DECISION MAKING IN AVALANCHE TERRAIN

A concept for an educational computer simulation tool for back-country ski guides with a special focus on human errors

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Abstract: Human errors are well recognised in avalanche education as one of the most important factors causing avalanche accidents. However, to date no adequate methods exist to enable people to learn about their own human weaknesses and ameliorate them. A second problem that contributes to many avalanche accidents is that it is not possible to exactly predict, when an avalanche will occur, since the triggering of an avalanche is a matter of probability and people are not well educated in dealing with probabilities. In order to overcome these two deficiencies, a concept for a role-playing computer simulation tool for backcountry ski guides is presented. Well-documented avalanche accidents, mixed with non-avalanche ski trips, are chosen as scenarios. At the start of the play, the role-player has to choose a role that is defined by two human factors, ambition and popularity, that aim to ensure that the player is acting in a realistic manner. During the simulation, the player has to make many decisions that influence his ambition and popularity as well as his safety. Avalanches are triggered based on a probability function such that the role-player can experience the consequences of relatively small occurrence probabilities and, subsequently, better understands the existing risk management rules.

Key words : avalanche education, human factor, decision-making, risk management, computer simulation

1. INTRODUCTION

Between 1980 and 1999 snow avalanches caused an average of 26 fatalities per year in Switzerland. Additionally, about 90 people on average per year were caught in an avalanche but survived (Tschirky et al., 2000).

Since 1992 avalanche education has started to focus not only on the snow cover analysis but also on risk management strategies to deal better with the uncertainties involved in the decision making process during back-country skiing (Munter, 1991). At the same time, the role of human factors has been recognised as one of the most important factors contributing to avalanche accidents. At present, several avalanche education books exist for back-country skiers (Engler, 2001; Larcher, 1999; Munter, 2003). All provide valuable risk management strategies about how to behave safely in avalanche terrain, including schemes and checklists that simplify the decision making process. These strategies are in good agreement with analytical decision making approaches (e.g. Dawes (1988), Yates (1990)) and include also elements of naturalistic decision making (e.g. Klein (1999)).

However, referring to the well-known quote "Tell me and I forget. Show me and I remember. Involve me and I understand." (either of Lao-Tse or Confucius), an educational tool is still missing that not only allows skiers to train the application of these strategies as often as possible in realistic situations but helps to thoroughly understand and subsequently accept these rules. The existing books are somewhere in between "tell me" and "show me" but are not at all "involve me". When it comes to human factors, it is especially important to be involved, in order to learn more about everyone's own human weaknesses. Schank (1997) who developed learning tools for business companies, stated that the best way of learning is by doing, failing, and practicing. Because most organisations can't afford massive on-the-job failure, Schank created a safe place to fail and learn: he rebuilt the reality with computer simulations and let the people learn using role-playing scenarios in this virtual reality.

Because avalanches accidents are often deadly, backcountry ski guides can not afford massive on-the-job failure either. Therefore, the goal of this paper is to propose a concept for a computer simulation tool that is based on role-playing scenarios in a virtual back-country-skiing environment. Within this computer simulation, backcountry ski guides have to make decisions that may lead to successful ski-trips or end in failures. Most fatal accidents are well documented in Switzerland (Winterberichte, 1936/37 - 1996/97). Information regarding location, the number of persons involved, the avalanche bulletin, detailed snow cover descriptions are available. These accident descriptions are a useful resource for developing challenging and close-to-reality scenarios. Within this concept of a role-play computer-simulation a special focus is directed to the integration of human factors.

The paper is structured as following. The next section gives a short summary about the existing rules how to behave in avalanche terrain in order to provide some basic understanding for readers that are unfamiliar with snow avalanches. Afterwards, the most important existing deficiencies in teaching and implementing these rules for backcountry ski guides are described. The fourth section provides reasons, why a computer simulation tool is suggested to overcome the identified deficiencies. In the final section the basic ideas of the tool are presented.

