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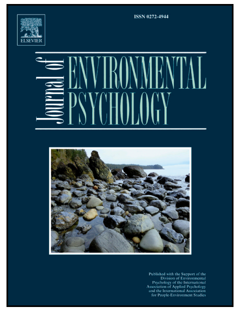

Who's at risk in the backcountry? Effects of individual characteristics on hypothetical terrain choices

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Who's at risk in the Backcountry? Effects of individual characteristics on hypothetical terrain choices

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1. Introduction

Avalanches are low probability events with potentially catastrophic consequences. Recreationalists, who voluntarily travel through avalanche terrain, represent the majority of avalanche fatalities (Tschirky, Brabec & Kern 2000; Birkeland, Greene & Logan 2017), and over 80 percent of avalanche accidents are triggered by the group that the victim was part of, or the victims themselves (Atkins 2000; McCammon 2000). Decision-making in avalanche terrain is especially challenging, given the asymmetric feedback that users receive in response to their decisions. Corrective feedback for poor decision-making is seldom provided, and when provided, can be fatal. This type of setting has been termed a "wicked learning environment" (Hogarth, Lejarraga, & Soyer 2015), and is one aspect that makes decision-making and risk perception so challenging in this setting.

An analysis of mechanisms associated with high avalanche risk exposure may facilitate identification of groups that are susceptible for accidents, and holds potential to make educational interventions and communication of information more efficient to the highest risk groups. Previous research suggest that risk attitudes and perception are important determinants for risk exposure in other environments (e.g., Zuckerman 1994; Weber & Milliman 1997; Nicholson, Soane, Fenton-O'Creevy & Willman 2005). The perception of risk partly depends on cognitive and emotional biases, e.g., availability bias (Tversky & Kahneman, 1973; Slovic, Fischhoff, & Lichtenstein 1981; Kahneman 2003), optimism-bias (Slovic et al 1981; Weinstein 1989), the affect heuristic (e.g., Slovic, Peters, Finucane & MacGregor 2005), and on social factors (e.g., Benthin, Slovic & Severson 1993).

Research on the mechanisms behind heightened levels of risk-exposure in avalanche terrain is still scant. Historically, avalanche accidents were treated as natural disasters caused solely by geophysical processes. It was not until the early 2000's that the view changed, and avalanche accidents started being seen as catastrophic events caused by the "human factor"

(Atkins 2000; McCammon 2002; McClung 2002a; 2002b; Harvey & Zweifel 2008; Boyd, Haegeli, Shuster & Butt 2009; Hendrikx and Johnson, 2014). The accident data analyses by McCammon (2000; 2002; 2004) and Atkins (2000) suggest that avalanche accidents are often caused by judgement errors that can be linked to previous findings in psychology and economics. Unfortunately, the dataset used, and nature of the environment makes it difficult to draw strong conclusions from their work.

Ideally, decision-making in avalanche terrain should be analyzed in a real-life setting. Ethical issues, data availability, and the complexity of avalanche danger makes such an approach challenging. A number of researchers have therefore employed hypothetical choice experiments to measure stated preferences (Haegeli, Haider, Longland & Beardmore 2010; Furman, Shooter & Schumann 2010; Marengo, Monaci & Miceli 2017). One advantage of this approach is that it makes it possible to evaluate how both different snow and terrain context, personality, and group characteristics affect the choices related to avalanche risk. The work by Furman et al (2010), Haegeli et al (2010), and Marengo et al (2017) suggest that the most important factor for hypothetical terrain choices is the forecasted avalanche hazard. However, these studies also find a significant effect of risk attitudes, and confirm some of the findings by McCammon (2002; 2004), e.g., that familiarity with an area and the possibility to ride untracked snow increases willingness to ride a steep slope.

The present study has three aims: 1) to analyze how individual characteristics, such as risk attitudes and perception, experience and socio-demographics, correlate with hypothetical risk exposure in avalanche terrain, 2) to evaluate if different factors explain stated *preference for* and *acceptance to* ski relatively risky terrain, and 3) if individual characteristics affect the perceived *relative* riskiness of different hypothetical ski runs.

We measured individual characteristics, including socio-demographics and risk attitudes through an online survey. To measure willingness to ski a risky slope, we use a stated preference approach, in which participants choose between different ski runs down a mountain. Our research is closely related to the work by Furman et al. (2010), Haegeli et al (2010), and Marengo et al (2017). However, our empirical strategy differs from previous research on several important aspects. First, and perhaps most important, we explore both stated *preference* for a hypothetical run, and the stated *willingness to accept* to ski down a run if someone else in the group say that they want to ski it. The distinction between the two is important, because it provides information on what individuals want to do, and what they might be willing to do.

