PERCEIVED SAFETY AMONG OFF-PISTE & BACKCOUNTRY SKIERS

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# Abstrakt (Norwegian)

Å overleve i skredfarlig terreng handler om å være på rett plass til rett tid, altså ta gode avgjørelser i forhold til skredfaren. Psykologisk forskning har vist at følelser som frykt og trygghet (fravær av frykt) er med på å gi valgene våre retning. Opplevelsen av trygghet antas derfor å være en viktig del av den menneskelige faktoren i snøskredulykker. Få studier har undersøkt skikjørernes egen opplevelse av sikkerhet. Dette studiet tok sikte på å utvikle et instrument for å måle opplevd sikkerhet hos skikjørere som kjører utenfor løypene (off-piste & backcountry). Basert på fokusgruppeintervju med skikjørere ble det utviklet et spørreskjema som ble distribuert elektronisk til skikjørere i hele Norge. Ved hjelp av faktoranalyse av resultatene ble faktorene *Perceived Exposure, Collective Safety, Safe Objects, Knowledge & Skills og Experience* identifisert og tilfredsstillende psykometriske egenskaper påvist. Funnene blir diskutert i lys av kunnskap tilegnet gjennom fokusgrupper og en gjennomgang av relevant litteratur.

*Keywords:* perceived safety, human factor, avalanche risk, off-piste skiing, backcountry skiing, risk-taking, heuristics.

Perceived safety among off-piste & backcountry skiers

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## Abstract

Survival in avalanche terrain is about being in the right place at the right time, i.e. taking the right decisions regarding avalanche danger. Psychological research has shown that emotions like fear and safety (absence of fear) influence our decisions. Perceived safety might therefore be an important part of the human factor in avalanche accidents. Few studies have examined perceived safety from a skier`s perspective. The aim of this study was to develop a scale for assessing perceived safety among off-piste and backcountry skiers. Based on focus group interviews with skiers, a survey was developed and distributed thru the internet to Norwegian skiers. Factor analysis of the results yielde the factors *Perceived Exposure, Collective Safety, Safe Objects, Knowledge & Skills and Experience*, all with satisfactory psychometric properties. Findings are discussed in the light of knowledge gained from the focus groups and from a literature review.

*Keywords:* perceived safety, human factor, avalanche danger, off-piste skiing, backcountry skiing, risk-taking, heuristics.

Perceived safety among off-piste & backcountry skiers

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## Preface

The idea of investigating perceived safety as a topic was first introduced at the University of Ulm in Germany by Professor Franz Porzsolt and his colleagues (Vangberg, 2008). By first looking closer at perceived safety in contexts as hospitals, schools and nursing homes, the idea grew in popularity and further included a great variety of areas like pharmacology, economy and engineering.

This study resulted from the author`s interest in issues on avalanche safety and the supervisors` experience and knowledge from an previous study on perceived safety (Vangberg, 2008). The combination resulted in this study on perceived safety among off-piste and backcountry skiers.

This study has been a joint venture between the student and his supervisors. The student collected the data and most of the literature, while the statistical analysis was done with some guidance from the supervisors. The entire study has been a close cooperation between the supervisors and the student with a reciprocal exchange of ideas.

This research study has created interest in local and national media, with interviews in papers, on radio and television. Authorities in the national snow science community have praised the initiative and called for a presentation of the study at the International Snow Science Workshop in Anchorage, Alaska in autumn 2012. Both focus group participants and survey respondents have expressed their enthusiasm for the study, finding participation as both interesting and worthwhile as a process of increasing awareness on human factors in this kind of recreational outdoor activities.

# Perceived safety among off-piste & backcountry skiers

"The literature and basic research shows avalanche accidents are not a terrain, weather, or snowpack problem; avalanche accidents are a human problem." (Atkins, 2000, p. 47)

Since 1972, more than two hundred people have been killed in avalanche accidents in Norway while pursuing backcountry recreational activities, i.e. more than five each year (NGI, 2001). Recently, the number of victims has further increased, with nine fatalities in 2009/2010 and ten in 2010/2011. So far in the winter season of 2012, avalanche accidents have already taken seven lives in Norway.

According to Landrø (2002) several avalanche accidents during the last couple of years have revealed a new type of behavior in the Norwegian mountains: ski and snowboarders who consciously seek adventure in steep snow-covered mountainsides. Accidents become inevitable for two reasons: first, avalanche hazards are impossible to predict with a hundred percent certainty, and second, avalanches can occur in any snow-covered slope that is steep enough (Landrø, 2002). Off-piste and backcountry skiers will therefore always be exposed to the risk of avalanches.

In 93 % of avalanche accidents, the victim or someone in his party triggered the avalanche (Tremper, 2008), a fact that highlights the human factors in avalanche accidents. Human factors can be defined as "the individual, team, client, organizational, and socio-political influences inherent in avalanche-related judgment and decision making" (Adams, 2005, p. 18).

In terms of avalanche danger, skiers and snowboarders can be regarded as one group, conducting two different types of travel: off-piste and backcountry skiing. Off-piste skiing is downhill skiing or snowboarding on unprepared and uncontrolled slopes outside, but close to ski areas, and access is primarily obtained by means of ski lifts and possibly short hikes to reach the top of the run (Haegeli, Falk, Brugger, Etter, & Boyd, 2011). In comparison, backcountry skiing is downhill skiing or snowboarding on unprepared and uncontrolled slopes away from ski areas where skiers or snowboarders reach slopes by their own power using climbing skins or snowshoes. Backcountry skiing by motorized vehicles (e.g. snowmobile or helicopter) are under strict regulation in Norway and therefore not common. For practical reasons, the type of skier and the activity of skiing will also include snowboarders and the activity of snowboarding in the present study.

**Previous work**

Human factors in avalanche accidents have been explored from a variety of perspectives, all trying to answer the overall question: “why do we get caught”? Observations of human error have made judgment and decision-making seen as the key to understand why we voluntarily put ourselves in danger of "the white death". Some themes covered are heuristic traps in recreational avalanche accidents (McCammon, 2004), amateur decision-making in avalanche terrain (Furman, Shooter, & Schumann, 2010; Haegeli, Haider, Longland, & Beardmore, 2010; McCammon & Haegeli, 2007), group dynamics and decision making (Bright, 2010), expert decision making (Adams, 2005; Stewart-Patterson, 2008) and risk perception (Eitzinger & Wiedemann, 2007). This study offers a new and promising perspective on human factors in avalanche accidents: perceived safety.

**Why focus on perceived safety?**

“Practically everything looks less important than safety”
(Maslow, 1943, p. 376).

Abraham Maslow proposed a need theory of motivation stating the feeling of safety as essential to all human beings (Maslow, 1943). Based on the assumption that people are driven by different needs, Maslow arranged these needs into a hierarchy and suggested that basic biological needs had to be fulfilled before moving on to the next step towards self-actualization. Maslow’s theory emphasizes the importance of safety, or at least the feeling of being safe (subjectively or objectively).

The human belief system of maximal avoidance of environmental risk was severely shaken when the “unsinkable” Titanic sunk in 1912 (Porzsolt, Killian, & Eisemann, 2007). As a catastrophe of modern times, this accident illustrates, more than any other, that there may be a tremendous difference between subjective and objective safety (Porzsolt et al., 2007). Three important types of information are provided by the Titanic- incident according to Vangberg (2008):

> Firstly, the subjective (perceived) safety not necessarily has to be in agreement with the objective (real) safety. Secondly, the example illustrates that the decisions we make will depend on subjective (perceived) rather than objective safety. Thirdly, subjective safety can influence objective safety. In the Titanic example the crew decided to take the more dangerous but faster polar route because they felt safe enough to accept this risk. This makes it

clear that the perceived safety is an indispensible determinant of human behavior that may induce both well-being and harm. (Vangberg, 2008, p. 18)

Since the avalanche danger never can be fully predicted, recreationists may perceive off-piste and backcountry skiing as safe, even when it in reality is not. Experiences without negative consequences in face of avalanche danger may fuel this impression, even if it was a coincidence that an avalanche was not triggered. Jumping with a parachute from an airplane describes an opposite situation, where the real safety is high, but the perceived safety is low (Porzsolt et al., 2007). Differences in safety measures between these two activities may highlight this paradox.

In applying Maslow´s hierarchy of needs (Maslow, 1943) to off-piste and backcountry skiers we can assume that fulfilling the basic physiological needs of food and sleep have to be achieved in order to be able to focus on safety. Safety in skiers' immediate environment may be determined by several factors, one of them being how they perceive their own safety. Skiers might perceive safety upon what they know about avalanches, their travelling skills, previous experience, trust in others or in their equipment, their group, and perceived exposure. Obviously, feeling safe is a prerequisite for recreational activities like skiing.

**The relationship between safety and risk**

Safety and risk are linked together both conceptually and pragmatically (Hollnagel, 2008). The conceptual link becomes obvious when comparing the definitions of the two concepts. Risk is often defined as the likelihood that something unwanted might happen. Safety on the other hand is defined as the absence of unwanted events, like risks. This reciprocity is reflected in the fact that safety, or lack of it, usually is measured by the number of unwanted events like accidents or incidents. A high level of safety is therefore equivalent to a lower occurrence of such events and therefore to a lower level of risk.

Until recently, our understanding of safety has been limited to the technical, real, i.e. objective safety since this has been the only measurable aspect of safety (Vangberg, 2008). Porzsolt, Polianski, Görgen, & Eisemann (2011) regard safety/security and risks as related topics, but belonging to different systems. By being located on a subjective and individual level closely linked to psychological systems, safety and security are different from risk. While risk can be measured and expressed in probabilities, safety and security cannot. A focus on perceived safety counters this challenge by focusing on the perceived and subjective experience of safety. With the use of psychometric instruments, the dimensions that influence perceived safety can be identified, and the degree of perceived safety can be quantified (Porzsolt et al., 2011).

Modern humans strive for avoiding risk on an individual basis by means of modern technology (Porzsolt et al., 2007). Examples from a skier´s perspective are high-tech avalanche airbags that reduce the likelihood of burial, rescue equipment like an avalanche beacon that speeds up the rescue process and highly advanced medical equipment like heart-starters that seemingly can reanimate people. As a consequence, people might have developed a more or less blind trust in these technological solutions, based on an illusion of control.

The concept of safety consists according to Porzsolt et al. (2007) of two constructs: the real (objective) safety and the perceived (subjective) safety. To fully understand the concept of safety, one has to look at these two components equally, taking into consideration that both aspects of safety constitute the basis of how we direct our behavior and make our decisions.

**Perceived safety and affect**

Perceived safety is directly influenced by affect thru the feeling of safety or the absence of fear. Affect has over the years been given a central role in dual-process theories of thinking, knowing, and information processing (Slovic, Finucane, Peters, & MacGregor, 2007). Dual-processes theories assume that people apprehend reality in two fundamentally different ways. These two processes are variously labeled intuitive, automatic, natural, nonverbal, narrative, and experiential, and the other analytical, deliberative, verbal, and rational (Epstein, 1994). One of the characteristics of the former, the experiential system is according to Slovic et al. (2007) its affective basis. Denoting analysis as important in some decision-making circumstances, they argue that reliance on affect and emotion is a quicker, easier, and more efficient way to navigate in a complex, uncertain, and sometimes dangerous world.