2. STATE OF THE ART IN AVALANCHE DECISION MAKING: EXISTING RULES

Munter (1991) introduced a risk-based approach to avalanche education in 1991. The physical methods were supplemented by including typical human factors contributing to avalanche accidents. Later, Munter developed and refined the so called 3x3 scheme that systematically structures the back-country ski trip planning in order to reduce planning errors (Munter, 1997). Table 1 shows the core elements of this 3x3 matrix with the most important checks and questions.

Table 1. 3x3 backcountry trip planning scheme. Modified after (Munter, 2003)

	A)Snowpack/Weather	**B) Terrain**	**C) Human Factor**
1) At Home (Trip Planning) → Researchable information	Check: avalanche report, weather forecast, information from locals, etc.	Use: 1:25'000 map, guide books, photos, own knowledge of terrain	Who's coming? Skill level? Equipment? Who's responsible?
2) Local (At arriving at start location: Visible area) → Observations before setting out	Assess: general snow conditions, wind direction and loading, new snow amounts, oddities, visibility, temperature	Check info you've previously received, i.e. relief, slope angle, steepness, ski tracks, convex rolls etc., Are there existing ski tracks- how many and when made?	Who's in my group? Is the equipment and transceivers complete? Time plan for tour? Itinerary left with someone?
3) Zonal (Exact location of questionable slope) → Go or not to Go	Check new snow amounts, Visibility, Solar radiation, Assess possible slab potential, What's keeping the snow together?	What's above and below me?, Steepest part of slope, convex rolls? Near the ridge? Any wind pockets?	Tiredness of people, discipline, technique, are distance between each other necessary (precaution measures)?

Starting with the trip planning at home, the checks are refined in three steps until a decision has to be made whether or not to traverse a critical slope ((1) at home, (2) at the starting point of the ski trip (local), and (3) at critical locations during the trip (zonal)). At every level, three basic factors have to be checked: (A) The snow and weather conditions, (B) the terrain and (C) human factors.

Munter (1997) based his hazard assessment strongly on the hazard level H of the public avalanche bulletin (i.e. 1=Low, 2=Moderate, 3=Considerable, 4=High, 5=Very High) that is updated daily in Switzerland. Based on extended snow stability studies, he found that the danger potential D is a function of the hazard level according to Equation 1.

$$D \approx 2^{H} . \tag{1}$$

Based on these field studies, Munter developed a risk reduction method. He analysed avalanche accidents with respect to terrain parameters, group size and particular precaution measures for different avalanche hazard degrees and developed based on this study reduction factors RF that reduce the risk of an avalanche triggering. The idea is to reduce the damage potential D defined by the hazard degree H using these reduction factors RF to an accepted remaining risk level $R = 1$ according to Equation 2,

$$R = \frac{D}{RF * RF} \leq 1 . \tag{2}$$

Table 2 shows the reduction factors RF to be used in Equation 2.

Table 2. Reduction factors RF as stated by (Munter, 2003)

Category	Description of risk reduction	RF
Slope (first class)	1) Steepest slope portion between 35 and 40°, or	2
	2) Steepest slope portion 35°, or	3
	3) Steepest slope portion of less than 35°	4
Aspect and frequency (second class)	4) Avoid northern slopes: NW (incl.) - N - NE (incl.), or	2
	5) Avoid northern half of slopes: WNW (incl.) - N - ESE (incl.), or	3
	6) Avoid all critical slopes and altitudes specified in the avalanche bulletin	4
	7) Frequently skied slopes	2
Precaution, group size (third class)	8) Large groups with distance between each other person	2
	9) Small group (2-4 persons), or	2
	10) Small group with distance between each other person	3

Several derivates of the Munter approach were developed recently and tools such as colour-coded schemes, check-lists etc. were created that allow an even easier and more structured way to make decisions (Engler, 2001; Larcher, 1999).

For the purpose of the concept of an educational computer simulation tool it is important to understand, that there exist clearly defined rules about what risk level is acceptable. These rules can be used as objective safety measure to assess the decisions people made in the educational simulation tool.