A second difference is that we evaluate how a set of personality characteristics affect risk-exposure. This means that we, in contrast to previous researchers, are not primarily interested in measuring how a set of *objective* risk factors affect the choice to ski/choose a slope. Instead, we use a set of choice alternatives, which vary systematically in terms of risk-exposure, and evaluate how personal characteristics affect the chosen risk level. Third, previous research has relied on relatively stylized examples of *planned* tours. This facilitates both the analysis and the choice for the participant. However, it also makes it more difficult to relate to real life choices, as participants may plan to re-evaluate the decision when on tour. Our approach means that respondents make a “go or no go” decision.

2. Material and methods

2.1 Participants

We collected all data using an online survey. To target the main population of interest for this study, backcountry riders (skiers, snowboarders etc.), we published a link to the survey on the research project web pages (https://whiteheatproject.com, and http://site.uit.no/care/), and on popular online platforms for skiers in Norway during March to May 2017. The aim of the survey was both to evaluate the relationship between individual characteristics and risk-taking behavior, and to test a set of instruments for future research. The estimated completion time was 35 minutes. To incentivize participants to complete the survey, they were given the opportunity to participate in a lottery to win an avalanche backpack (value about €500 / US$600) upon completion.

Eight-hundred and thirty-six individuals agreed to participate in the survey, and were over 18 years of age. Among these, 467 provided complete answers on the relevant sections of the survey. An overview of the sample is provided in *Table 1*, below.

[Table 1 about here]

Twenty-seven percent of sample participants are female. Median age was 33 (mean = 34, SD =10.07), and 80 percent were currently enrolled at university or had a university degree. Nearly 50 percent of the participants have skied in the backcountry for more than five years, and about 26 percent had on average 30 or more ski days per season during the past five years. Eighty-one percent of the participants rate themselves as either strong or expert backcountry travelers[1] but over 45 percent lack formal avalanche training. Thirty-eight percent has experience of avalanche accidents and/or near-miss incidents.

2.2 Measurement instruments

2.2.1. Risk-taking behavior in avalanche terrain (dependent variable)

We measured risk-taking behavior in avalanche terrain via hypothetical ski terrain choices. We elicited stated preferences for ski terrain by describing a hypothetical backcountry ski tour[2] to the respondent, and by asking the respondent which of four alternative routes down the mountain that s/he would *prefer*, and *accept*, to ski. The alternatives were constructed in collaboration with the head of avalanche forecasters in Norway (and co-author on this paper), such that the alternatives would represent different levels of risk exposure. Brief descriptions of the hypothetical runs are presented in *Figure 1*, below (see the online *Appendix A*) for a full description).

[Figure 1 about here]

Weather, snow conditions, and the overall avalanche danger level and problem were identical for all runs, while the risk and consequences of a fall or an avalanche varied systematically. We introduced this variation in risk via differences in slope of the run and presence of terrain features that amplifies the consequence of a fall or an avalanche. The Ridge and the Field represent low angle terrain with low probability of an avalanche occurring and no dangerous terrain features, while the Bowl and the Chute represent steep terrain traps where avalanches are possible (see *Figure 1*). To ensure that the order did not affect the answers, we randomized the order of presentation of the run choices between respondents.

2.2.2. Risk attitudes and perception

We measure attitudes to risk via the Brief Sensation Seeking Scale (BSSS-8; Hoyle, Stephenson, Palmgreen, Lorch & Donohew, 2002), a short version of sensation-seeking scale (SSS) developed by Zuckerman (1979; 1994; 2007). Both SSS (Robinson 1992; Rowland, Franken & Harrison 1986) and BSSS-8 (Eachus 2004; Stephenson, Velez, Chalela, Ramirez, & Hoyle 2007; Lepp & Gibson 2008) have been shown to hold strong predictive power for engagement in a variety of risk-taking behavior, including high-risk sports. To derive a measure of sensation-seeking preferences via the BSSS-8, respondents are asked to state to what extent they agree with a set of eight statements on a 6-point scale from 1 (strongly disagree) to 6 (strongly agree). Examples of these statements include: ”I would like to explore strange places”, and ”I like to do frightening things”. The different indicators are combined by the use of factor analysis and estimation of factor scores to create an index of sensation-seeking preferences. Our factor analysis of the BSSS-8 indicator variables shows that the measure displays a satisfactory fit to the data (Kaiser-Meyer-Olkin test = 0.82, Chronbach's alpha = 0.79). Detailed results for the factor analysis are available in *Tables C.1* and *C.2*, in the online *Appendix C*).

