

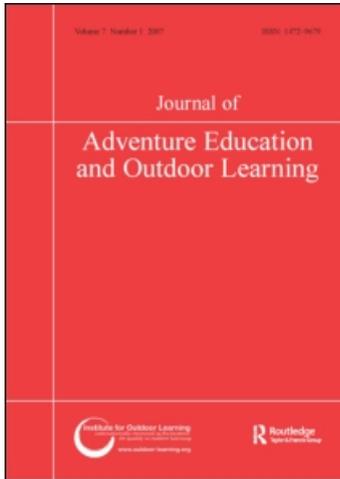
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## Journal of Adventure Education & Outdoor Learning

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t777550184>

### Between safety and risk: A model for outdoor adventure decision making

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Online Publication Date: 01 January 2003

**To cite this Article** Boyes, Michael A. and O'Hare, David(2003)'Between safety and risk: A model for outdoor adventure decision making',Journal of Adventure Education & Outdoor Learning,3:1,63 — 76

**To link to this Article:** DOI: 10.1080/14729670385200251

**URL:** <http://dx.doi.org/10.1080/14729670385200251>

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# **Between Safety and Risk: A Model for Outdoor Adventure Decision Making**

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## **Abstract**

*The quality of outdoor leadership is an important factor in providing safe and enjoyable adventure education experiences for participants. A framework model of outdoor adventure decision making is described and proposes ongoing decisions by expert leaders is about finding an ideal balance of challenge (the interaction of risk and competence). The model draws on naturalistic decision making (NDM) processes and emphasises the importance of situational recognition and prior experience as the basis for sound decision making. The complexity of the socio-cultural environment is recognised with key information being drawn by the leader from the natural environment, people and goals. The model predicts that if situations of over or under-challenge exist then steps are taken to increase or reduce the challenge level accordingly. Failure to recognise or act on critical information leads to crisis situations. Two case studies are presented in support of the model.*

## **Introduction**

For a number of years there has been increasing interest in the outdoor adventure field with participation rates at all time high levels (Kearsley, 1990, 1993; Manning, 1999; Miles & Priest, 1999). In addition, outdoor adventure pursuits are now a mandated component of the New Zealand health and physical education school curriculum (New Zealand Ministry of Education, 1999). Along with increased participation rates comes a need for responsible, safe and enjoyable use of these unique educational environments. The novice often comes with no experience or understanding of adventure activities or contexts, as a result their safety and quality of experience rests in the hands of an experienced leader.

One of the key dilemmas for leaders involved in educational and facilitated adventure contexts has been managing the balance of safety and risk. James (1980, p.20) recognised this dilemma in identifying "without risk, there would be no genuine adventure." While some sort of danger is essential to an adventure process, unmanaged risks, perils and hazards can lead to negative consequences such as fatalities, injuries and psychological incidents. Conversely, too much emphasis on safety will remove the excitement and challenge that was the attraction in the first place (Dickson, 2000). In this paper we present a model of outdoor adventure education decision making that proposes that one of the key tasks for decision makers in the field is managing an ideal balance of safety and risk in order to provide a secure and rewarding experience for participants.

## **The Outdoor Adventure Context**

Facilitated outdoor adventure experiences that involve leaders have an interwoven context where an individual interacts with challenges in the physical environment whilst in social interaction with members of a group. Leaders are guides and facilitators of the experience and have a moral and legal responsibility for the welfare of their group members and the quality of the experience. Outdoor pursuits often provide the activity pattern and environmental context and include activities such as

rock climbing, mountain biking, hiking and canoeing. Participants come from a wide range of socioeconomic backgrounds, cultural preferences, and levels of experience. Hence, they have wide ranging values, attitudes and motivations (Manning, 1999). The social context is omnipresent in a direct sense where social cohesion is linked to success (e.g. large boat sailing) and where tasks require shared work and group problem solving. In these situations, the exercise of interpersonal skills such as co-operation, communication, trust and conflict resolution become paramount (Boyes, 1983; Miles & Priest, 1999). This is less true for activities where the adventure focus is more on the individual (e.g. parapenting); where the social group plays a more incidental role.