3. IDENTIFICATION OF THE EXISTING DEFICIENCIES IN AVALANCHE EDUCATION

All the above mentioned new European methods as well as some North-American avalanche safety experts (Atkins, 2000; Fredston et al., 1994; Tremper, 2001) emphasise the importance of human failure as cause of avalanche accidents. Most of them deal with the "human factor" by mentioning, explaining and visualising as well as possible the most important human factor categories such as pride, "ego", hubris, "herding instinct", "testosterone effect", poor communication (Fredston et al., 1994), over confidence, complacency, poor group management (Atkins, 2000), "lion syndrome", "sheep syndrome", "horse syndrome" or cultural arrogance (Tremper, 2001). However, mentioning, explaining and visualising is often not sufficient to really change the way people behave. Fredston et al. (1994) provided a very illustrative example for a failure of theoretically teaching and discussing human factor aspects:

> "During one avalanche workshop with very unstable snow, the instructor picked a goal that was unrealistic for the conditions and knew that the group would have to turn around when they reached a certain crux spot. The group reached this last safe spot, ate lunch, and talked in great detail about all the clues to instability and the high avalanche potential. Everyone then put their packs back on and the group continued uphill. The instructor let them file out ahead of him, knowing that they could move about 40 meters before they were in real danger. The last person in line turned around, saw the instructor standing in place, and asked if he was coming. The instructor answered "hell no" and the group scurried back. They were asked why they decided to go in the face of all the data and were amazed when they discovered that even in an avalanche workshop, where communication is encouraged, they had fallen victim to peer pressure and the "sheep syndrome". They learned far more from falling into this trap than if they had just been told to turn around by the instructor." (Fredston et al., 1994).

In avalanche education there exists a deficiency of provoking traps, where human factor and other avalanche safety aspects can be learned by self-experience instead of only by reading about them in guidebooks or by being told by instructors. This experience is very important, since not all humans have the same human weaknesses. Therefore, it is crucial for every backcountry skier to identify and experience his or hers own human factor weaknesses and also to accept them in order to know in what kind of situations he or she has to take them into account. The problem is that such self-experience in real avalanche terrain is usually very dangerous.

Therefore, a method is needed that allow the participants of avalanche safety courses to make valuable experiences in a safe environment. In search of such techniques, Atkins (2000) found that in the aviation industry, fire fighting and military already several techniques have been developed to reduce the human factors in accidents. Orasanu and Martin (1998) provide a very comprehensive overview about errors in aviation decision-making and suggest strategies to improve the capabilities of aircrews. They split the problem into two parts: situation awareness and course of action. One point to improve the situation awareness is to provide to the pilots better diagnostic information and more accessible, comprehensible and integrated displays that show trends. Within the topic of avalanche safety, methods such as Munter's 3x3 checklist or the reduction method in combination with frequently updated avalanche information, that is now available on the internet exactly meet this demand.

As a second point, Orasanu and Martin (1998) mention the need to improve a decision makers experience by giving them better training: if they have a large number of exemplars to choose from, they will be able to select a model which more closely fits the problem. For avalanche education, we would have – as already mentioned – a lot of exemplars of such failures in the detailed accident descriptions (Winterberichte, 1936/37 - 1996/97), but they are not easy accessible by everyone.

Another deficiency is also related to the same problem: the consideration of likelihood of different course of actions is a problem. Orasanu and Martin (1998) stated that people are notoriously poor at integrating numerical probabilities. If an aircraft crew have been encountered in the past a somewhat similar risky situation and the crew has successfully taken a particular course of action, they will expect also to succeed this time. Given the uncertainty of outcomes, in many cases they will be correct, but not always. Reason (1990) called this "frequency gambling". Skiing a slope above 30° is always frequency gambling, since there is always a particular risk that an avalanche can occur. Since the exact instability pattern of a slope is unknown (Conway and Abrahamson, 1988; Landry et al., 2003), avalanche triggering is related to a probability. Part of the problem is that if nothing happens, you never know how close you have been to an avalanche triggering: you don't know how dangerous your "frequency gambling" was. A likelihood of 1:20 to trigger an avalanche in a particular slope is far above the accepted remaining risk, but in average this likelihood allows to ski this slope 19 times without that anything happens. Of course, the education methods will urge you not to ski such a slope, but if one sees others skiing this slope without anything happening your trust in these rules may be weakened. Therefore, it is important to have a tool that helps to understand better the essence of the likelihood.

