

## Compiling and studying professional avalanche worker incident data to improve worker safety

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### ABSTRACT:

Avalanche professionals work in a hazardous alpine environment, often under physical and emotional stress. Working in an uncertain, stressful, and risky environment takes its toll on the avalanche community. A growing number of studies suggest that decision-making errors are significant contributors to avalanche accidents. Although decision-making processes leading to avalanche incidents in professional settings are seldomly studied, we believe they play a significant role in avalanche incidents involving professionals. Therefore, attempts to reduce professional avalanche accidents should include improving decision-making. In this paper, we present a road map to improve workplace safety in the avalanche field. Our intention is to create a confidential online database where avalanche professionals can report avalanche related incidents and near misses. The data will be used to better understand the decision-making processes and snowpack, weather, and avalanche conditions associated with professional workplace incidents or near misses. In addition, this database will allow us to develop a decision-making focused training program, gain field experience without hazardous exposure, and improve awareness by sharing case studies across the industry.

### 1. INTRODUCTION:

Avalanche professionals work in a hazardous alpine environment, mitigating avalanche hazard to allow the public to work, travel, live and recreate safely. Occasionally, "unexpected" avalanches occur and catch avalanche professionals, resulting in injury or even death. Incidents involving avalanche professionals should come as no surprise as avalanche mitigation work is hazardous under the best of conditions. Unfortunately, avalanche professionals rarely work under ideal conditions; they work in harsh, exposed, challenging environments. Rapidly changing weather conditions in alpine environments can limit visibility, create communication issues, and shift one's focus to basic survival instincts like staying warm.

In addition to the hazardous conditions in which avalanche professionals often operate, they also face high expectations from peers, management and clients. Avalanche professionals are expected to mitigate hazard and open areas in a

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timely fashion, regardless of weather conditions. Compounding the problem is the fact that some winter operations operate on marginal profit margins, allowing a few decisions to dramatically affect an organization's bottom line.

In addition to the challenges of working with a complex material like snow, professionals working in the avalanche industry encounter many situations that can affect their decision-making and get them into trouble. Many avalanche related incidents involving experienced recreationists can be attributed to decision-making errors (Atkins 2000), and it is likely that this holds true for professionals as well.

In this short paper we briefly discuss situations that appear to influence avalanche professionals' field based decision-making. We outline our project goals and explore possible routes to achieve those goals.

### 2. PAST RESEARCH:

A large body of research demonstrates how social and mental situations contribute to poor decision-making. Miller (1956) highlighted the limitation of the human brain to handle numerous situations at the same time. Tversky and Kahneman (1991) discovered people's

tendency to strongly favor avoiding losses to acquiring gains (loss aversion). Westen (2007) showed that our decision-making is strongly influenced by our agenda, pre-conceived notions, and beliefs. Tavis and Aronson (2007) suggested that our actions reflect our need to self-justify previous actions even though they involved poor behavior and decision-making. And many avalanche professionals work on a few specific slopes throughout the season, possibly rendering them susceptible to the familiarity heuristic (McCammon, 2004).

#### Experience and decision-making

Avalanche programs often operate under limited resources and tight budgets. As a result, many avalanche programs struggle to retain experienced personnel and gain expertise as a whole. The physicist Niels Bohr describes an expert as “a man who has made all the mistakes which can be made, in a narrow field.” Clearly, either this definition doesn’t hold in the avalanche field or there are no experts in this field. However, experience does promote some level of expertise, developing an individual’s expert decision-making strategy. Expert decision-making strategy relies on recognizing a situation as being similar to already encountered situations, mentally testing a response or choosing a response from past experience, and then acting (Klein, 1998). Klein called this process recognition primed decision-making (RPD). The process of recognizing key features of a situation and formulating the appropriate response happens quickly and unconsciously, commonly being described by the experts as “intuition.” The aviation industry successfully uses simulators to help pilots gain experience in situations they may encounter in the future. This simulator training allows pilots to “shift” familiar tasks to the unconscious parts of the brain, freeing the frontal cortex to process complex and previously unencountered situations.

#### Distractions

Avalanche professionals get distracted by the harsh alpine environment, expectations, personal issues, and countless other things. Unfortunately, the amount of information the human brain can process at any given time is limited. Miller (1956) demonstrated that the human mind can only process about seven pieces of information at any given moment. While some individuals possess a greater ability

to “multitask” than others, recent studies show that people that regularly process multiple pieces of information (multitasking) become more easily distracted and less capable of multitasking over time (Ophir et al 2009).