Participants in outdoor adventure activities are deliberately seeking activities that feature risk. The motivational aspects of such involvement are well documented (see Csikszentmihalyi & Csikszentmihalyi, 1999; Miles & Priest, 1999; Priest & Gass, 1997). The interrelationship of perceived risk and competence is one of the key aspects that defines outdoor adventure activities and decision-making. Competence is considered to be “the capability to deal effectively with the demands created by the surrounding environment” (Priest, 1994, p.4). Priest recognised that each person has a personal perception of their own competence and the risks associated with a specific activity. Likewise, it could be considered that a leader has a developing perception of the competence levels of the group members relative to the activity. The different combinations of the two parameters of risk and competence form levels of challenge, as amplified in what Martin and Priest (1986) refer to as the adventure experience paradigm. The model proposes that where group and individual competence is at a level capable of handling the risks and associated challenges, the experience is generally viewed as positive and educational. In a situation where risk levels exceed competence, an over-challenging situation exists and where competence exceeds risk, an under-challenging situation could arise. In the former, group members are propelled into a state of anxiety and in the latter a state of boredom (Csikszentmihalyi). For this reason the leader is compelled to manage competence levels and environmental challenges in order to achieve a balance between safety and risk in order to minimise the potential for harm and maximise the educational potential of the experience.

## **Decision Making**

The study of naturalistic decision making (NDM) focuses on how experienced leaders actually make decisions in real life, context-rich environments and includes decisions in a holistic sense from the initial knowledge of the situation (situational awareness), focusing on the salient features (situational assessment), through to option selection, the implementation of a decision and reflection on the outcome. As such, experience, perception and action are important parts of the cognitive process. Based on Orasanu & Connolly (1993), some of the contextual factors that operate in typical adventure based NDM situations are:

1. Uncertain dynamic environments (e.g. the weather).
2. Changing and evolving goals (e.g. physical & social conditions may force a change of plan).
3. Action / feedback loops (e.g. the negative effects of continuing on in bad weather).
4. Time constraints (e.g. the onset of hypothermia demands instant action).
5. Meaningful consequences (e.g. a bad decision can result in an accident).
6. Multiple players (i.e. the social group).
7. The influence of organisational goals and norms (i.e. most adventure programmes operate from an institution or a private operator).

For the individual decision-maker, decisions are made on the basis of prior experiences which can be drawn from actual, real experiences and also include indirect sources like reading, training, discussions and organisational policies etc. These form the basis for pattern recognition (Klein, 1999) where information cues from the social or physical environment are recognised and interpreted. Before an incident occurs a great deal of key information is available. As a scenario unfolds a leader will have a set of knowledge structures and prototypes in operation. In effect, an astute leader will be in a state of *pre-primed* readiness (McLennan & Omodei, 1996).

### **Situational Awareness and Assessment**

Endsley, (1995, 1997, p.270) has focused on the role of situational awareness as the driving force in the decision-making process. She defines it as “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.” She proposes that there are three elements in a situational awareness process. Level one involves the perception of the elements in the environment, in terms of their attributes, status and dynamics (e.g. weather, individual behaviour). Level two synthesises level one elements into a holistic meaningful construct, compatible with one’s goals. In the final level, projection of future status, potential actions and interactions of the elements are considered before a decision is reached and acted upon.

In a similar approach, Klein (1989) proposed a *recognition-primed decision (RPD) model* of rapid decision making that has four main features. The first feature is that experts are quickly able to recognise that the problem is similar to one they had encountered or heard about before, hence the concept of recognition-priming. This judgement of typicality forms the second feature of Klein’s model, described as situational understanding where the decision-maker recognises four types of information that give guidance on how to proceed:

1. Plausible goals relate to “specific outcomes that a decision-maker tries to achieve” (Klein, 1989, p. 53). These provide a picture of what it is possible to accomplish in the given situation and are useful for structuring the decision problems.
2. Critical cues refer to the notion that key items are available amongst the information. Klein observes that experts are able to recognise this key information and forecast causal implications of specific cues.
3. Expectancies, provide an understanding of what is likely to happen and when and therefore prepares the decision-maker for action.
4. Typical actions involve information about likely responses and in particular the generation of the best option as the first one considered.

Another feature of Klein’s model comes from the observation that proficient decision-makers will think through options one at a time until a satisfactory one is found, with the first option considered often the best one. Providing no serious violations are found, the option is adopted. If a potential problem arises then another option is considered until adoption or rejection. Klein describes this process as serial evaluation. In the final feature of Klein’s model, a process of mental simulation is employed to imagine how an option will be carried out, thus anticipating the likely reactions and implications.