4. OPPORTUNITIES OF COMPUTER SIMULATION TOOLS

Schank (1997) pictured an ideal computer simulation tool as follows:

> "You would be thrown into scenarios just as trainees are; you would be asked to make decisions and solve problems related to skills you are training for; and you would invariably make mistakes. When you messed up, you would have alternatives about what to do next. … You could hear an expert tell a story related to your failure; or you could start over and try again… Participants get angry, upset, confused, challenged, entertained and rewarded as they move through the plot."

If we compare this statement to the deficiencies mentioned in the previous section, we can recognise several connections: "Provoking traps" and "you would invariably make mistakes" or "lack of valuable role playing scenarios" and "you would be thrown into scenarios". With today's multimedia technologies it is possible to provide many scenarios derived from real accidents as well as non-accident trips. They can be elaborated to be very similar to reality in an attractive and entertaining way. Participants will be involved as interactive role-players and they are allowed to fail, since failing in a computer simulation game is safe and not embarrassing. One can also easily test the limits in order to better understand them. Barry LePatner once stated about learning by failing: "Good judgement comes from experience, and experience comes from bad judgement" (cited after (Tremper, 2001)).

Dörner (1989) used several computer simulations to scientifically study the behaviour of humans to solve complex problems such as to improve the welfare of the Moros, an African community. He underscored the fact that his models do not use "dirty tricks" to provoke failures of participants. Sometimes, the models are based completely on physics (i.e. the refrigerating storage house experiment, p. 201ff.). Other models are logically consistent and the participants mostly agree with the models when the driving model laws are disclosed to them after the computer simulation. Computer simulations have the advantage that there has to exist a well-defined model in the background that drives the simulation and evaluates the decisions of the participants. This model can be disclosed to participants after the computer simulation. The participants can later discuss whether or not the model is realistic.

Another advantage is the time-lapse capability of the computer simulations. In Dörner's Moro simulation, 20 years where simulated in 2 hours. This time-lapse capability provides the trainees with many more opportunities to make decisions than in real world experiences. Therefore, it is possible to gather in a relative short time a lot of exemplars. These exemplars are not only presented to the user, but the user is directly involved in the decision making process.

Finally, computers may also help to ameliorate the human inability to deal with low propabilities. Since likelihood can be easily integrated into the simulation, people can experience the consequences of probabilities and start to learn to understand them.

5. CONCEPT OF A SIMULATION TOOL FOR BACKCOUNTRY SKI GUIDES

5.1 Principal goals of the concept

The concept of a computer simulation tool aims to overcome some of the identified deficiencies in avalanche education. It does not at all aim to compete with existing methods. On the contrary, it should be built directly on the existing knowledge and rules of how to behave in avalanche terrain. The target audience are not beginners, but backcountry ski guides, that already know the basic rules of backcountry ski safety. To them, the simulation game should provide an attractive and valuable training tool that:

a) allows to frequently apply the existing rules;
b) provides a realistic, but safe environment, where failures are possible;
c) enables experiences with a special focus of the recognition of everyone's own human factor weaknesses.

The bottom line is to involve the participant as much as possible to create a better understanding of the existing knowledge and rules.

5.2 Structure of the simulation tool

The 3x3 approach of (Munter, 2003) is used as a basis for the structure of the simulation, since it is well accepted within the back-country skiing community. Using the 3x3 approach the participants of the simulation proceed in the same way as they would on a real backcountry ski trip. Figure 1 shows the 3 spatial steps (1-3) as well as the 3 thematic factors (A-C) that have to be considered at every spatial step.

In the following, the three steps and the three factors are briefly outlined in order to provide a more detailed understanding of the procedure of the simulation structure. The factors that are involved in the simulation are indicated each time with the letters (A), (B) and (C) according to the legend in Figure 1.