> Epstein (1994) gives affect a direct and primary role in motivating behavior: The experiential system is assumed to be intimately associated with the experience of affect, . . . which refer[s] to subtle feelings of which people are often unaware. When a person responds to an emotionally significant event . . . the experiential system automatically searches its memory banks for related events, including their emotional accompaniment. . . If the activated feelings

> are pleasant, they motivate actions and thoughts anticipated to reproduce the feelings. If the feelings are unpleasant, they motivate actions and thoughts anticipated to avoid the feelings (Epstein, 1994, p. 716).

Perceived safety might be one of these subtle feelings motivating behavior. For the skier the additional safety felt by wearing an avalanche airbag or by skiing with someone one trusts might be the sole factor deciding if one is to ski a particular slope or not. Old tracks or familiar terrain might also create the same feelings of safety, guiding us towards potential danger. In off-piste skiing the experiential system is kept busy by a ski lift, continuously putting us in new situations demanding rapid decisions regarding the avalanche danger. Backcountry skiing has in contrast the advantage of time to make good decisions on our way up, at least if one travels non-mechanically.

**The somatic marker hypothesis.** A well-known account of the role of affect in decision making is presented by the neurologist, Antonio Damasio (1994), in his book *Descartes' Error: Emotion, Reason, and the Human Brain*. Seeking to determine what in the brain allowed humans to behave rationally, Damasio (1994) argued that thought is made largely from images, broadly construed to include sounds, smells, real or imagined visual impressions, ideas, and words. Through a lifetime history of learning these images become ''marked'' by positive and negative feelings linked directly or indirectly to somatic or bodily states: ''In short, somatic markers are . . . feelings generated from secondary emotions. These emotions and feelings have been connected, by learning, to predicted future outcomes of certain scenarios'' (Damasio, 1994, p. 174).

When a negative somatic marker is linked to an image of a future outcome, an alarm goes of (Slovic et al., 2007). For a skier this somatic marker could be experienced as a "negative feeling of fear", linked to an image of oneself being caught in an avalanche. On the other hand, when a positive marker is associated with the outcome image, it can become the green light that says "go". A "positive marker" can, for a skier, be linked to an outcome image of unworried skiing in a safe place. The somatic marker hypothesis might therefore be valuable for understanding the underlying mechanisms of perceived safety and their influence in decision-making.

In short, the somatic marker hypothesis proposes that images, marked by positive and negative affective feelings, guide judgment and decision-making. By developing this idea further, Slovic et al. (2007) have suggested that people use an affect heuristic to make judgments:

> … representations of objects and events in people's minds are tagged to varying degrees with affect. In the process of making a judgment or decision, people consult or refer to a ''affect pool'' containing all the positive and negative tags consciously or unconsciously associated with the representations. Just as imaginability, memorability, and similarity serve as cues for probability, judgments (e.g., the availability and representativeness heuristics), affect may serve as a cue for many important judgments (Slovic et al., 2007, p. 1335).

Dual process theories, the somatic marker hypothesis and the affect heuristic all point to our feelings playing a central role in decision-making. Perceived Safety fits this trend with its emphasis on the subjective feeling of safety.

**Perceived safety and heuristics**

The majority of avalanches catching people are triggered by people (Fredston, Fesler, & Tremper, 1994; D. McClung & Schaerer, 2006; Tremper, 2008). This striking phenomenon has lead to speculations of avalanche victims tending to make critical decisions based on human desires, assumptions and the use of heuristics, rather than on the integration of key elements of physical data (Fredston et al., 1994; McCammon, 2004). While some avalanche accidents might be the result of people not recognizing the potential hazard, most accidents occur according to Fredston and colleagues (1994) when the victims either underestimate the hazard or overestimate their ability to deal with it. Another suggestion is that people are misled by unconscious heuristics, or rules of thumb, that guide most of our decisions in everyday life (McCammon, 2004).

**Heuristics.** In their seminal study *Judgment under Uncertainty: Heuristics and Biases (1974),* Tversky and Kahneman demonstrated how boundedly rational individuals employ heuristics such as *availability, representativeness,* and *anchoring and adjustment* to make judgments. Kahneman defines a heuristic as "a simple procedure that helps find adequate, though often imperfect, answers to difficult questions" (Kahneman, 2011, p. 98). Heuristics, Kahneman suggests, work by the process of *substitution*, that is, when a difficult question cannot be answered quickly, we automatically find a related question that is easier to answer (Kahneman, 2011). Substituting one question for another can be an adequate strategy when faced with difficult problems if this is a deliberate choice. It becomes problematic when heuristics are not chosen, but become a consequence of the “mental shotgun”, the imprecise control we have over targeting our responses to questions (Kahneman, 2011).

Heuristics are in general both useful and effective but can sometimes lead to severe and systematic errors. Avalanches present according to McCammon (2004) a unique hazard that renders some of our heuristics irrelevant, and in some cases dangerous as they can lead us into what is called a heuristic trap by producing a grossly inaccurate perception of a hazard. When considering skiing a slope, the key question should be: what is the avalanche danger in this particular slope? When faced with the overwhelming amount of uncertainty in avalanche risk assessment, the process of *substitution* would suggest that we answer a simpler question to make the decision: does it feel safe?

In his article *Heuristic Traps in Recreational Avalanche Accidents: Evidence and Implications*, McCammon (2004) examined the existence of heuristics in avalanche accidents by reviewing 715 recreational accidents that took place in the United States between 1972 and 2003. These investigations lead McCammon to suggest the following heuristics to be influential among skiers: *familiarity, consistency, acceptance, the expert halo, social facilitation* and *scarcity*. McCammons findings were later tested by Furman et al. (2010) who found five factors influencing the decision to ski a particular slope (McCammons heuristics in brackets): (a) that a slope is untracked (*scarcity)*, (b) whether skiers were familiar with the slope (*familiarity)*, (c) that there was a leader in the group (*the expert halo heuristic)*, (d) that there were other skiing parties present (*social facilitation)*, and (e) that the skier was committed to skiing a particular slope (*commitment)*. We argue that at least three of the suggested heuristics: familiarity, the expert halo heuristic, and social facilitation are the results of perceived safety.

**The familiarity heuristic.** The familiarity heuristic relies on the use of past actions to guide behavior in a familiar environment (McCammon, 2004). The familiarity heuristic is mostly reliable, but when the hazard changes and the setting remains familiar, McCammon points to a potential trap. The positive reward associated with skiing a particular slope without negative consequences yields an association between the slope and a positive outcome. According to the previously mentioned *somatic marker hypothesis* (Damasio, 1994), this association has influence on future decisions under similar circumstances, that is, feeling safe in a familiar place. Familiarity might also be related to habituation, where individuals repeat past behavior out of habit (Furman et al., 2010). Support for the familiarity heuristic has been provided by McCammon (2004) who found a significant increase in exposure scores for all groups in a familiar terrain, and the effect was most pronounced in parties with the highest level of training. The familiarity heuristic also gets support from Furman et al. (2010) who found familiarity with a slope to be positively related to the likelihood of skiing a slope. Perceived safety related to familiarity would expand the foundation of the familiarity heuristic.

**The expert halo heuristic.** Skiers mostly travel in groups. The need for leadership in these groups often produces informal leaders who, for various reasons, end up making critical decisions for the party. This leadership can be based on knowledge and experience in avalanche terrain. However, sometimes it is simply based on being older, a better rider, or more assertive than other group members (McCammon, 2004).

The *halo effect* is according to Kahneman (2011) "the sense we often get that we know and understand a person about whom we actually know very little" *(p. 114).* According to McCammon (2004), the *expert halo heuristic* may influence party members to ascribe avalanche skills to a person, that the person may not have. With the application of Kahneman`s theory of substitution, the expert halo heuristic then may lead group members to substitute the target question of avalanche risk into a heuristic based on trust in the leader. Skiing accidents have also been suggested to be more likely when a group fails to rely on its own judgment by abandoning decision making in general to a leader (McCammon, 2004). This heuristic may also be a product of groupthink: that cohesive groups make decisions without critically scrutinizing them (Furman et al., 2010). An important prerequisite for the expert halo effect might also be perceived safety, i.e. that the expert makes us feel safe.

**The social facilitation heuristic.** The social facilitation heuristic is based on the assumption that we are more likely to take risks in the presence of others. McCammon (2004) operationalized social facilitation as whether or not skiers encountered other parties while in the backcountry and found that parties that had met others exposed themselves to significantly more hazards than parties who had met nobody. This finding is supported by Furman et al. (2010), who found encountering other parties was positively related to the likelihood to skiing a slope.

An important prerequisite for social facilitation might also be perceived safety, i.e. feeling safe amongst other people.

Animal studies have documented that individuals visually scan for predators less frequently when in the safety of larger groups (Bednekoff & Lima, 1998), indicating that group size affects how animals perceive safety. Humans are thought to be susceptible to the same effect, called “safety in numbers”, i.e., we feel safer in large groups. This hypothesis is based on the assumption of being less likely to be the victim of an accident when being part of a large group, or in the proximity of others. Assuming safety in numbers is dangerous to skiers, as exemplified by accidents where entire parties of skiers got caught in the same avalanche. This was recently the case in Kåfjord, Northern Norway, where five people in a group of six were killed when the entire party was caught in an avalanche in March 2012.

Whilst heuristic traps and perceived safety might describe the foundation of our decisions, risk compensation theory is about how all this might influence our behavior.

**Risk compensation theory**

The use of avalanche airbags to prevent burial and avalanche beacons to speed up the location of buried avalanche victims have proven to reduce mortality significantly (Haegeli et al., 2011). In their study, the relative risk of being killed was reduced by 91% by the use of an avalanche airbag. The analysis showed also that in 20% of avalanche accidents where an airbag was worn, the balloons did not inflate, due to technical failure or because the user was unable to activate the airbag by pulling the string (Haegeli et al., 2011). The reliability of an avalanche airbag is therefore questionable and should not be included as a protective factor in risk assessment. A theory that acknowledges this danger is the Risk Compensation Theory (Hedlund, 2000) hypothesizing that safety measures can influence our behavior, making us use up the additional safety through more risky actions:

> Risk compensation can occur —people are not machines. We all change our behavior in response to changes in our environment. Safety measures change our environment, so we may change our behavior in response to them. Many rational and behavioral factors influence whether and how our behavior will change. Never assume that behavior will not change. (Hedlund, 2000, p. 88)

According to Hedlund (2000) four factors influence risk compensation: visibility, effect, motivation, and control. Hedlund helpfully sets out four rules for judging the circumstances in which behavior might or might not change in terms of risk compensation. First, ”If I don't know it's there, I won't compensate for a safety measure.” An avalanche airbag fails this test. Secondly; “If it doesn't affect me, I won't compensate for a safety measure.” A confirmation of the item “ I feel safer with an avalanche airbag than without” could indicate that it does affect us and that compensation is likely to occur. Thirdly: “If I have no reason to change my behavior, I won't compensate for a safety measure.” Many factors could serve as a motivation for skiing in avalanche terrain, e.g. powder skiing. Fourthly:” If my behavior is tightly controlled, I won't compensate for a safety measure.” Off-piste and back-country skiing are activities with a considerable freedom to compensate.