To be able to control for differences in perceived risk, we asked respondents to answer the following question: "Keeping the information about terrain and snow conditions in mind: how big do you think the risk for an accident (e.g., due to an avalanche or a fall) would be for you if you skied down this run? The value 1 means that you think that it would be totally safe for you to ski down the run, and the value 6 means that you think that it would be a very high risk for you to ski down the run." We used these responses to ensure that participants ranked the risk of the different runs in accordance with our intended design.

2.3 Statistical analysis

Our first aim of this paper is to analyze if individual characteristics correlate with hypothetical choices in avalanche terrain. Terrain choices are ordinal in risk. The ordinal nature of terrain choice suggests an ordered Logistic approach. However, ordered models are best suited for large datasets with many observations in each cell, or group. Our sample size is relatively small, and few individuals *preferred* the steepest run. Both the Chute and the Bowl represent relatively risky choices, while the Ridge and the Field represent relatively safe ways down the mountain. To facilitate estimation, we use this distinction and collapse the different routes into two categories: choosing the Ridge or the Field (relatively safe choice), and choosing the Bowl or the Chute (relatively risky choice).

We use one-sided student t-tests to conduct a bivariate analysis of differences in individual characteristics related to stated *preference for* and *acceptance of* the Bowl or the

Chute. Because perceived risk is on ordinal scale, we also test the difference using the Mann-Whitney U test. We use a Logit approach to estimate multivariate regression models. To check robustness of our multivariate regression results, we also estimate OLS regressions on the full hypothetical choice set, i.e., all four runs. These results are presented in *Table C.7* in the online *Appendix C*. To evaluate model fit between different specifications, we conduct Likelihood ratio test, link tests, and compared the Akaike Information Criteria (AIC). We only present results for variables, which add significant information to the model according to these tests. Finally, to test, and correct for potential heteroscedasticity, we estimate heteroscedastic Probit (Harvey 1976; Greene 2012; Blevins & Khan 2013) regressions, and we use robust standard errors in the ordinary least square model.

To address our second aim, i.e., if the participants' stated *preference* for a certain level of risk is different from their *willingness to accept* risk, we compare the perceived level of risk of their *most preferred* run, to the perceived level of risk of the runs that the individual states that she or he would *accept* to ski. More specifically, we use a Wilcoxon signed rank test to analyze if the perceived risk level of the riskiest (as perceived by the individual) accepted run is significantly different from the perceived risk level of the most preferred run.

Our analysis of the effect of perceived risk level requires a special mention. We hypothesize that current *preferences* for ski terrain depend on the individual's risk attitudes, perceived risk of the risky runs, and ability to mitigate risk. As described above, the question on perceived risk allows us to control for the subjectively perceived risk of each run. However, our main regressions have an outcome variable that takes the value one if the individual *prefers* (*accepts*) to ski the Bowl *or* the Chute, and zero otherwise. To evaluate if the perceived riskiness of the relatively steep runs affects choices, we construct a variable that is equal to the perceived risk of the *preferred* (*accepted*) run, if the individual *prefers* (*accepts*) one of the two relatively steep runs, and equal to the perceived least risky of the two steep runs, if the individuals *prefer* (*accept*) one of two the relatively less risky runs. The motivation for choosing the latter is that the least risky of the steeper runs should represent the closest alternative to the run chosen.

Related to the third aim of our study, we say that the ranking of the riskiness of hypothetical runs is "consistent" if the individual ranks the Field as strictly riskier than the Ridge, and the Bowl and the Chute as strictly riskier than both the Field and the Ridge, and "inconsistent" otherwise. We thereafter create a variable taking the value one if the ranking is consistent and zero if the answer is inconsistent, and run a Logistic regression to analyze if individual characteristics correlate with a "consistent" ranking of the different runs.

Finally, previous research show that long surveys are associated with more careless response due to Ego depletion (Meade and Craig, 2012), and our survey certainly falls into this category with an estimated 35-minute completion time. We identify careless response by an analysis of Even-Odd correlation, and Longest String (Meade and Craig, 2012).

All data analysis was conducted by the use of the statistical software STATA 15.

3. Results

3.1 Data quality

3.1.1 Careless response and missing values

Using the methods described in Section 2.3 we assessed our data quality, and found that 70 percent of the sample has an Even-Odd correlation over 0.7. Only five percent of the sample has a correlation equal to or lower than 0.11. Less than 10 percent of the sample have strings of 10 or more identical values. For maximum, minimum, and middle values, the share is below 4 percent. Concerning missing values, it appears that many followed the link to the survey out of curiosity but never followed through. The sample is divided between one group with less than 5 percent missing observations (56 percent), and one group with over 50 percent missing observations (41 percent). The majority of the latter group left the survey within 5 minutes after opening, and 175 individuals answered nothing more than the question on informed consent.

