (to fit women flex profile)	**5,2 2,7, 2,1 2 2,5 3,3 6,9**	-	-	-		
Rocker (tip height, tip length, tail length, tail height)	60 400 400 20	**60 360 380 20**	65 380 400 15			
Camber	**2**	1,5	1	2,5		
Lengths	**4 lengths: 158, 166, 174, 182**	5 lengths: 158, 166, 172, 178, 184	4 lengths: 158, 168, 174, 180	3 lengths: 158, 168, 178		
				Including widths from the men series but not 118, since it is very wide. Not necessary to make both men and women ski of it		
				Balsa for a lightweight ski		
				Shorter radiuses than for men but still with a wide range of radiuses for the different widths		
				Moving the mounting point 0,3% forward		
				Semicap - cheaper than full sidewall, still gives an exclusive impression		
				Keep flex since it corresponds well to the intended		
				Long low rocker in both front and tail. Very low in tail - flat tail		
				Only four lengths from short to long		

Supertonic series				
	Today	Alt 1	Alt 2	Alt 3
Width	107	**102**	**108**	98
Material core	**Balsa**	Poulawnia	Beech	Poplar
Radius	15-20m	16-22m	14-18m	**14-22m**
Boot centre	46%	47%	46,8%	**46,5 %**
Sidewall/cap	Sidewall	Fullcap	**Semicap**	
Flex tail to tip (to fit women flex profile)	3,9 2,8 3,2 2,5 6,3	3,9 2,7 3,2 3,0 6,3	**3,9 2,6 3,2 3,5 6,3**	3,9 3,0 2,8 3,4 6,3
Rocker (tip height, tip length, tail length, tail height)	**-**	**70 320 310 65**	-	-
Camber	**2**	1,5	1	2,5
Lengths	4 lengths: 158, 164, 174, 182	4 lengths: 158, 164, 170, 176	**4 lengths: 158, 166, 174, 182**	3 lengths: 158, 168, 178
				More widths to chose from, adjusted widths to fit CT 3.0 mould
				Balsa gives a more lightweight ski
				Longer radiuses for the 108 waist and shorter for 102 waist
				Moving the mounting point 0,5% forward
				Semicap - cheaper than full sidewall, still gives an exclusive impression
				Adjusting the flex by making a softer flex in the front but keeping the same flex in the tail.
				Rocker according to CT 3.0