Hedlund (2000) also warns against injury prevention measures that promise more benefits than they deliver, due to bad science, political pressures, or failure to consider risk compensation or system effects. One advertisement for avalanche airbags reported a 97% survival rate for those who managed to activate their airbag. This unduly optimistic prediction qualifies for a warning.

An individual may be both producers and/or consumers of safety (Porzsolt et al., 2011). Skiers can try to avoid high-risk terrain and buy safety equipment, but external hazard like an avalanche cannot always be controlled. To buy safety thru expensive equipment may therefore be an effort to take control over the hazard.

**Locus of control**

How skiers perceive their own ability to avoid danger might also depend on how they perceive situational control in avoidance and handling of accidents. The concept of locus of control describes a person's perception of responsibility for the events in his or her life (Rotter, 1966). Locus of control thereby refers to whether people tend to attribute that responsibility internally, within themselves, or externally, to luck, fate, chance or other people. Internal locus of control refers to the expectancy that the individual has control over events in the environment. For skiers, a reliance on internal factors like knowledge and skills could indicate an internal locus of control influencing the perception of safety. A reliance on a guide or experienced others could on the other side indicate that the perceived safety is influenced by an external locus of control. Other personality traits might influence perceived safety as well.

**Personality traits**

McClung (2002) argued that personality traits influence decision making in avalanche terrain and identified risk propensity as such a personality trait. To investigate the role of risk propensity Furman et al. (2010) used the Stimulating Risk Inventory (SRI) (Zaleskiewicz, 2001) in an effort to account for the influence of the participants trait level perception of risk on decision making. The SRI is a ten item, trait-based measure of risk-taking tendency aimed at providing indicators of a person`s tendency to take risks. The SRI is part of a two dimensional measure known as the Stimulation-Instrumental Risk Inventory (SIRI), which was developed to measure dual-process decision making (rational and intuitive)(Zaleskiewicz, 2001). The SRI scale centers on stimulating risk-taking, e.g. like the risk one might encounter while skiing in avalanche terrain. Furman et al. (2010) selected the SRI for its foundation in heuristic-based decision making, ease of administration, and because it was related to the preference for recreational risks. The SRI is assumed to be associated with personality features connected with paratelic orientation, arousal seeking, impulsivity, and strong sensation seeking according to Zaleskiewicz (2001). Two examples from the SRI are as follows: “I am attracted by different dangerous activities.” and “I make risky decisions without an unnecessary waste of time.” Furman et al. (2010) found that a measure on risk-taking propensity was positively related to the decision to ski a slope, indicating that this factor was important in the decision-making process. To explore the relationship between risk taking propensity and the perception of safety, we chose to include both dimensions of the SIRI in this study. The Instrumental Risk-taking Inventory (IRI) constitutes the second part of the Stimulation-Instrumental Risk Inventory (SIRI) (Zaleskiewicz, 2001). IRI is a seven item trait-based measure of risk-taking tendency, aimed to provide indicators of respondents’ own tendency to take risks to make an achievement.

A person who takes instrumental risk to reach some future profit strives, according to Zaleskiewicz (2001), for “controlling the environment to avoid the possibility of engaging in an activity whose outcome depend mainly on chance. Consistently, an instrumental decision maker deliberates more the kind of possible consequences, analyses the probabilities and concentrates on negative outcomes.” Instrumental risk taking is therefore assumed to be more achievement oriented, based on a more complex way of information processing and the use of cognitive clues (Zaleskiewicz, 2001). Climbing a steep and impressive mountain or skiing a particular slope under moderate avalanche danger certainly demands instrumental risk-taking.

According to dual process theory mentioned earlier, the use of cognitive clues might indicate that instrumental risk-taking works by analytical, deliberative, verbal, and rational processes (Epstein, 1994). Stimulating risk-taking on the other hand is presented as a more rapid, effortless and even automatic behavior (Zaleskiewicz, 2001) indicating intuitive, automatic, natural and experiential processes (Epstein, 1994). The possible presence of both forms of risk-taking made us include both IRI and SRI in our study.

**Aim**

The aim of this study was to develop an instrument for assessing perceived safety among off-piste and backcountry skiers. By means of such an instrument human factors in avalanche accidents could hopefully be studied in a more precise manner pointing towards areas of interest in understanding and prevention of future accidents.

## Method

This study consists of three parts: a literature review, focus group interviews and an electronic survey. The literature review and the focus groups were both conducted with the purpose of item generation for an assessment tool to be used for the electronic survey.

### Literature review

A literature review failed to uncover any existing literature on perceived safety among off-piste and backcountry skiers. Different databases were scrutinized for relevant literature, i.e. Psych Info, MedLine, ERIC, ISI web of knowledge, the local university library, historical articles and books. Examples of search terms were "safety in skiing, perceived safety off-piste, avalanche safety, avalanche risk, skiing risk, perceived safety, backcountry skiing, dangers in skiing, natural hazards and safety, recreational activity and safety." The researcher obtained an overview of the problem by the literature review and participation in the National Avalanche Conference held in Tromsø in November 2011.

### Focus groups

A focus group brings together a small group of participants to discuss a topic of interest. Focus groups provide a different perspective on the research problem compared to individual interviews (Palys, 2003). By using focus groups, the goal is to uncover factors relating to complex behavior or motivations and to generate an understanding of complicated topics (Krueger, 1994). Focus groups also provide insights into the attitudes, perceptions and opinions of the participants (Adams, 2005).

Focus groups are particularly useful for exploratory research, where preliminary findings can be presented to the focus group for further consideration and discussion (Palys, 2003). In this way, opinions and themes derived from individual surveys or case studies are placed on the table for discussion and extensive group interaction (Adams, 2005).

**Participants.** Participants for the focus groups were recruited by *snowball sampling* and were all experienced skiers living in Tromsø in the North of Norway. An inquiry was sent to the participants (N=12) by email during December 2011 for the focus group meetings to be held in January 2012. Information about the study was given both orally and in writing, and all participants signed a consent form declaring their voluntary participation. The form also highlighted their right to leave the focus group at any time and informed the participants that the interview would be tape-recorded for further analysis. Recording also made it possible for the researcher to focus on the moderation and observation of the discussion without getting distracted by taking notes. There were three focus groups consisting of 3, 4 and 5 participants, respectively. All interviews were held in comfortable chairs in a round table setting with coffee and cakes at the Department of Psychology at the University of Tromsø, Norway.

**Procedure.** Three focus groups with a total of 12 skiers were held to identify main topics for item generation. The focus groups lasted between two and two and half hours, depending on the talkativeness of the participants. An interview guide had been prepared in advance to provide the moderator with guidelines when conducting the focus group. In order to create this guide the researcher had reviewed the scientific literature, had several discussions with avalanche safety specialists and participated in the National Avalanche Conference held in Tromsø November 2011. These sources were used to generate ideas and reflections on where to look for areas of interest concerning perceived safety.

**Electronic survey**

**Participants.** The survey respondents lived all over Norway, as shown by their postal codes. The largest group lived in northern Norway (Nordland and Troms county). The mean age of responders was 32 years (SD = 8.81). Only 25% of the responders were female (N=418). The proportion of respondents with own children was 31,6%. The sample was highly educated in avalanche safety (Figure 2, Appendix -B). The sample was also very well academically educated compared to the general population, with 75% of the respondents having completed 3 years or more of higher education (university/ college) compared to 27,8% in the general Norwegian population (SSB, 2010). In more detail, 41% had completed more than 4 years of studies on a higher educational level (university/ college), 34% had completed up to and including 3 years of tertiary education, 23 % had completed high school, and 1% secondary school. The samples means of travel are described in figure 4 (Appendix – B). More than 71% knew someone who had been caught by an avalanche and 17,5% confirmed that they had been caught themselves. 40,5% had triggered an avalanche and 73,5% had observed an avalanche being triggered. Equipment usage in the sample population is described in Figure 3, Appendix –B. As concerns avalanche forecasts, 52,4% confirmed that there is an avalanche forecast available in the area they ski the most. Only a couple of weeks prior to the survey was released, a beta version of regional avalanche forecasts was made available by a state authority on the internet at *varsom.no*, covering most of the high-traffic areas in Norway. Since this service was brand-new, it is unlikely that all responders knew if there was an avalanche forecast covering their area.

**Procedure.** After completing the focus group interviews, the recordings were reviewed and aspects concerning safety extracted. The important safety-related issues were then phrased into 127 items. Due to redundancy and irrelevance the number of items was reduced to 54 items before being compiled into the scale. Forty-one items on background information like demographics, experience, equipment and a rating of feared events were included, as well (see Appendix). In addition, the survey contained our Norwegian version of the 17 item Stimulating-Instrumental Risk Inventory (Zaleskiewicz, 2001).

The validity and logic of the scale was tested with the help of experienced skiers. Changes to the items were made accordingly, and the survey was finalized for distribution with a total of 127 items (see Appendix C).

The electronic survey was distributed and data collected by means of the online survey tool *Questback*. A link to this survey was distributed by email, Internet sites like *friflyt.no, utemagasinet.no, snoskred.no, snøskredvarsel.no,* and by *facebook.com*. Together with the link for the survey a short general presentation of the study was enclosed. The participants could win an avalanche airbag.

Statements concerning perceived safety and SIRI were answered by ticking one alternative on a five-point Likert scale ranging from “totally disagree” to “totally agree”. To complete the survey, no answers could be skipped yielding an extremely low amount of missing items.

**Statistics.** To decide if factor analysis was possible with the sample at hand, general guidelines were considered. A common rule recommends at least 10-15 participants per item to ensure reliability in factor analysis (Field, 2009). Costello & Osborne (2005) found that only 18,4% in a sample of published factor analysis had a subject to item ratio of >20:1. With N=1663 and 54 variables, our measure of perceived safety gave an item/subject ratio of 30:1. Our ratio should therefore be in the range for a “large-sample” procedure like EFA, where generalizable or replicable results are unlikely if the sample is too small (Costello & Osborne, 2005).

A principal component analysis with Varimax rotation and Kaiser Normalization was conducted. The inter-item correlation was inspected by visually scanning the correlation matrix to check for redundant items. A parallel analysis was conducted to assist factor extraction. The Kolmogorov-Smirnov test of normal distribution was used to see if the variables were normally distributed. Spearman's correlation coefficients were calculated to test relationships between variables and Cronbach alpha ($\alpha$) to check the internal consistency.