### **Team Decision Making**

Because of the social context of outdoor adventure situations it is appropriate to consider the influence of group processes on decision making. Orasanu & Salas (1993, p. 327) define team decision

making where there is “a set of two or more individuals, more than one information source, interdependence and coordination among members, adaptive management of internal resources, common valued goals, defined roles and responsibilities and task relevant knowledge.”

Orasanu (1990) has also identified the cognitive characteristics that support team decision making. She emphasized the importance of *situational awareness* in interpreting situational cues and appreciating their significance. While Klein uses the concept of mental simulation to define and project the situation, Orasanu uses the descriptor metacognition, in that a reflective overview is required at a cognitive distance from the problem. *Shared mental models* is where recognition of the social nature of team decisions is realised. If all are to work toward the same goal, an articulation and sharing of the metacognitive process is important; hence a group understanding of the definition of the situation, the interpretation of cues and information, the plan and strategies proposed, and the roles and responsibilities of the participants. This culminates in resource management to implement the decision by the management and co-ordination of the social resources. Together these four strategies provide a social context for decision making. Situational assessment identifies the problem, metacognition determines a plan, a shared situation model uses the group capabilities and resource management effectively uses the resources available.

### **An Outdoor Adventure Decision Making Model**

The model presented in Figure I takes the perspective of the experienced leader and proposes that one of the key tasks a leader undertakes is to find and maintain an ideal balance of challenge (the interaction of participants' perceived risk and personal competence) as discussed above. It is argued that if this balance can be maintained, then safety requirements will also be met and the experience will be optimised to enable satisfaction for the participants (Boyes, 1999).

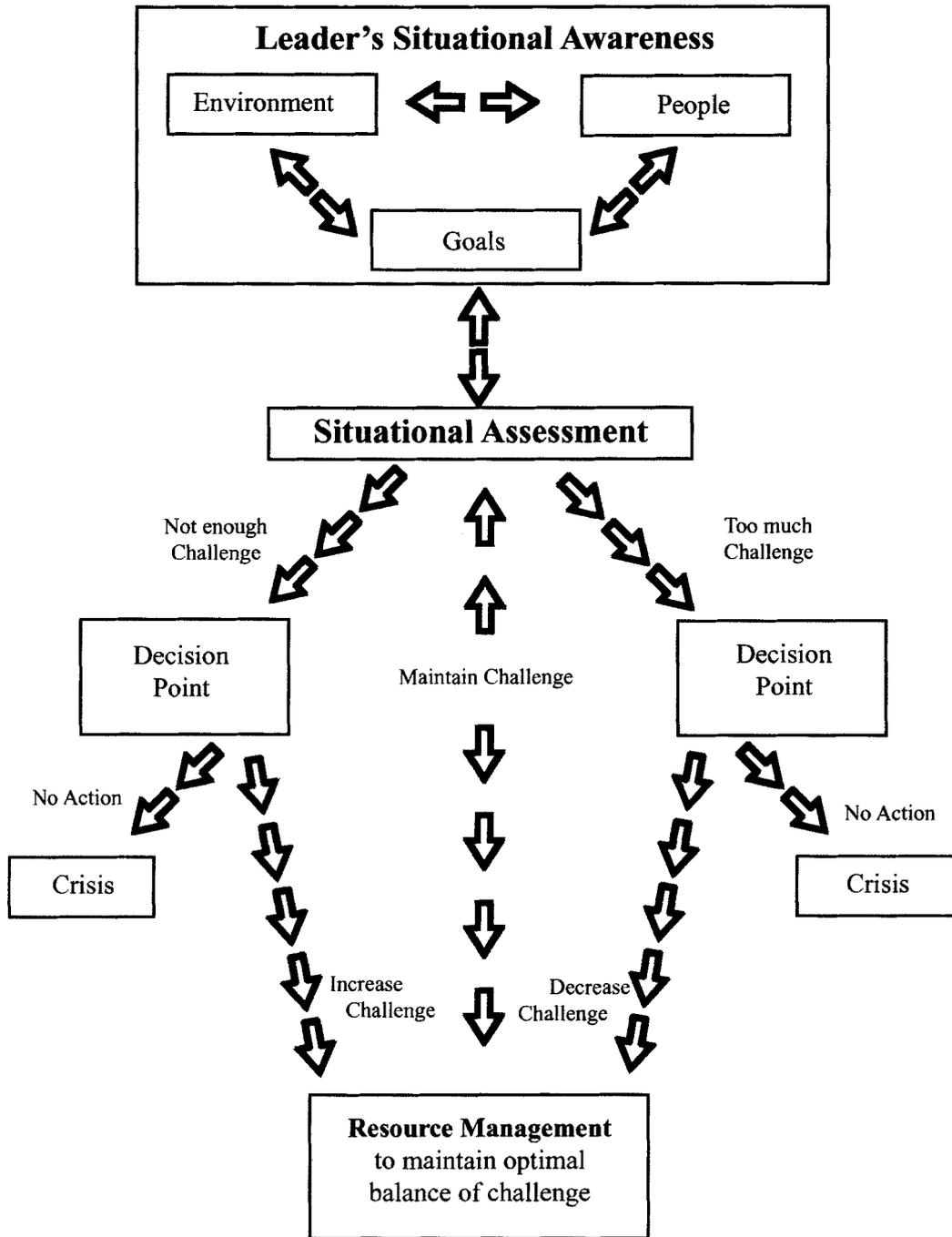
A basic premise is the recognition that the leader is an expert and brings to the adventure situation a repertoire of relevant and contemporary expertise (Priest, 1999; Raiola & Sugarman, 1999). The general flow of the model begins with ongoing information being obtained from two main sources: group members (people) and the physical environment. These information sources are integrated with the goals of the leader (also influenced by institutional goals, customs and practises) to confirm that the group experience is on the right track (situational awareness). Where information indicates an imbalance of challenge is developing, decisions and adjustments need to be made. These are based on making and enacting ongoing decisions that can be seen as taking place via two phases, situational assessment and resource management.