Our analysis of missing values suggests that many individuals either found the survey to be too long and complex to answer, or were not interested in the topic. However, the responses of those who decided to answer the survey, and on which this research is based on, do not show that careless response is a problem. In support of this conclusion about the quality of our data, a relatively large share of the participants provided detailed and voluntary comments (for example, 98 individuals provided extensive details about their avalanche training). We interpret this as that most participants, who answered the survey, and proceeded beyond the first few questions were engaged while taking it.

3.1.2 Perceived risk

Our analysis of the participants ranking of the different runs in terms of risk shows that some individuals ranked the risk differently from us. *Table 2* provides descriptive statistics for the 333 individuals who ranked the risk consistently with our intended design, and the 134 individuals who ranked the relative risk differently.

[Table 2 about here]

As can be seen in *Table 2*, there are some differences between the samples. The results show that age, gender, university education, and attitudes to risk hold some explanatory power: Older individuals, males, individuals without university education, and individuals with higher scores on the BSSS-8 are less likely to rank the risk of the runs in accordance with our intentions (estimation results are available in *Table C.3*, in the online *Appendix C*). The significant effect of education is worrying, because it suggests that uneducated individuals found it difficult to understand the description of the runs. It should be noted that we find no effects of avalanche training, backcountry experience or self-assessed backcountry travel skills between the groups. Based on feedback provided by participants, it appears that some individuals focused on certain, micro-terrain features in the pictures, which indicated less consequences of an avalanche on the steeper runs, and that this reduced their assessed risk of these runs. To ensure that we do not treat a run as risky when a participant perceives it as relatively safe, we conduct our empirical analysis on the consistent sample. This way we also ensure that only individuals who read the descriptions carefully are included in the analysis. It should be noted, that an inclusion of the individuals who ranked the risk differently from the intended design in the analysis reduces the fit of the model but still yields broadly similar results.

Table 3 contains information on the perceived risk of the different runs, by participants who ranked the risk per our intentions: a high share of individuals perceives the Ridge and the Field as relatively non-risky, and no one perceives these runs to be associated with very high risk. In contrast, no participant rates the Bowl or the Chute as safe, and relatively many rates these runs as highly risky.

[Table 3 about here]

3.2. Bivariate analysis

Table 4 shows the percentage of individuals who stated that they would *prefer* and *accept* to ski the different runs. As can be seen in the table, a higher share *accepts* to ski the Bowl or the Chute, than state that they *prefer* to ski down these runs[3]. The Wilcoxon signed rank test shows that the difference in choice of run is significant (p<0.001), and that the perceived risk of the most *preferred* run is lower than the perceived risk of the subjectively most risky *accepted* run (p<0.001).[4]

[Table 4 about here]

The bivariate boxplot analyses presented in *Figures 2a* and *2b* suggest that individuals, who *prefers* and/or *accepts* to ski the Bowl or the Chute, are more positive towards risk and perceive the level of risk as lower.

[Figure 2a and 2b about here]

One-sided Student t-tests confirm that the differences are significant for both stated *preference* (BSS-8: t = -5.012, p < 0.001, Perceived risk: t = 6.066, p < 0.001), and *acceptance* (BSSS-8: t = -5.971, p < 0.001, Perceived risk: t = 8.168, p < 0.001. Mann-Whitney U tests are also significant (p < 0.001).

Individuals, who assess their backcountry skills to be relatively high, have a high number of ski days per year, and have skied in the backcountry for many years, are more likely to *prefer* to ski the Bowl or the Chute. The same holds for men, younger individuals, and individuals with avalanche experience (accident or close call). The bivariate analyses of the choice to *accept* to ski the Bowl or the Chute are similar. However, we find no statistically significant differences (on 5 percent level) concerning ski experience, or gender for this hypothetical choice. Men in our sample have significantly more positive attitudes to risk (One-sided t-test, p = 0.004), ski more days per year (Mann-Whitney U test, p < 0.001), and rate their skills to be higher (Mann-Whitney U test: z = -7.482, p < 0.001), than women. The difference in avalanche training between men and women is not significant on 5 percent level (Mann-Whitney U test, p = 0.06). A summary of the bivariate results is available in *Table C.4*, in the online *Appendix C*.

3.3 Multivariate analysis

We present the results of our multivariate analysis in *Table 5*. The outcome variables are dichotomous taking the value one, if the individual *prefers* (column 1) or *accepts* (column 2) to ski the Bowl or the Chute, and zero otherwise.