## Results

### Sampling

More than 1100 responses were collected during the first 24 hours. After another two weeks a total of 1715 responses had been returned. Due to missing items and error 14 responses had to be discarded. Since the instrument was aimed at an adult population, all respondents under the age of 18 years were removed. This left us with a sample of N=1663.

### Analysis

A Principal Component Factor Analysis (PCA) of all items (N=54) with an orthogonal (Varimax) rotation to simplify structure was conducted using SPSS (Version 19). A Varimax rotation was chosen based on a visual inspection of the correlation matrix, showing low correlations, indicating that the components was not related. The sampling adequacy was verified by a Kaiser-Meyer-Olkin measure, KMO= .88 ("great" according to Field (2009)), and all KMO values for individual items were >.662, which is well above the accepted limit of .5 (Field, 2009) Bartlett's test of sphericity $\chi^2$ (1431) = 22370.934, p< .001 indicated that correlations between items were significantly strong for PCA. The number of factors to retain for further analysis was determined by inspection of the scree plot (Figure 1. Appendix-A). An inspection indicated an "elbow" at both five and nine factors. A parallel analysis supported the use of eight or fewer factors and cumulative percentage of explained variance indicated that if eight factors were extracted these would explain 44,0% of the variance. In comparison, extracting five factors only would explain 33,9% of the variance.

PCA was conducted with the limitations of 5 and 8 factors. Due to low $\alpha$, many cross-loadings and limited real life logic and relevance on several of the factors in the fixed 8 factor rotation, a limitation of 5 factors was chosen. Items loading <.40 were excluded, and a new PCA was run on the remaining items. Negatively correlating factors were reversed to fit the content of the factors and resulted in improved Cronbach $\alpha$ coefficients. Due to a very low $\alpha$-level and no real life logic or relevance another item was removed, requiring a new PCA. The factor loadings of the final factor analysis are presented in table 1 (Appendix A). This last analysis provided a Kaiser-Maier-Olkin criterion, KMO= .880 ("great" according to

Field (2009)), and Bartlett's test of sphericity $\chi^2$ (630) =15567.617, p< .001. The cumulative variance explained in the final five-factor model totalled to 42,3%.

The five factors identified in the final analysis were: *Perceived Exposure, Collective Safety, Safe Objects, Knowledge & Skills* and *Experience (Table 1. Appendix-A).* This factor structure yielded a scale consisting of 35 items in total.

**Factor 1.** *Perceived Exposure* emerged as the strongest factor explaining 18,5% of the variance and a Cronbach α .77 (seven items). Following are some sample items from this factor, and the percentage of respondents who agreed or strongly agreed to the items: "I feel safer in slopes that I know are frequently skied" (58,8%), "I experience frequently skied mountains as safer" (56,3%), "Riding in the forest feels safer than riding in open mountain sides" (82,7%).

**Factor 2.** *Collective Safety* accounted for 8,7% of the variance with a Cronbach α .78 (6 items). The following are some sample items from this factor, and the percentage of respondents who agreed or strongly agreed to the items: "I feel safer when we are many hiking together" (75,2%), "Traveling collectively as a group feels safer" (68,1%), "I feel safer when hiking if there are others nearby" (64%).

**Factor 3.** *Safe Objects* accounted for 6,4% of the variance with a Cronbach α .71 (8 items). Following are some sample items from this factor, and the percentage of respondents who agreed or strongly agreed to the item: "I feel safer with an avalanche beacon than without" (86,1%), "Leaving my avalanche beacon can make me feel unsafe" (82,5%), "I feel safer carrying a shovel and a probe than without" (74,2%), "I feel safer with others I know have a lot of knowledge about avalanches" (95,6%), "I would have felt safer carrying an avalanche airbag" (78,6%), "I feel safer riding with a helmet than without" (85,9%), "I feel safer skiing or snowboarding with someone with more experience than myself" (73,4%), "When I follow someone I trust, I feel safe" (64,6%).

**Factor 4.** *Knowledge & Skills* accounted for 4% of the variance with a Cronbach α .69 (7 items). Following are some sample items from this factor, and the percentage of respondents who agreed or strongly agreed to the item: "I can use my safety equipment efficiently" (79,9%), "Increased knowledge has made me feel safer in terms of avalanche danger" (73,0%), "Weather history and knowledge about the snow conditions are vital for me to be able to feel safe" (87,5%), "Keeping distance to others increase security" (89,1%).

**Factor 5.** *Experience* accounted for 4,7% of the variance with a Cronbach α .66 (seven items). Following are some sample items from this factor, and the percentage of respondents who agreed or strongly agreed to the item: “I can feel unsafe in places I know there have been avalanches before” (87,8%), “Changes in weather and snow conditions can make me feel unsafe” (91,0%), “I more often feel unsafe in unknown terrain” (80,4%), “Observing that an avalanche has been triggered can make me feel unsafe” (73,8%), “I feel unsafe more easily when there is plenty of snow” (53,4%) “Increased knowledge and experience has made me more cautious regarding avalanches (86,8%), “I more easily feel unsafe when I have responsibility for others” (60,4%).

**Correlations.** The Kolmogorov-Smirnov normal distribution test showed a significance level of .000 for all factor scores, suggesting a violation of the assumption of normality and the use of a nonparametric test of correlation. Because the Likert scale produced ordinal variables, Spearman’s correlation coefficient was used. The relationship between the different factors and various items can be seen in table 2 (Appendix - A).

There was a strong positive correlation between *Perceived Exposure* and *Collective Safety (rho=.453, p<.01), Collective Safety* and *Safe Objects (rho=.500, p<.01)* and SRT and IRT *(rho=.412, p<.01).* Amount of Avalanche Education correlated moderately to *Perceived Exposure (rho=-.320, p<.01), Collective Safety (rho=-.343, p<.01)*, *Experience (rho=.338, p<.01)* and Number of backcountry trips per season *(rho=.387, p<.01).* Weak but significant correlations were also found between *Age* and *Perceived Exposure (rho=-.139, p<.01)*, *Collective Safety (rho=-.103, p<.01)*, *Safe Objects (rho=-.210, p<.01)* and *Knowledge & Skills (rho=.100, p<.01)*. The trait measures of risk propensity SRT and IRT, and the factors of perceived safety were significantly but only weakly correlated.

# Discussion

The aim of this study was to develop an instrument for assessment and exploration of perceived safety among off-piste and backcountry skiers.

All statements in our survey can be seen as heuristics concerning perceived safety. The high level of agreement indicates that these heuristics represent important aspects for perceived safety among skiers.

By factor analysis, five factors were identified representing the main items determining the perceived safety of off-piste and backcountry skiers. These factors were *Perceived Exposure, Collective Safety, Safe Objects, Knowledge & Skills and Experience*. These factors explain a notable proportion of the total variance, suggesting them as key factors in the forthcoming discussion and investigation of perceived safety. Instead of suggesting these factors as new heuristics in the debate about heuristic traps, it can be argued that all of them are under the influence of one single factor: perceived safety.

## Perceived Exposure

Items clustering in factor 1 all described situations and places that can be seen as more or less exposed to avalanche danger. Perceived exposure is an important factor concerning safety and an obvious prerequisite for feeling safe. One of the items in the factor *Perceived Exposure* is “I feel safer in slopes I know get skied frequently”. The idea that frequently skied slopes are safer is widespread and based on the fact that frequent skiing contributes to a stabilization of the snowpack. But frequent skiing makes no guarantee against avalanches, since weather conditions may change and previous skiers might not have loaded the slope sufficiently to trigger an avalanche (Landrø, 2002). To perceive frequently skied slopes as safe may therefore be a heuristic trap. This is also the case with experiencing frequently skied mountains as safer. As mentioned earlier, avalanches can occur in every snow-covered slope that is steep enough.

Respondents did not report feeling safer when skiing off-piste or in the proximity of a ski lift compared to backcountry. However, discussions in the focus groups suggested that this might be the case. Few of the experienced skiers admitted to take the same safety precautions when skiing off-piste compared to backcountry, pointing to a lack of time and opportunity to do personal evaluations of the avalanche danger when transported by a ski lift. If skiers are comfortable with fewer safety precautions when riding off-piste, this could indicate a higher degree of perceived safety. Few Norwegian ski lifts offer avalanche forecasts to their visitors, only general warnings. While an avalanche forecast has the potential to guide behavior thru its influence on perceived safety, general warnings tend to be ignored.

The majority also felt safer riding in the forest than in open mountainsides. While a high density of trees may have a stabilizing effect on the snow-pack and hamper avalanches, scattered trees on open slopes represent no protection against avalanches (D. McClung & Schaerer, 2006). Since only scattered forest is suitable for skiing, perceived safety while skiing in the forest also makes a potential heuristic trap. Perceived exposure therefore seems as an important part of perceived safety as acknowledged by these heuristics.

With the use of decision-making tools, heuristic traps can be replaced with sound heuristics, making perceived safety more in line with objective safety. But as the ongoing debate about the quality of some current tools indicates, faulty decision-making tools can also create a false sense of security (Uttl, Kisinger, Kibreab, & Uttl, 2009; Uttl et al., 2010).

**Collective Safety**

Items clustering in factor 3 described perceived safety as part of a group or in the proximity of others, and can be exemplified with the item "I feel safer when we are many hiking together". The survey respondents agreed moderately to this item, indicating its importance for perceived safety.

Animal studies have documented that individuals visually scan for predators less frequently when in the safety of larger groups (Bednekoff & Lima, 1998), indicating that group size affects how animals perceive safety. That skiers feel safer hiking many together could indicate that this effect also affects humans.

We also suggest that perceived safety might be an important prerequisite for the social facilitation heuristic mentioned previously. Perceived safety as a result of group size puts the skier at risk of heuristic traps, but also to group dynamics like conformity. *Collective Safety* showed a negative correlation with age, the amount of avalanche education and the number of backcountry trips per season. This finding is in accordance with the observation from the focus group interviews that older, more educated and experienced skiers avoid large groups due to safety measures because of their susceptibility of group dynamics.

## Safe Objects

The *Safe Objects* factor-clustered statements on perceived safety related to safety equipment and towards trusted people. “I feel safer with an avalanche beacon than without” concerns perceived safety related to the use of safety equipment. Avalanche beacons have been proven to increase the probability of survival by approximately 50% thru a reduction of burial time (Landrø, 2002). But reduced burial time is apparently not enough, mechanical injuries and suffocation kill people, no matter how well equipped they are. Perceived safety related to equipment is therefore questionable, both concerning its contribution to the affect heuristic and in terms of risk compensation. Several focus group participants expressed their fear of risk compensation, especially with the use of avalanche airbags. The following suggestion even emerged from the discussion: to test out if your safety equipment affects your decisions, ask yourself: would I have skied this slope without?