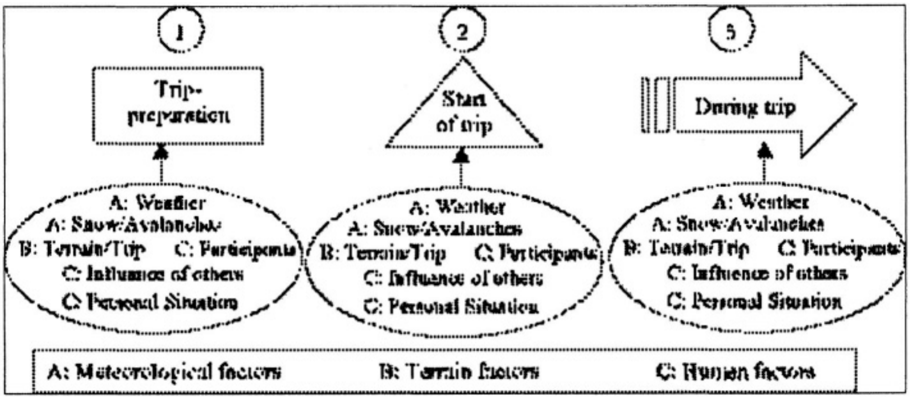

Figure 1. Structure of the backcountry skiing avalanche simulation game.

5.2.1 Preparation at home

The idea is to start the simulation with the planning process about 3 days before a ski-trip. At this time, the computer provides a randomly generated weather forecast for several areas (A). The person that plays the simulation (in the following named "actor" or "role-player") has access to the avalanche bulletin that is related to the given weather forecast (A). Based on this information, the actor – in the role of the back-country ski guide – has to make the decision whether or not to go on a ski trip and if he or she decides to go, where to go (B) and with whom to go (C). The terrain and trip descriptions (B) will be similar to those in reality (guidebooks, pictures, maps etc.). At this stage, the influence of others (C) can be: advice of colleagues, mountain guides etc. The potential participants are described in detail with respect to their skills, experience, fitness and behaviour (C). The actor has to define a time schedule for the ski trip and give instructions as to what equipment is necessary to take with.

5.2.2 Start of the ski trip

The computer simulates the travel to the ski tour departure point. Usually everything will go as planned and no tune delay will result. But the simulation may also introduce – driven by probability functions of various events – delays caused by reasons such as that one participant was still asleep at the appointed time or problems with cars, etc. Therefore, the proposed time schedule has to be compared with the real time spent with travelling and in case of a delay, its impact has to be assessed.

At the ski tour departure point, the actor receives an update of the weather and avalanche situation in the region of his ski trip by the simulation

(A). This information has to be evaluated with respect to the consequences for the planned ski trip. The actor has also to make a material check and security (beacon control). Also these tests will not always be perfect and the actor has to assess the consequences of failure with respect to material (C).

5.2.3 During the ski trip

Every ski trip has several decision points, i.e. points, where the actor has to decide whether or not to proceed the ski trip as planned, to take additional safety measures or to return. The decision will be influenced by the weather and avalanche situation that may or may not change during the trip (A), by the ability of the group to match the proposed time schedule (reasons for delays could be: not fit enough, material problems etc.) (C) and by the decisions of other groups (C). The decision will also be influenced on the terrain (B), i.e. the steepness, the aspect of a single slope portion. The terrain elements can be visualised using videos, images and digital maps.

5.3 Including the human factors in the simulation

As we have seen already, the human factor is a very important element in the decision making process. Tremper (2001) put it the following: “Human factors are woven into the fabric of every avalanche relevant decisions” or “Human beings have not only intelligence but also emotions and often, emotions are much stronger than intelligence”. Another very interesting quote comes from the Canadian Mountain Helicopter ski guide Roger Atkins “Staying alive in avalanche terrain probably has more to do with mastering yourself than mastering any knowledge of avalanches” (cited after (Tremper, 2001)). All these human factors are well recognised as important, but unfortunately there does not exist an easy and convincing way to train the mitigation of these factors.

Making a training simulation game that tries to include the human factors appears to be difficult, since the actors will be very well aware of the fact, that the simulation may try to provoke human errors and thus, since the computer screen is not reality, the emotions that usually prevail will disappear and therefore every actor will try to play it safe, which should be quite easy with a normal intelligence and an average knowledge of the avalanche safety basics. Therefore, it will be one of the most difficult tasks of this simulation tool to introduce realistic human factors nevertheless, i.e. to provoke human error.