Just like the bivariate analyses, our multivariate results suggest that perceived risk and sensation-seeking preferences are key. While individuals who perceive that the risk of skiing a run is high are relatively unlikely to choose to ski that run, individuals who display sensation-seeking preferences are relatively likely to *prefer* and *accept* to ski a steep run. The qualitative effects are similar across the regressions, and robust to controls for self-assessed skills and backcountry ski experience (see *Table C.5 – C.6*, in the online *Appendix C*). However, the size of the effects is much more prominent for stated *acceptance*, than they are for stated *preference* to ski a run. The predicted probability that an individual *prefers* to ski the steeper runs increases from 8 - 37 percent, i.e., 29 percentage points, if his/her perceived level or risk goes from relatively high to relatively low. The corresponding increase in the probability to *accept* to ski the run is 66 percentage points (an increase in predicted probability from 11.3 to 77.7 percent). With respect to sensation-seeking preferences, we find that the predicted probability that an individual *prefers* a steeper run increases from 6 percent to 29 percent (23 percentage points) if the BSSS-8 score goes from -2 to 2. The corresponding increase for *accepting* to ski a steeper run is from 7 percent to 67 percent (60 percentage points).

[Table 5 about here]

For ski- and backcountry experience and skill, we find that self-assessed backcountry ski skills constitute an important explanatory factor for stated *preference* for the relatively risky runs. Ski and backcountry experience also predict *preference* but hold less explanatory power than self-assessed backcountry skills (see *Table C.5*, in the online *Appendix C*). However, we find no effects of skills or experience on the probability that an individual *accepts* to ski the steep runs.

By contrast, we find that, while formal avalanche training does not predict stated *preference* for skiing the Bowl or the Chute, the effect is significant and strongly negative on willingness to *accept* skiing these runs: the probability that an individual without formal avalanche education *accepts* to ski the Bowl or the Chute is 41 percent. For an individual with a level 1 courses or higher, this probability is only 22 percent.

Similar to Marengo et al (2017), we find a positive correlation between past experience of avalanche incidents and *preference* for the steeper runs. The probability that an individual with no experience of avalanche incidents *prefers* the Bowl or the Chute is 12 percent. For an individual with some experience of avalanches, the corresponding probability is 20 percent. However, our estimated effect is not significant when we adjust for multiple testing with Bonferoni correction (the original p-value is 0.054), and we find no correlation between past experience of avalanche incidents and stated *acceptance* to ski the steeper runs.

Our results further suggest that individuals who admire people who ski radical lines are more inclined to both *prefer*, and *accept*, to ski steep terrain. Individuals in our sample, who to some extent agree with the statement "I look up to people who ski steep/exposed lines", are 10 (16) percentage points more likely to *prefer* (*accept*) to ski the Bowl or the Chute than are individuals who disagrees with this statement.[5] We find no effect of gender on hypothetical terrain choices.

4. Discussion

Our findings that individuals are more likely to both *prefer* and *accept* to ski a relatively risky run if they perceive a low level of risk or have positive attitudes to risk, is supported by previous research on skiers (e.g., Ruedi, Abart, Ledochowski, Burtscher & Kopp 2012; Kopp, Wolf, Ruedl, & Burtscher 2016, Marengo et al., 2017), behavior in traffic (e.g., Dahlen, Martin, Ragan, & Kuhlman 2005), for sexual behavior (e.g., Donohew, Zimmerman, Cupp, Novak, Colon & Abell 2000), and financial decisions (e.g., Wong & Carducci 1991). The finding that risk perception is key is consistent with the work by Weber and Milliman (1997). In accordance with Byrnes, Miller & Schafer (1999) we find that men have significantly more positive attitudes to risk than women do, but given these attitudes, we find no evidence of gender effects in our hypothetical choice scenarios. This finding is also consistent with the findings of Furman et al (2010) and Marengo et al (2017).

None of the aforementioned results is likely to come as a surprise to many. However, we also find that individuals in our sample are willing to *accept* to ski runs that they perceive as significantly riskier than their most *preferred* run, and that backcountry skills and experience hold no explanatory power for *accepting* to ski steep terrain. In other words, individuals with a low level of experience and skill are equally likely to *accept* to ski the steeper runs, as individuals with a high level of skill and experience. This result indicates that novices may end up in terrain that they do not have the skills to master, and given the nature of avalanche terrain as a wicked learning environment, they will not receive the correct feedback, and may therefore be more prone to continuing to make risky decisions.