The majority of the respondents reported using safety equipment like helmet, shovels, probe and avalanche beacons (Appendix B, Figure 3). The widespread use of safety equipment confirms the importance of safety in this group.

“I feel safer together with someone I know has a lot of knowledge of avalanches” measures perceived safety in a relation between two people. Following someone you trust is usually a good advice, but can also makes ground for the halo heuristic previously mentioned. Safe Objects therefore seems as an important aspect of perceived safety, with the potential to influence skiers` decisions in face of avalanche danger.

## Knowledge & Skills

Factor number 4 clustered items of perceived safety related to the respondents` knowledge and skills and can be exemplified with the item: “I feel confident on my own ability to assess avalanche danger. ” *Knowledge & Skills* had the only significant positive correlation to age, suggesting that older respondents perceive safety more in terms of their own knowledge and skills. In comparison, age showed a weak negative correlation with *Perceived Exposure*, *Collective Safety* and *Safe Objects* indicating a reduction of perceived safety regarding these factors with age. This could be a result of greater internal locus of control in older respondents making them trust their own skills and evaluations more than external factors beyond their control. A high level of perceived internal control in the face of uncontrollable elements like avalanche danger may constitute a risk by itself.

Amount of avalanche education and *Knowledge & Skills* showed only a weak positive correlation that might be due to the fact that the sample in general was relatively well educated concerning avalanche safety (see appendix B, figure 2.).

**Experience**

*Experience* represents a factor of statements concerning perceived safety related to personal experience. The survey respondents agreed or strongly agreed to several of these items, indicating them as relevant for the perceived safety. One example from this factor is "I more often feel unsafe in unknown terrain". The high level of agreement on this last statement supports perceived safety as an important basis for the familiarity heuristic previously mentioned. Interestingly, the factor *Experience* did not correlate with age. A possible explanation of this finding could be that the *Experience* factor measures recent episodes more than general life experience, making it susceptible for the availability heuristic which according to Kahneman (2011) is the process of judging frequency by the ease with which an instance comes to mind.

**Personality traits**

Safety and security are according to Porzsolt et al. (2011) influenced by states like situations and by traits such as persistent factors related to personality. Intentionality to increase risk is therefore an interesting trait in terms of risk compensation theory and perceived safety. A normal distribution on both the SRT (Stimulating Risk Taking) and IRT (Instrumental Risk Taking) scores indicate that our population did not stand out as significantly risk- averse or risk seeking. Weak correlations between the trait measures of risk propensity and the factors of perceived safety are further underlining this finding.

**Limitations**

The limited amount of literature on the topic was a challenge in the development of this instrument. Findings from this study should be viewed with consideration of the limitations implicit of self-report data obtained from surveys. This study was also conducted during a limited period of time and thru a selection of channels on the Internet, compromising the generalizability of the instrument to some degree. When using Principal Component Analysis, the conclusions are restricted to the sample collected (Field, 2009). Further testing is necessary, but the current scale gives an indication of areas of concern.

Cross-validation of the factor analysis was in this study only done by visual inspection due to limited time. A further development of the scale will therefore have to include a cross-validation and a Confirmatory Factor Analysis.

Some respondents commented that they disagreed on items they found imprecise in their wording. This could indicate that some respondents perceived the scale as a “test of knowledge”, with right and wrong answers, and failed to acknowledge perceived safety as the target. This misunderstanding might have led some respondents to disagree more frequently, but this seems not to have affected the response-pattern notably.

**Further studies**

Further studies should focus on other contributing factors to perceived safety like motivation, personality, locus of control, group processes and physiological aspects like the effect of hormones. The role of perceived safety in decision-making could also be experimentally tested in a scenario inspired by Furman et al. (2010). The relationship between perceived safety and quantified risk could be explored by measuring perceived safety related to the different levels of danger on the avalanche scale. The influence of unconscious thoughts in decision-making among skiers should also be of interest. From a perceived safety perspective, all measures that contribute to bring perceived safety more in line with the objective safety seem valuable for accident prevention.

**Conclusion**

This study is intended as a contribution to the understanding of human factors in avalanche accidents by exploring skiers own perspective on safety. Our findings support perceived safety as central in skiers decision-making.

The author of this thesis argues that perceived safety is driven by the underlying mechanisms of cognition and affect. This claim is supported by dual process theory and the heuristics of perceived safety revealed in this work. Perceived safety related to these numerous heuristic traps has the potential of guiding our decisions towards increased risk taking, in line with risk-compensation theory. The process of substitution suggests that we substitute the major questions with minor ones. We argue that substitution works not only by reducing complexity, but also by shifting our focus towards questions we perceive more relevant to one of the most critical aspects of our living: safety.

As a novel and interesting perspective on human factors in avalanche accidents, we hope this study will generate more research on the topic and be of practical use to skiers and avalanche educators in the prevention of future accidents.

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# Appendix A

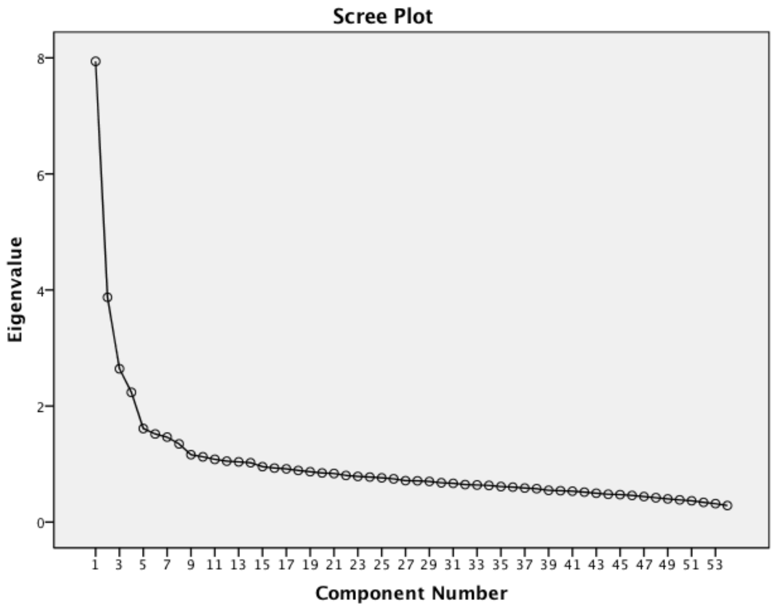



*Figure 1:* Scree plot

# Appendix - A

*Table 1.* Item loadings with Varimax rotation.

| Item | Pattern Coefficients | | | | | Communalities |
|---|---|---|---|---|---|---|
| Varimax | Factors | | | | | |
| | 1 | 2 | 3 | 4 | 5 | |
| *Perceived Exp.* | | | | | | |
| 25 | **.694** | | | | | .490 |
| 24 | **.664** | | | | | .473 |
| 34 | **.622** | | | | | .482 |
| 19 | **.614** | | | | | .483 |
| 15 | **.572** | | | | | .474 |
| 27 | **.532** | | | | | .322 |
| 21 | **.505** | | | | | .385 |
| *Collective Safety* | | | | | | |
| 38 | | **.754** | | | | .637 |
| 45 | | **-.685** | | | | .535 |
| 8 | | **.676** | | | | .539 |
| 20 | | **.645** | | | | .533 |
| 16 | .403 | **.464** | | | | .463 |
| 10 | | **.446** | .438 | | | .442 |
| *Safe Objects* | | | | | | |
| 18 | | | **.714** | | | .553 |
| 46 | | | **-.610** | | | .465 |
| 13 | | | **.554** | | | .315 |
| 11 | | | **.527** | | | .399 |
| 30 | | | **.521** | | | .335 |
| 7 | | | **.492** | | | .271 |
| 23 | | | **.438** | | | .372 |
| 12 | | | **.412** | | | .338 |
| *Knowledge & S.* | | | | | | |
| 3 | | | | **.735** | | .627 |
| 4 | | | | **.617** | | .466 |
| 2 | | | | **.613** | | .417 |
| 5 | | | | **.597** | | .404 |
| 29 | | | | **.449** | | .369 |
| 17 | | | | **-.415** | | .475 |
| 31 | | | | **.410** | | .313 |
| *Experience* | | | | | | |
| 33 | | | | | **.641** | .500 |
| 35 | | | | | **.571** | .376 |
| 32 | | | | | **.544** | .392 |
| 14 | | | | | **.540** | .323 |
| 42 | | | | | **.523** | .394 |
| 22 | | | | | **-.507** | .376 |
| 44 | | | | | **.430** | .279 |

*Table 2*. Characteristic values

| Factors | Item number | Range | M | SD | α | Intercorrelations | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1. Factor 1 | 7 | 8-35 | 23.40 | 4.43 | .769 | 1.000 | - | - | - | - | - | - | - | - | - | - | - |
| 2. Factor 2 | 6 | 10-30 | 21.90 | 3.02 | .783 | .453** | 1.000 | - | - | - | - | - | - | - | - | - | - |
| 3. Factor 3 | 7 | 16-40 | 30.60 | 3.18 | .713 | .323** | .500** | 1.000 | - | - | - | - | - | - | - | - | - |
| 4. Factor 4 | 7 | 11-35 | 25.63 | 2.88 | .689 | -.277** | -.212** | -.162** | 1.000 | - | - | - | - | - | - | - | - |
| 5. Factor5 | 7 | 11-33 | 21.30 | 2.70 | .661 | -.111** | -.027 | .162** | .162** | 1.000 | - | - | - | - | - | - | - |
| 6. SRT | 10 | 12-42 | 24.83 | 5.07 | .705 | .141** | .047 | .077** | .108** | .100** | 1.000 | - | - | - | - | - | - |
| 7. IRT | 7 | 7-33 | 21.07 | 3.41 | .645 | .113** | .050* | .094** | .005 | .107** | .412** | 1.000 | - | - | - | - | - |
| 8. Age | - | 18->60 | 32 | 8.81 | - | -.139** | -.103** | -.210** | .100** | -.040 | -.201** | -.099** | 1.000 | - | - | - | - |
| 9. Exposure | - | - | - | - | - | -.159** | -.206** | -.205** | .153** | .177** | -.001 | -.027 | .507** | 1.000 | - | - | - |
| 10. Av. Edu. | - | - | - | - | - | -.320** | -.343** | -.217** | .177** | .338** | -.029 | -.010 | -.036 | .178** | 1.000 | - | - |
| 11. B.C. Trips | - | - | - | - | - | -.294** | -.288** | -.196** | .074** | .221** | -.014 | -.033 | -.029 | .138** | .387** | 1.000 | .- |
| 12. Off-piste | - | - | - | - | - | -.006 | -.044 | .078** | .052* | .255** | .270** | .119** | -.148** | .110** | .166** | .137** | 1.000 |

*Note:* **. P<.01, *. P<.05.
Factor 1 = Perceived Exposure
Factor 2 = Collective Safety
Factor 3 = Safe Objects
Factor 4 = Knowledge & Skills
Factor 5 = Experience

SRT = Stimulating Risk Taking
IRT = Instrumental Risk Taking
Exposure = Years of backcountry travel
Av. Edu = Avalanche education
B.C. Trips = Average amount of backcountry trips pr season

Off-Piste = Average amount of off-piste skiing a season.