The basic idea to include the human factors in the simulation is to replace the emotions occurring in reality by artificial emotional parameters within the role-play. Before starting the simulation game, the actor has to choose a role (i.e. mountain guide XY, mountaineering club guide WZ). Every role is defined by two emotional parameters: (1) ambition and (2) popularity. Ambition is meant as: “Am I myself satisfied with what I have reached” and popularity is meant as: “What are the others thinking of my decisions”.

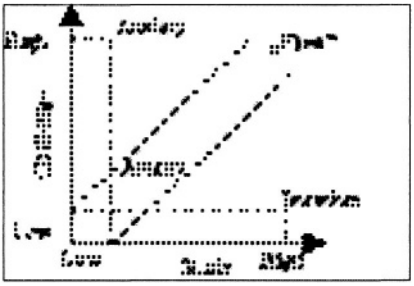

Figure 2. Sketch of the “flow” concept of (Csikszentmihalyi, 2002).

The ambition parameter is linked strongly to the “flow” concept of (Csikszentmihalyi, 2002). Following the core elements of this concept shown in Figure 2, every human being needs “flow experiences” in order to be satisfied with his or her living.

If someone is confronted with a lot of challenges but has no skills to manage them, he or she will be anxious. On the other hand, if someone has a lot of skills, but no challenge, it is boring. No skills and no challenge leads to apathy. What makes life really satisfying is when you are able (i.e. when you have developed the necessary skills) to manage even high challenges smoothly. This is what Csikszentmihalyi calls “flow experiences”. Back-country skiing is challenging since it can be dangerous and as mentioned by Munter (2003) it requires a lot of skills to be a safe back-country ski guide. Thus a backcountry ski trip can provide “flow experiences”. The link to the ambition parameter is that in order to be able to reach the level that allows flow experiences you need to be ambitious: You have to develop skills and you have to accept challenges. Of course not everyone has the same level of ambition, but without any ambition you usually don’t lead ski trips. A person that always wants to climb the most difficult mountains and to ski down the steepest slopes with the best powder snow is considered to be more ambitious than a person that just likes to enjoy a sunny day. Ambition is also linked to the risk. The more ambitious you are, the more likely you are exposed to the avalanche danger.

Before starting the simulation, the actor must chose a back-country ski guide role with an associated ambition characteristics, e.g. a value within a range of 0 – 100, where 0 means: not ambitious at all and 100 means very ambitious. During the simulation (e.g. 4-5 different backcountry ski trip simulations) the actor must gather at least the points (e.g. 75) that are associated with his role. He can gather these points by choosing appropriate trips, powder snow conditions and participants. The more difficult a trip is, the better the powder snow conditions and the more ambitious participants are the more points the actor will collect. If he fails to gather at the end enough ambition points, the simulation is over and the actor failed, because he was not satisfied with his own achievements. The need to achieve this predefined ambition limit should ensure, that the role-player has to take risks in a similar way as he would do it in reality. Since it is a role game one can choose different ambition levels and then experience the consequences of being very ambitious or only moderately ambitious. Finally, it should motivate the skiers to reflect on the own ambitiousness and the one of the colleagues in reality.

The second emotional parameter is "popularity". Decisions are often not independent of the opinions of colleagues or customers. Mountaineering club guides leading ski trips in their spare time like to be popular among their participants, as most humans do. However, mountain guides, that make their living guiding back-country ski trips need to be popular among their clients, otherwise they will not have any customers anymore. Therefore, as for the ambition parameter, you have to reach the number of popularity points that is associated with the role. If the role is the one of a mountain guide this value can be rather high. The gathering of popularity points depends strongly on the participants. If you have very ambitious participants, popularity points can be gathered for more or less the same decisions as ambition points. However, if your participants are very safety concerned you would collect only popularity points, if you make safe decisions.

5.4 Assessment of the decisions with respect to safety

The decisions of the actor will be assessed with respect to the safety in two ways. The first assessment will be, whether or not the group triggered an avalanche. When the group triggers during the simulation an avalanche, after the actor decided to ski a particular slope, it is a very strong indication, that some decisions were wrong with respect to the safety standards. The second safety assessment is based on the reduction method of (Munter, 2003).