Formal avalanche education ideally provides individuals with knowledge on how to assess and mitigate avalanche danger. Research on the role of avalanche training and its net influence on risk is still in its infancy. In other, somewhat similar settings (e.g. driver education), research show that training may contribute to over-confidence and increased risk taking (e.g. Harrington 1972; Peck 1993; 2011; Nichols 2003), and there is currently a debate if avalanche training is associated with the same problems. We find no evidence of such negative effects in our data. The negative effect of avalanche education in the *acceptance* regression rather suggests that individuals with avalanche training feel more confident in their decision to say no to terrain that is too risky from their perspective.

Our finding that past experience of avalanche incidents is positively correlated with *preferences* for relatively risky runs are consistent with previous findings by Marengo et al (2017). Marengo et al (2017) interpret the link as support for the hypothesis that surviving a serious incident creates a sense of invulnerability and increases risk-taking behavior. However, we are cautious to make this interpretation due to endogeneity issues. More specifically, given the data at hand, it is impossible to differentiate between individuals who develop preferences for steep terrain because of an avalanche incident, and individuals who have preferences for steep terrain and therefore have a heightened risk of having had an avalanche incident. To establish causality, we need information on *changes* in preferences and behavior due to experiences of avalanche incidents.

Finally, our results suggest that admiration of people who ski radical lines is associated with an increase in both the probability to both *prefer* and *accept* the relatively risky runs. This is consistent with findings by e.g., Benthin et al., (1993), who find that social admiration is strongly linked to participation in risky activities.

Many of the observed effects presented here warrant further research. Stated choice experiments offer researcher with the ability to create a controlled environment, but the hypothetical nature of the experiments also introduces various forms of bias. We therefore urge caution with a direct translation into a real-life setting. To fully understand the relationship between personality characteristics and risk-taking behavior in avalanche terrain, a combination of real-world observations of backcountry travel and information on personality trait metrics is needed.

5. Conclusions

In this paper, we have analyzed the correlations between personality characteristics and hypothetical choices related to risk in avalanche terrain. Our empirical analyses suggest that both risk perception and risk attitudes are key for decisions related to avalanche risk. However, our analysis also shows that many individuals are willing to *accept* to ski runs that they perceive to be significantly riskier than their most *preferred* choice, and that individuals with a low level of experience and skill are equally likely to *accept* to ski the steeper runs, as are individuals with a high level of skill and experience. Finally, we find some indications that social aspirations affect terrain choices. Taken together, these latter results indicate that social factors play a role in decisions related to avalanche risk. In life, we often to accept to do things that is not our most preferred choice, because the benefits of doing so outweighs the costs. However, accepting a higher level of risk in avalanche terrain may be lethal. It is therefore important to raise the question of *why* we choose to do so. Our analysis suggests that individuals without formal avalanche training are more likely to accept to ski risky terrain. To avoid avalanche accidents, it may therefore prove fruitful to have participants in avalanche awareness seminars and one-day courses reflect on how their choices depend on the preferences and actions of others.

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Footnotes

[1] See the online *Appendix B*, or Hendrikx and Johnson (2014) for a definition of backcountry travel skills.

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[2] Touring on skis/splitboard/snow shoes in mountainous terrain that is not possible to reach from a ski lift.
[3] The distribution is the same if we separate between the decision to ski either the Bowl or the Chute. We then find that more individuals are willing to accept to ski the Chute, than state that they would prefer skiing this run. Since some individuals rate the Bowl and the Chute as equally risky, we do not want to treat the Chute as a riskier choice.
[4] When we use the participants' subjective risk evaluation of the different slopes, we can also conduct a Wilcoxon signed rank test of equality in perceived risk between preferred and accepted run on the full sample. The test rejects the null hypothesis of equality in perceived risk ($p<0.001$).
[5] Note that, in the heteroscedasticity robust Probit model, the effect is only significant if we use a continuous measure of the variable. Individuals who agrees strongly with the argument drive the effect (see *Table C.8* in online *Appendix C*).

Tables

Table 1. Descriptive statistics of the sample characteristics

Gender		**Years of BC skiing**	
Female	27%	Less than 1 year	13%
Male	73%	1-2 years	19%
		3-4 years	21%
Age (mean)	34	5 or more years	48%
		Self-assessed ski skill	
Education		Beginner	3%
Prim or sec education	20%	Intermediate	16%
University: Bachelor	41%	Strong	50%
University: MSc/ PhD	39%	Advanced/expert	28%
Ski days past 5 years		Extreme	3%
0-10 skidays	25%	**Avalanche education**	
11-20 skidays	31%	No formal training	45%
21-30 skidays	19%	Avi Level 1	32%
31-40 skidays	8%	Avi level 2 or 3	20%
41-50 skidays	8%	Professional	3%
More than 50 days	10%	**Avalanche experience**	39%
N	467	N	467

Table 2. Descriptive statistics for individuals who ranked the risk of the runs per our intentions, and for individuals who ranked the risk differently.