## Appendix - A

*Table 3.* A translation of the final items.

| Item number | Item content |
|---|---|
| Factor 1: **Perceived Exposure** | |
| 30. | I feel safer in slopes I know get skied frequently. |
| 29. | I am less scared of getting caught by an avalanche when skiing off-piste than in backcountry skiing. |
| 39. | I feel safer where there are tracks already. |
| 24. | I see frequently traveled mountains as safer. |
| 16. | I feel safer when I am in the proximity of a ski-lift. |
| 32. | Riding in a forest feels safer than on an open mountainside. |
| 26. | I feel safer when there is less snow. |
| Factor 2: **Collective safety** | |
| 43. | I feel safer in a big group than in a small group. |
| 52. | I feel safer in a small group than in a big group. |
| 8. | Traveling collectively as a group feels safer. |
| 25. | I feel safer when we are many hiking together. |
| 17. | I feel safer when hiking if there are others nearby. |
| 10. | When I am hiking with others who are familiar with the area it seems safer. |
| Factor 3: **Safe objects** | |
| 23. | I feel safer with an avalanche beacon than without. |
| 54. | Leaving my avalanche beacon at home can make me feel unsafe. |
| 14. | I feel safer with a shovel and a probe than without. |
| 11. | I feel safer together with others who I know have a lot of knowledge about avalanches. |
| 35. | I would feel safer if I carried an avalanche airbag. |
| 7. | I feel safer when riding with a helmet than without. |
| 28. | I feel safer when riding with someone more experienced than myself. |
| 12. | When I follow someone I trust, I feel safe. |
| Factor 4: **Knowledge & skills** | |
| 3. | I trust my own ability to assess avalanche risk. |
| 4. | My skiing/ snowboarding skills make me safer in steep terrain. |
| 2. | I can use my safety equipment effectively. |
| 5. | Increased knowledge has made me feel safer regarding avalanches. |
| 34. | Weather history and knowledge about snow conditions are vital for me to feel safe. |
| 18. | Leaving the avalanche danger assessment to others can feel safe. |
| 36. | Keeping distance to the others increase the overall safety. |
| Factor 5: **Experience** | |
| 38. | I can feel unsafe in places I know there have been avalanches before. |
| 40. | Changes in weather and snow conditions can make me feel unsafe. |
| 37. | I more often feel unsafe in unknown terrain. |
| 15. | Observing previously triggered avalanches can make me feel unsafe. |
| 47. | I feel unsafe more easily when there is plenty of snow. |
| 27. | Increased knowledge and experience have made me more cautious regarding avalanches. |
| 50. | Having responsibility for others makes me more easily feel unsafe. |

*Note:* Authors translation

Appendix - B

*Figure 2:* Amount of Avalanche Education in the study population (N=1663)

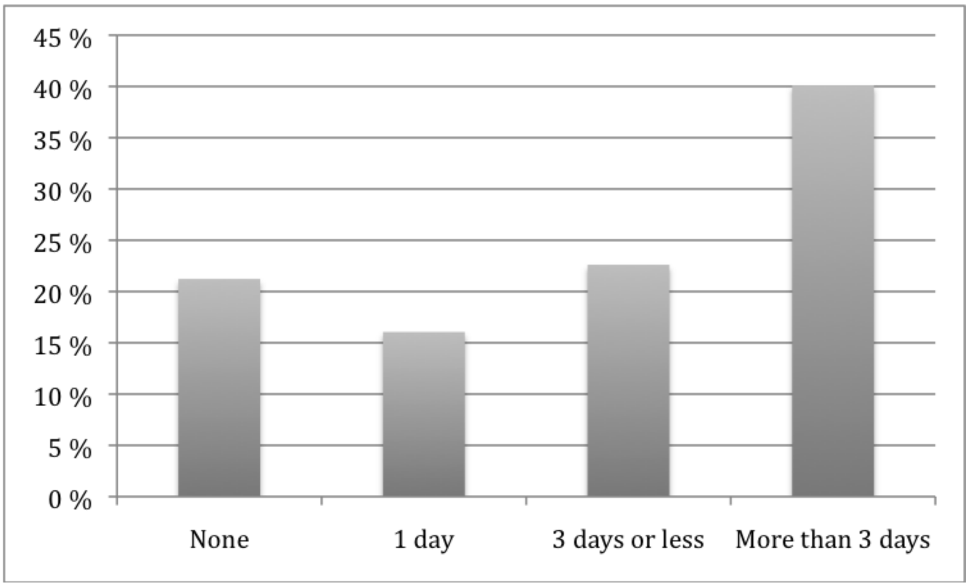
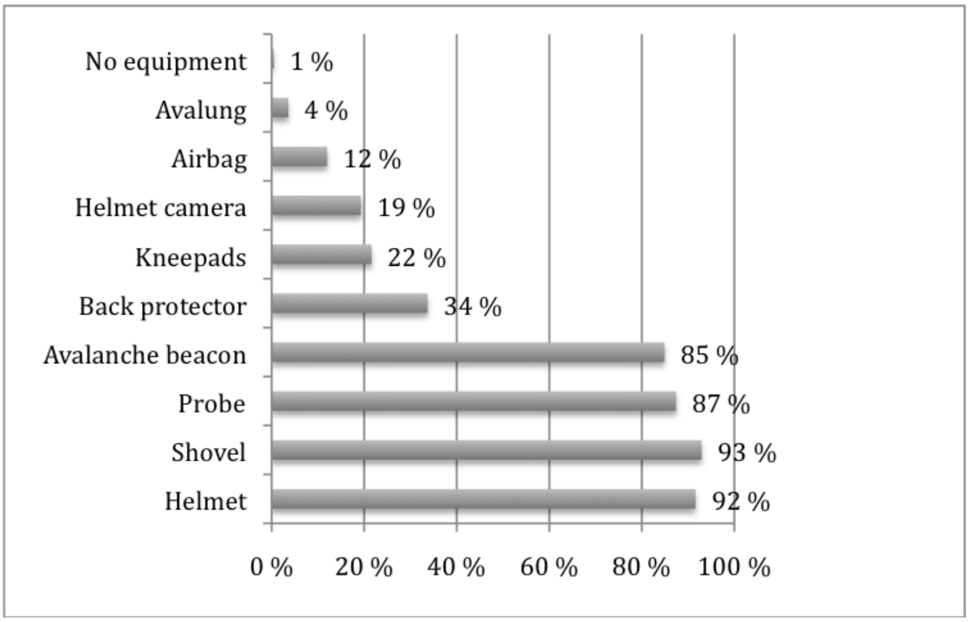
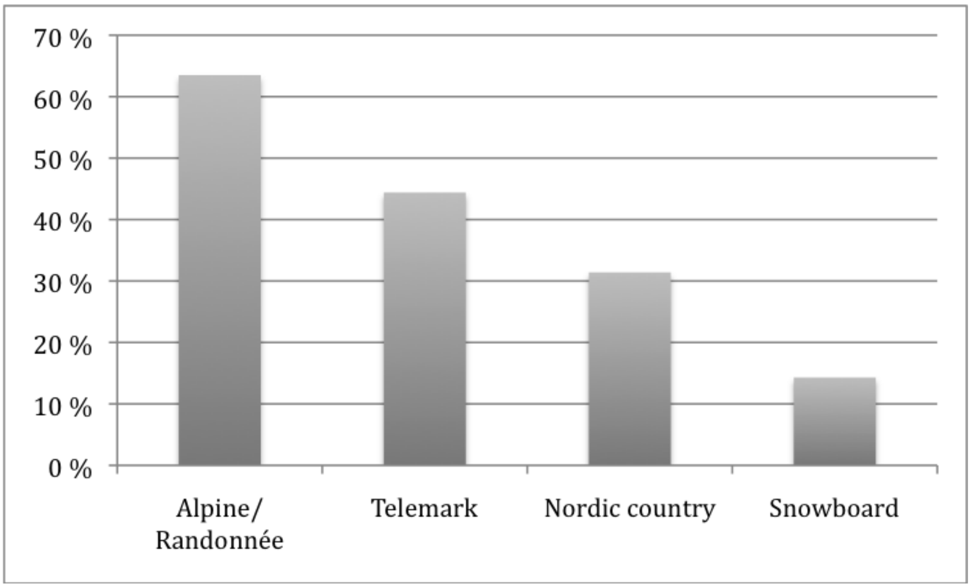



*Figure 3:* Equipment usage in the study population (N=1663)



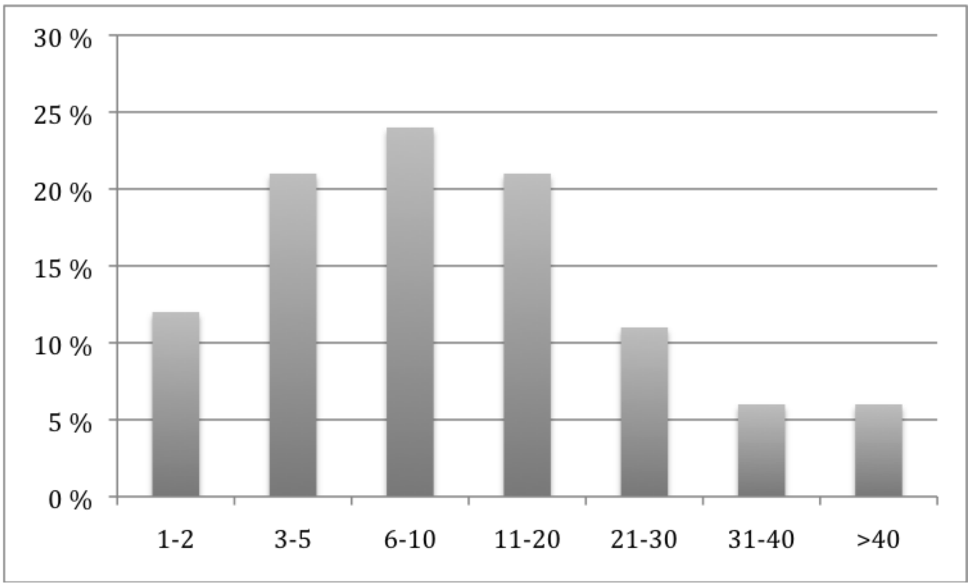
Appendix B

*Figure 4:* Travel means in the study population (N=1663)




*Note:* Nordic country = fjellski. Respondents using multiple types of equipment could tick of several, for example Snowboard + Backcountry Nordic.