We have seen that it is not possible to clearly state whether a slope will avalanche or not. We don't know a priori where the weak spots in a slope are located or whether or not the slope is homogenous. Consequently, it is a matter of probability if and where an avalanche is triggered. Even worse, the probability of an avalanche triggering is usually rather low which makes it more difficult for human beings to understand the risk of an avalanche event. A computer simulation is well suited to deal with probabilities, based on a probability function as shown in Figure 3 in combination with Munter's reduction method.

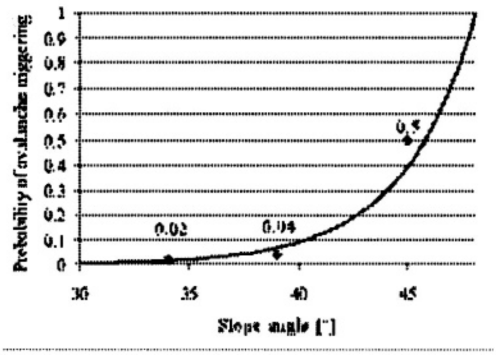

Figure 3. Possible avalanche triggering probability in function of the slope incline for an avalanche hazard level 3 without the application of reduction factors RF as stated in Table 2.

According to this probability function, a group of 10 people, skiing a northerly exposed slope of 45° without the application of precaution measures when the public bulletin hazard level is 3 (i.e. "considerable") will trigger an avalanche event with a probability of approximately 0.5, since no reduction factors RF according to table 2 are applicable. If reduction factors are applicable, e.g. the group size is less than 4 (provides a RF=2), the probability of an avalanche triggering will be 0.5/2 = 0.25 etc. The simulation will be able to determine all elements that are necessary to calculate this risk:

- The actor has to draw on a map exactly the path that he or she intends to go. Based on this path, the steepness and the aspect can be exactly derived;
- The avalanche bulletin provides the danger potential;
- The computer knows how many people are in the group and the simulation provides also information about how many existing trails are in a particular slope;
- Depending on the actor's request to apply precaution measures, the reduction factors will be taken into account.

For each slope, which the actor decides to ski, the triggering probability will be calculated and the simulation will trigger or not trigger an avalanche based on this probability.

The second safety assessment is based on the same parameters, but it does not provide information, whether or not an avalanche was triggered. Based on the same parameters, it is determined according to equation 2, whether or not the decision was above or below the accepted remaining risk:

For every decision point during the back-country ski trip, the reduction method will be used to assess the chosen decision with respect to its safety (point 1: R=0.2; point 2: R= 0.5; point 3: R= 0.2 → overall safety: 0.3 (i.e. safe at every point of the ski trip)). The idea of this second safety assessment is, that if the risk is above the accepted remaining risk, the safety assessment of the actor will be bad, even if he didn't trigger an avalanche during the first safety assessment method. In other words, if the actor decides to ski a slope with a triggering probability of 1:20, he will trigger an avalanche in average only once in 20 times, but he will nevertheless receive a bad safety rating, since he is above the accepted remaining risk.

5.5 Overall assessment at the end of the simulation

The concept of the assessment of the actor is to provide it at the time, when he would also be assessed in reality. During a learning sequence, the actor should play about 4-5 backcountry ski trips. During the ski-trip, he will be assessed immediately with respect to the following criteria:

- Whether an avalanche was triggered or not;
- Whether his decisions have been popular (direct feedback by participants);
- How many ambition points he gathered.

However, the results of the safety assessment by the reduction method will not be disclosed to him, but at the end of the learning sequence after he did several ski trips. The reason is, that in reality, you also don't have a direct feedback on your safety behaviour unless you trigger an avalanche. This aims to provoke the traps, i.e. to get the feeling that you can collect a lot of ambition and popularity points with skiing steep slopes without being reminded always by the reduction method that your risk is far above the accepted level.

The actor should realise, that ambition, popularity and safety are often contradictory and that he has to make decisions with the following goals:

- Satisfy the ambitions;
- Stay on the safe side;
- Be as popular as possible.

The actor should realise, that skiing a slope is always a sort of "frequency gambling" and therefore, learn to accept rules such as the reduction method for his risk management.

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