	"Consistent" sample	"Inconsistent" sample
Gender		
Female	29 %	20 %
Male	71 %	80 %
Age (mean)	34	35
Education		
Primary or secondary education	16 %	31 %
University: Bachelor	42 %	38 %
University: MSc/ PhD	42 %	31 %
Ski days past 5 years		
0-10 ski days	23 %	29 %
11-20 ski days	34 %	25 %
21-30 ski days	17 %	22 %
31-40 ski days	8 %	7 %
41-50 ski days	8 %	7 %
More than 50 days	9 %	10 %
BSSS-8 (mean)	-0.03	0.11
Years of BC skiing		
Less than 1 year	12 %	15 %
1-2 years	20 %	16 %
3-4 years	22 %	19 %
5 or more years	47 %	50 %
Self-assessed ski skill		

Beginner	3 %	4 %
Intermediate	16 %	16 %
Strong	51 %	46 %
Advanced/expert	26 %	34 %
Extreme	4 %	1 %
Avalanche education		
No formal training	45 %	46 %
Level 1	32 %	31 %
Level 2 or 3	20 %	19 %
Professional training	2 %	4 %
Avalanche experience	38 %	42 %
N	333	134

Table 3. Perceived risk.

	Perceived risk of slope						
	1. Safe	2.	3.	4. (%)	5.	6. Very high risk	Total (%)
The Ridge	63.96	33.33	2.40	0.30	0.00	0.00	100
The Field	10.21	59.16	25.53	4.80	0.30	0.00	100
The Bowl	0.00	6.31	30.33	29.73	27.33	6.31	100
The Chute	0.00	1.50	8.71	22.22	34.53	33.03	100
Number of obs.							333

Table 4. Preferred and subjectively most risky accepted slope.

	Preferred slope (%)	Accepted slope (%)
Ridge	11.71	5.71
Field	66.37	58.56
Bowl or Chute	21.92	35.74
Number of observations	333	333

Table 5. Marginal effects (at means), from a Logit regression. Standard errors in parentheses.

	PREFER	ACCEPT
Perceived risk	-0.081***	-0.228***
	(0.020)	(0.032)
BSSS-8	0.052*	0.168***
	(0.022)	(0.036)
Self-assessed skills		
Level 3	0.127**	
	(0.038)	
Level 4 or 5	0.197***	
	(0.054)	
Formal avalanche education	-0.062	-0.201**
	(0.039)	(0.061)
Experience of avalanche incident	0.081	
	(0.042)	
Admire people who ski steep/exposed	0.094*	0.163**
	(0.038)	(0.056)
Education		
University (Bachelor)		0.183*
		(0.066)
University (MSc, PhD)		0.183**
		(0.065)

N	333	333
Chi 2	79.133	115.514
Pseudo r2	0.226	0.266
AIC	287.128	332.639

+ $p < 0.10$ (0.05), * $p < 0.05$ (0.025), ** $p < 0.01$ (0.005), *** $p < 0.0005$ (0.0003), Bonferroni corrected p-values (two tests).