*Figure 5:* Average number of backcountry trips per season in the study population (N=1663)



Appendix - B

*Figure 6:* Average number of days with off-piste skiing pr. season in study population (N=1663)

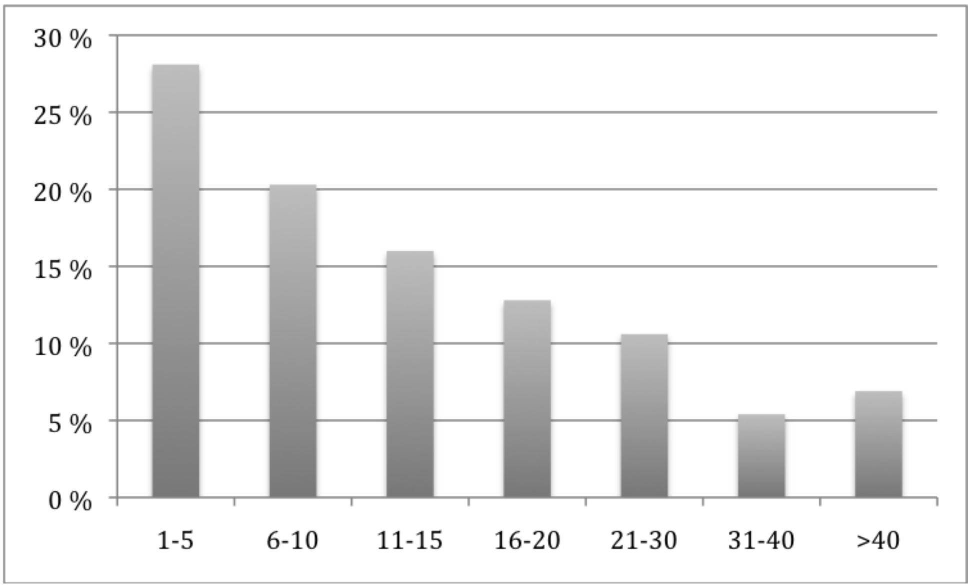
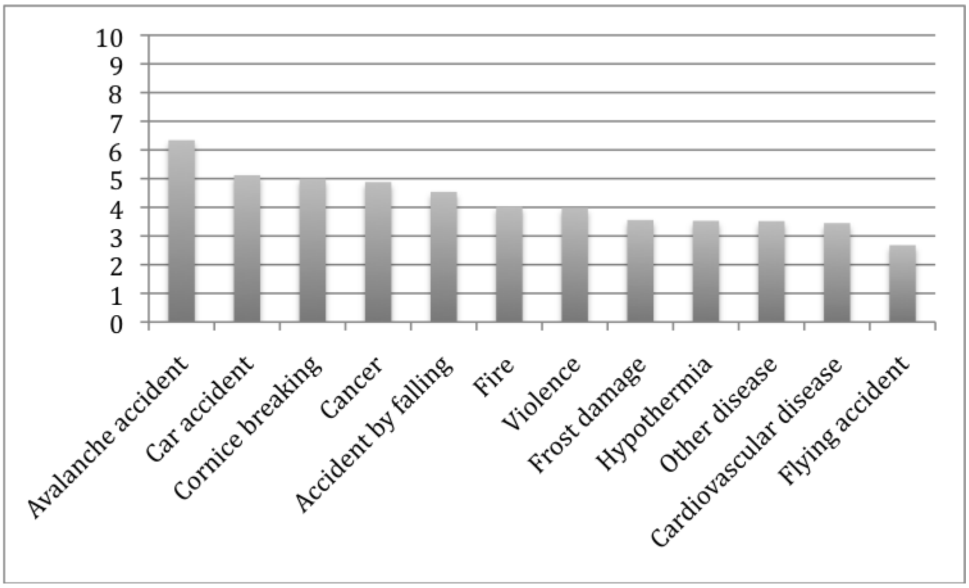



*Figure 7.* Mean rating of dangers in the sample population (N=1663)




*Note:* "Please rate how scared you are for the following dangers on a scale from 1-10, where 1 is minimally scared and 10 maximally scared." The high rating of Avalanche accidents could be a result of priming. The item "Utglidning" was removed due to a lack of real life logic.

Appendix C

## Undersøkelse om opplevd sikkerhet

Under følger en del spørsmål om din opplevelse av trygghet og sikkerhet når du ferdes på ski eller brett utenfor løypene fra et skitrekk eller på topptur.

Din anonymitet vil bli ivaretatt og du kan når som helst avbryte
Besvarelsen tar ca 10 min.

| | | Helt uenig | Uenig | Verken enig eller uenig | Enig | Helt enig |
|---|---|---|---|---|---|---|
| 1. | Det er viktig for meg at jeg føler meg trygg når jeg er ute på ski/ snøbrett. | 1 | 2 | 3 | 4 | 5 |
| 2. | Jeg kan benytte meg effektivt av alt sikkerhetsutstyret mitt. | 1 | 2 | 3 | 4 | 5 |
| 3. | Jeg er trygg på min egen evne til å vurdere snøskredfare. | 1 | 2 | 3 | 4 | 5 |
| 4. | Mine ski/snøbrettferdigheter gjør meg tryggere i bratt terreng. | 1 | 2 | 3 | 4 | 5 |
| 5. | Økt kunnskap har gjort at jeg føler meg tryggere i forhold til snøskred. | 1 | 2 | 3 | 4 | 5 |
| 6. | Opplevelser med snøskred har gjort meg utrygg i tiden etterpå. | 1 | 2 | 3 | 4 | 5 |
| 7. | Jeg føler meg tryggere når jeg kjører med hjelm enn uten. | 1 | 2 | 3 | 4 | 5 |
| 8. | Å ferdes som en samlet gruppe oppleves tryggere. | 1 | 2 | 3 | 4 | 5 |
| 9. | Jeg føler meg sikrere når jeg kjører nedover enn når jeg går oppover. | 1 | 2 | 3 | 4 | 5 |
| 10. | Jeg opplever det som tryggere når jeg er sammen med folk som er kjent i området. | 1 | 2 | 3 | 4 | 5 |
| 11. | Jeg føler meg tryggere når jeg er sammen med andre som jeg vet kan mye om snøskred. | 1 | 2 | 3 | 4 | 5 |
| 12. | Når jeg går etter noen jeg stoler på, føler jeg meg trygg. | 1 | 2 | 3 | 4 | 5 |
| 13. | Å ta skredkurs har gjort meg mindre redd for snøskred. | 1 | 2 | 3 | 4 | 5 |
| 14. | Jeg føler meg tryggere med spade og søkestang enn uten. | 1 | 2 | 3 | 4 | 5 |
| 15. | Å se at det har gått snøskred kan gjøre at jeg føler meg utrygg. | 1 | 2 | 3 | 4 | 5 |
| 16. | Jeg føler meg tryggere i nærheten av et skitrekk. | 1 | 2 | 3 | 4 | 5 |
| 17. | Jeg føler meg tryggere på tur når det er andre folk i nærheten. | 1 | 2 | 3 | 4 | 5 |
| 18. | Det kan kjennes trygt å overlate skredfarevurderingen til andre. | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19. | Jeg føler meg tryggere på fjell som jeg kjenner. | 1 | 2 | 3 | 4 | 5 |
| 20. | Dårlig sikt kan gjøre meg uttrygg. | 1 | 2 | 3 | 4 | 5 |
| 21. | Jeg føler meg tryggere når jeg står på ski/ brett sammen med noen som er eldre enn meg. | 1 | 2 | 3 | 4 | 5 |
| 22. | Å se snøskred på film kan gjøre at jeg føler meg utrygg. | 1 | 2 | 3 | 4 | 5 |
| 23. | Jeg føler meg tryggere med skredsøker enn uten. | 1 | 2 | 3 | 4 | 5 |
| 24. | Fjell som mange pleier å gå på opplever jeg som tryggere. | 1 | 2 | 3 | 4 | 5 |
| 25. | Jeg føler meg tryggere når vi er flere på tur. | 1 | 2 | 3 | 4 | 5 |
| 26. | Jeg føler meg tryggere når det er lite snø. | 1 | 2 | 3 | 4 | 5 |
| 27. | Økt kunnskap og erfaring har gjort meg mer forsiktig i forhold til snøskred. | 1 | 2 | 3 | 4 | 5 |
| 28. | Jeg føler meg tryggere når jeg står på ski/ brett sammen med noen som har mer erfaring enn meg | 1 | 2 | 3 | 4 | 5 |
| 29. | Jeg er mindre redd for å bli tatt av skred når jeg kjører utenfor løypene i et skitrekk enn når jeg er på topptur. | 1 | 2 | 3 | 4 | 5 |
| 30. | Jeg føler meg tryggere i heng som jeg vet at blir kjørt ofte. | 1 | 2 | 3 | 4 | 5 |
| 31. | På steder med snøskredvarsel føler jeg meg tryggere. | 1 | 2 | 3 | 4 | 5 |
| 32. | Skogskjøring kjennes tryggere enn kjøring i åpne fjellsider. | 1 | 2 | 3 | 4 | 5 |
| 33. | Jeg føler meg tryggest når jeg kan basere meg på andres vurderinger av snøskredfaren. | 1 | 2 | 3 | 4 | 5 |
| 34. | Værhistorikk og kjennskap til snøforholdene er avgjørende for at jeg skal kunne føle meg trygg. | 1 | 2 | 3 | 4 | 5 |
| 35. | Jeg ville følt meg tryggere med en skredballongsekk på ryggen. | 1 | 2 | 3 | 4 | 5 |
| 36. | Å holde avstand til de andre øker sikkerheten. | 1 | 2 | 3 | 4 | 5 |
| 37. | Jeg føler meg lettere utrygg i ukjent terreng. | 1 | 2 | 3 | 4 | 5 |
| 38. | Jeg kan føle meg uttrygg på steder der jeg vet at det har gått snøskred før. | 1 | 2 | 3 | 4 | 5 |
| 39. | Jeg føler meg tryggere der det er spor fra før av. | 1 | 2 | 3 | 4 | 5 |
| 40. | Endringer i vær og føreforhold kan gjøre meg utrygg. | 1 | 2 | 3 | 4 | 5 |
| 41. | Jeg føler meg tryggere hvis jeg kan bevege meg raskt igjennom terrenget. | 1 | 2 | 3 | 4 | 5 |
| 42. | Jeg opplever noen fjell som tryggere enn andre når det gjelder snøskred. | 1 | 2 | 3 | 4 | 5 |
| 43. | Jeg føler meg tryggere i en stor gruppe enn i en liten gruppe. | 1 | 2 | 3 | 4 | 5 |
| 44. | Jeg kan føle meg utrygg hvis andre i gruppen har mer sikkerhetsutstyr enn meg. | 1 | 2 | 3 | 4 | 5 |
| 45. | Jeg føler meg tryggere på våren når det ikke lenger er lagdelt vintersnø. | 1 | 2 | 3 | 4 | 5 |
| 46. | Grundig turplanlegging er avgjørende for at jeg skal kunne føle meg trygg. | 1 | 2 | 3 | 4 | 5 |
| 47. | Når det er mye snø så blir jeg lettere uttrygg. | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 48. | Jeg føler meg tryggere når jeg har tilgang på et skredvarsel for området jeg skal kjøre i. | 1 | 2 | 3 | 4 | 5 |
| 49. | Jeg føler meg lettere utrygg når jeg har ansvar for andre. | 1 | 2 | 3 | 4 | 5 |
| 50. | Jeg frykter at sikkerhetsutstyr som en skredballongsekk kan få meg til å utsette meg for større risiko. | 1 | 2 | 3 | 4 | 5 |
| 51. | Jeg føler meg tryggere når jeg er sammen med folk som jeg vet har samme risikoaksept som meg selv. | 1 | 2 | 3 | 4 | 5 |
| 52. | Jeg føler meg tryggere i en liten gruppe enn i en stor gruppe. | 1 | 2 | 3 | 4 | 5 |
| | Hvis jeg ikke er helt i form så kan jeg lettere føle meg usikker. | | | | | |
| 53. | Hvis jeg har glemt skredsøkeren så kan jeg føle meg utrygg. | 1 | 2 | 3 | 4 | 5 |