#### Loss aversion

“In human decision-making, losses loom larger than gains.” (Tversky and Kahneman 1991). In other words, people will take significant risks to avoid losing possessions, money, or status. People will also take significant risks to avoid uncomfortable situations (e.g. disappointing others). Recent research (Gal 2006) suggests that sometimes, the phenomena attributed to loss aversion are outcomes of inertia rather than loss/gain asymmetry.

#### Motivated reasoning

Unfortunately, our mind often surrenders to the temptations of motivated reasoning, drawing conclusions that we want to draw instead of objectively examining the situation at hand. Drew Westen (2007) showed that during the 2004 presidential election, both Democrats and Republicans tended to disregard facts that showed inconsistencies in their candidate while being concerned with inconsistencies of the opposite candidate. Further, he showed that when presented with facts contradicting their beliefs, they “shut down” the frontal cortex, the region of the brain responsible for rational thoughts and processing new information. Goal-oriented, type A personalities and those with large egos are especially susceptible to motivated reasoning.

#### Cognitive dissonance

Tavis and Aronson, (2007) describe cognitive dissonance as the internal conflict that ensues when someone holds two inconsistent or polarizing cognitions (ideas, attitudes, beliefs, or opinions). We tend to view ourselves in a positive light as intelligent, rational and moral human beings. When we do something that goes against our self image that we like to project, we self-justify our actions to maintain our positive view of ourselves. Over time, we tend to convince ourselves that our actions were rational, appropriate and well justified, luring us to repeat the same action again and again. For example: many avalanche professionals have experienced an avalanche related near miss

during the course of their career. Many of them tend to regard these isolated near misses as “no big deal” events. Other folks tend to remember how they managed to get away and regard the event as a testimony to their skiing ability rather than a near miss. Some folks even change their technique to fit their newly formed (and incorrect!) opinions (e.g. thinking that ski cutting hard slabs, ski cutting under small pillows, or using fewer explosives in order to save the company’s money are safe, accepted practices). In general, if you have been working in the avalanche field for years thinking you have never had a near miss then you are probably self-justifying.

### Communication

Poor communication, or a lack of communication, can contribute to incidents. Failing to communicate intentions, hazard observations, or other information can cause incidents. Poor communication can give the wrong impression about hazardous condition and can also cause incidents.

We only discussed a few possible cognitive contributors to avalanche incidents, and we are well aware that many more contributing factors likely exist.

### 3. GOALS AND METHODS:

We aim to improve avalanche worker safety by creating and maintaining a database of avalanches that surprised professional avalanche workers. The database would accept snowpack and weather, avalanche and decision-making data. We are committed to maintaining the anonymity of entities, organizations, businesses, and individuals that contribute information to the database; protecting contributors’ personal and financial interests is a priority. We hope to promote workplace avalanche safety by providing data to individuals interested in increasing the avalanche community’s understanding of avalanche phenomena and workplace safety. We envision collecting the pertinent information via online forms and questionnaires that leave room for important first hand accounts of incidents.

Many of the avalanche professionals we know, including the authors, have experienced near misses or were involved in an incident during their career. Avalanche professionals and

avalanche operations that acknowledge, investigate, and learn from their near misses are gaining valuable insight and experience; safety engineers would argue that operations which fail to acknowledge and discuss these occurrences are wasting a valuable opportunity. However, in today’s litigious society, legal counsel often advises operations to stifle the documentation and open discussion of workplace avalanche incidents and near misses. Although they understand the potential safety benefits of openly discussing incidents, lawyers often correctly argue that defending an operation with a proven record of incidents and near-misses is more difficult than defending an operation with no documented incidents or near-misses. We need to ensure that this database will only be used to improve avalanche workplace safety. How can we do this?

The medical, aviation, and structural fire fighting industries already have systems in place to share and analyze incidents and near-misses without increasing individual organizations’ liability or culpability. We would like to reach that state in the avalanche industry. If we are somehow able to achieve this state, we hope that this database would be used to improve our understanding of snow and avalanche phenomena, hazard mitigation techniques, decision-making and human factors leading to avalanche related incidents. Other industries use databases and open discussion of incidents to identify industry wide deficiencies, develop new equipment and training programs, and hone the skills of individuals working in the field. It is our goal to “keep up with the Joneses” and begin collecting avalanche workplace incident data without increasing avalanche professionals’ or avalanche organizations’ liability.

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