Figures

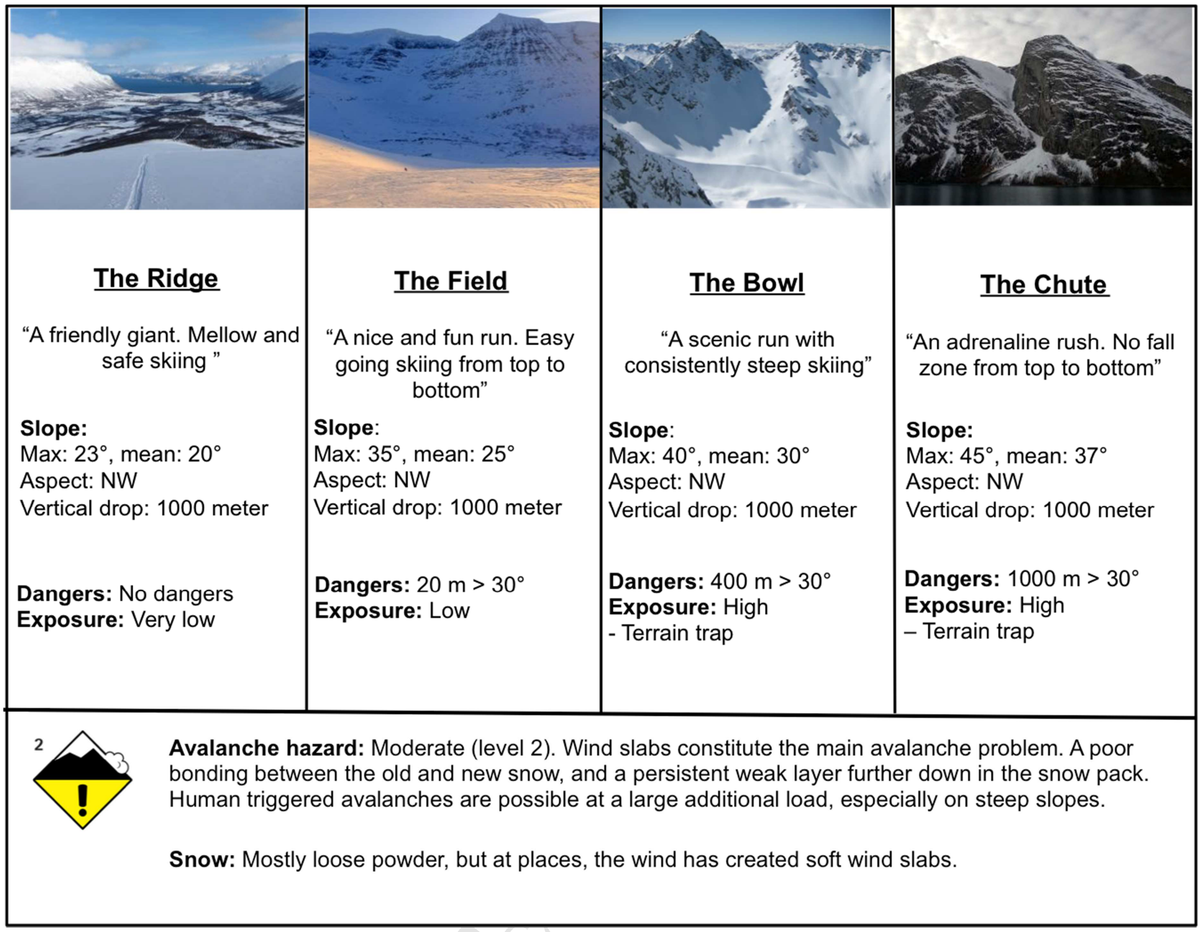

Figure 1. Hypothetical ski runs as presented to participants in our online survey

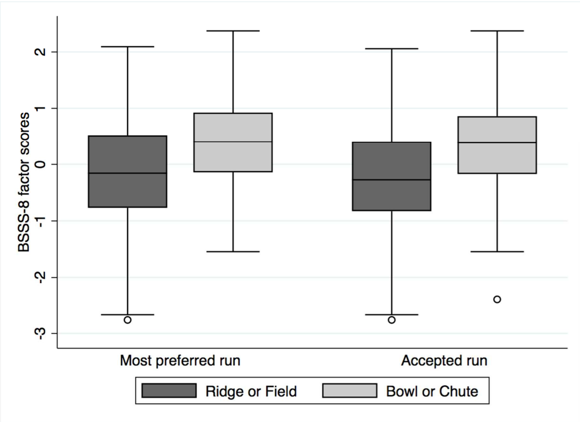

Figure 2a. Sensation-seeking factor scores and hypothetical terrain choices. Bars represent median and interquartile range. Whiskers show min and max values, excluding outliers.

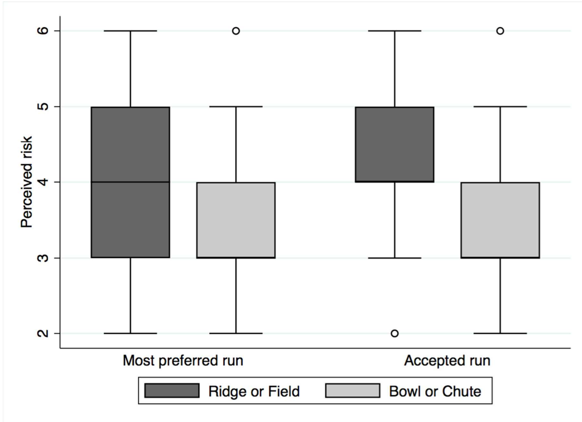

Figure 2b. Perceived risk and hypothetical terrain choices

Highlights:

- Attitudes and perception of risk predict hypothetical choices in avalanche terrain
- Social factors may play an important role in decisions related to avalanche risk
- Riders accept to ski terrain that is riskier than their most preferred run
- Neither experience nor travel skills predict acceptance to ski risky terrain