| | **Stimulating-Instrumental Risk Inventory (Zaleskiewicz, 2001)** | Helt uenig | Uenig | Verken enig eller uenig | Enig | Helt enig |
|---|---|---|---|---|---|---|
| 1. | Hvis jeg spiller et spill (f.eks kort) foretrekker jeg å spille om penger. | 1 | 2 | 3 | 4 | 5 |
| 2. | Jeg liker å ta risiko (risk taking) | 1 | 2 | 3 | 4 | 5 |
| 3. | Jeg tar ofte risiko bare for morro skyld. | 1 | 2 | 3 | 4 | 5 |
| 4. | Jeg tar sjanser kun hvis det er absolutt nødvendig for å oppnå et viktig mål. | 1 | 2 | 3 | 4 | 5 |
| 5. | Jeg tiltrekkes av ulike farlige aktiviteter. | 1 | 2 | 3 | 4 | 5 |
| 6. | Når jeg tar en risiko får jeg en behagelig kriblende følelse | 1 | 2 | 3 | 4 | 5 |
| 7. | Jeg unngår aktiviteter der tilfeldigheter i for stor grad bestemmer utfallet. | 1 | 2 | 3 | 4 | 5 |
| 8. | Jeg synes pengespill virker veldig spennende. | 1 | 2 | 3 | 4 | 5 |
| 9. | I forretninger bør man kun ta risiko hvis situasjonen kan kontrolleres. | 1 | 2 | 3 | 4 | 5 |
| 10. | Jeg tar risikofylte avgjørelser raskt og uten å kaste bort unødvendig med tid. | 1 | 2 | 3 | 4 | 5 |
| 11. | Jeg foretrekker en jobb med høy lønn som jeg lett kan miste fremfor en fast jobb men med lavere lønn. | 1 | 2 | 3 | 4 | 5 |
| 12. | For å oppnå noe i livet må man ta risiko. | 1 | 2 | 3 | 4 | 5 |
| 13. | Hvis det er en stor sjanse for profitt tar jeg til og med en veldig høy risiko. | 1 | 2 | 3 | 4 | 5 |
| 14. | For å få stort utbytte i næringslivet må man ta en høy risiko. | 1 | 2 | 3 | 4 | 5 |
| 15. | Hvis det var en stor sannsynlighet for å mangedoble kapitalen ville jeg til og med investert pengene mine i aksjene til et fullstendig nytt og usikkert firma. | 1 | 2 | 3 | 4 | 5 |
| 16. | Jeg foretrekker en jobb med høy lønn som jeg lett kan miste fremfor en fast jobb men med lavere lønn. | 1 | 2 | 3 | 4 | 5 |
| 17. | For å oppnå noe i livet må man ta risiko. | 1 | 2 | 3 | 4 | 5 |

*Note:* 1-10: SRT, 11-17: IRT

Vennligst oppgi hvor redd du er for følgende farer på en skala fra 1-10 der 1 er minimalt redd og 10 maksimalt redd:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Flyulykke | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Hjerte og karsykdommer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Hypotermi (nedkjøling) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Snøskredulykke | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Å bli utsatt for vold | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Fall | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Å få kreft | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Utglidning | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Bilulykke | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Skavlbrudd | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Personlige data

| | |
|---|---|
| Kjønn | |
| Alder | |
| Har du egne barn? | |
| Hva er ditt postnummer? | |

Hva står du på? (kryss av):

| | |
|---|---|
| Alpint/ randonee | |
| Telemark | |
| Snøbrett | |
| Fjellski | |

| Noen spørsmål: | Ja | Nei |
|---|---|---|
| Har du blitt tatt av et snøskred? | | |
| Kjenner du noen som har blitt tatt av snøskred? | | |
| Har du selv utløst et snøskred? | | |
| Har du observert et snøskred når det gikk? | | |
| Er det skredvarsling der du kjører mest på ski? | | |
| Kan du høre på musikk når du kjører utenfor løypene? | | |

Hvor mye utdannelse/ kurs har du når det gjelder snøskred: (kryss av)

| | |
|---|---|
| Ingen | |
| 1 dag | |
| <3 dager | |
| >3 dager | |

Hvor mange toppturer går du i løpet av en vanlig sesong? (kryss av)

| | |
|---|---|
| 1-2 | |
| 3-5 | |
| 6-10 | |
| 11-20 | |
| 21-30 | |
| 31-40 | |
| >40 | |

Hvor mange dager i løpet av en vanlig sesong kjører du utenfor løypene fra et skitrekk? (kryss av)

| | |
|---|---|
| 1-2 | |
| 3-5 | |
| 6-10 | |
| 11-20 | |
| 21-30 | |
| 31-40 | |
| >40 | |

I hvor mange år har du ferdes på ski eller snøbrett i potensielt skredfarlig terreng?

| | |
|---|---|
| 1-2 | |
| 3-5 | |
| 6-10 | |
| 11-15 | |
| 16-20 | |
| 21-25 | |
| 26-30 | |
| 31-35 | |
| 36-40 | |
| >40 | |

Bruker du følgende utstyr (kryss av):

| | |
|---|---|
| Spade og søkestang | |
| Skredsøker (sender/mottaker) | |
| Skredballongsekk | |
| Avalung | |
| Hjelm | |
| Knebeskyttere | |
| Ryggskinne | |
| Hjelmkamera | |

Appendix D

## The perceived safety scale for off-piste and backcountry skiers

This scale contains a number of statements concerning your safety when skiing. There are no right or wrong answers, so please give your opinion as frankly as possible. The first answer that comes to your mind is often the best.

To what extent do you agree on the following statements:

| | | Totally disagree | Disagree | Neither agree nor disagree | Agree | Totally Agree |
|---|---|---|---|---|---|---|
| 1. | I can use my safety equipment effectively. | 1 | 2 | 3 | 4 | 5 |
| 2. | I trust my own ability to assess avalanche risk. | 1 | 2 | 3 | 4 | 5 |
| 3. | My skiing/ snowboarding skills make me safer in steep terrain. | 1 | 2 | 3 | 4 | 5 |
| 4. | Increased knowledge has made me feel safer regarding avalanches. | 1 | 2 | 3 | 4 | 5 |
| 5. | I feel safer when riding with a helmet than without. | 1 | 2 | 3 | 4 | 5 |
| 6. | Traveling collectively as a group feels safer. | 1 | 2 | 3 | 4 | 5 |
| 7. | When I am hiking with others who are familiar with the area it seems safer. | 1 | 2 | 3 | 4 | 5 |
| 8. | I feel safer together with others who I know have a lot of knowledge about avalanches. | 1 | 2 | 3 | 4 | 5 |
| 9. | When I follow someone I trust, I feel safe. | 1 | 2 | 3 | 4 | 5 |
| 10. | I feel safer with a shovel and a probe than without. | 1 | 2 | 3 | 4 | 5 |
| 11. | Observing previously triggered avalanches can make me feel unsafe. | 1 | 2 | 3 | 4 | 5 |
| 12. | I feel safer when I am in the proximity of a ski-lift. | 1 | 2 | 3 | 4 | 5 |
| 13. | I feel safer when hiking if there are others nearby. | 1 | 2 | 3 | 4 | 5 |
| 14. | Leaving the avalanche danger assessment to others can feel safe. | 1 | 2 | 3 | 4 | 5 |
| 15. | I feel safer with an avalanche beacon than without. | 1 | 2 | 3 | 4 | 5 |
| 16. | I see frequently traveled mountains as safer. | 1 | 2 | 3 | 4 | 5 |
| 17. | I feel safer when we are many hiking together. | 1 | 2 | 3 | 4 | 5 |
| 18. | I feel safer when there is less snow. | 1 | 2 | 3 | 4 | 5 |
| 19. | Increased knowledge and experience have made me more cautious regarding avalanches. | 1 | 2 | 3 | 4 | 5 |
| 20. | I feel safer when riding with someone more experienced than myself. | 1 | 2 | 3 | 4 | 5 |

Appendix D

# The perceived safety scale for off-piste and backcountry skiers

| | To what extent do you agree on the following statements: | Totally disagree | Disagree | Neither agree nor disagree | Agree | Totally Agree |
|---|---|---|---|---|---|---|
| 21. | I am less scared of getting caught by an avalanche when skiing off-piste than in backcountry skiing. | 1 | 2 | 3 | 4 | 5 |
| 22. | I feel safer in slopes I know get skied frequently. | 1 | 2 | 3 | 4 | 5 |
| 23. | Riding in a forest feels safer than on an open mountainside. | 1 | 2 | 3 | 4 | 5 |
| 24. | Weather history and knowledge about snow conditions are vital for me to feel safe. | 1 | 2 | 3 | 4 | 5 |
| 25. | I would feel safer if I carried an avalanche airbag. | 1 | 2 | 3 | 4 | 5 |
| 26. | Keeping distance to the others increase the overall safety. | 1 | 2 | 3 | 4 | 5 |
| 27. | I more often feel unsafe in unknown terrain. | 1 | 2 | 3 | 4 | 5 |
| 28. | I can feel unsafe in places I know there have been avalanches before. | 1 | 2 | 3 | 4 | 5 |
| 29. | I feel safer where there are tracks already. | 1 | 2 | 3 | 4 | 5 |
| 30. | Changes in weather and snow conditions can make me feel unsafe. | 1 | 2 | 3 | 4 | 5 |
| 31. | I feel safer in a big group than in a small group. | 1 | 2 | 3 | 4 | 5 |
| 32. | I feel unsafe more easily when there is plenty of snow. | 1 | 2 | 3 | 4 | 5 |
| 33. | Having responsibility for others makes me more easily feel unsafe. | 1 | 2 | 3 | 4 | 5 |
| 34. | I feel safer in a small group than in a big group. | 1 | 2 | 3 | 4 | 5 |
| 35. | Leaving my avalanche beacon at home can make me feel unsafe. | 1 | 2 | 3 | 4 | 5 |