#### **Situational Awareness**

Situational awareness is based on a leader's experiences, beliefs, values and goals interacting with information from the natural environment, the individuals in the group and the social group as an entity. Environmental information is accessed in the form of cues that give meaning to environmental events such as weather, terrain and physical obstacles. At the same time considerable information is forthcoming from the people in the group, both in terms of individual characteristics, behaviour

Figure I

Framework Model of Outdoor Adventure Decision Making (Boyes, 1999)



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and goals (e.g. through verbal & non verbal cues), and also group entity and functioning (e.g. group cohesion, & harmony). When a student-centered approach is applied, the group as an entity could well consider this information.

The leader needs to make sense of this information to form a mental model of the specific situation. As the experience proceeds, this mental model is growing and changing, building an understanding and context for creating and managing the situation. This mental model also provides the basis for the situational assessment phase where recognition of events as typical or atypical takes place (Endsley, 1997; Klein, 1997). By the time a decision is required, the leader is already pre-primed with a good deal of relevant information.

### **Situational Assessment**

This is a more specific process that is triggered by key information cues from the environment (e.g. rain), an individual (e.g. boredom), the group (e.g. misbehaviour), or any combination of these to indicate that an imbalance is developing. The cues generate expectancies about what is likely to happen and when, and typical options for action are evaluated by mental simulation before an option is selected for implementation. The interpretation of too much challenge refers to a situation where the risk factors are perceived to be greater than competence levels and conversely too little challenge is where risk factors are less than competence levels. *Decision points* emphasise that once cues are interpreted as indicative of situations with too much or too little challenge, then action is needed to redress the balance. This action will be to decrease the challenge in over-challenging situations or increase the challenge in under-challenging situations. If the cues indicate things are going well, then “more of the same” may be the chosen strategy.

If the cues are not recognised or action is not taken, then a crisis may eventuate. In over-challenging situations, this may result in psychological or physical injury and/or damage and loss of property. For instance, if the dangers of crossing a flooded river are not recognised then a fatality may result. Similarly, an excessive challenge is likely to create a state of irresolvable anxiety for individuals that is amplified by the group situation, particularly where fear of social failure is a factor. In under-challenging situations the crisis is likely to be a breakdown of the group process so people may seek to increase the challenge level themselves and end up on the over-challenging side of the model in a misadventure situation. An example would be a school group that arrives early at a campsite without a programme of activities for the time available. The children end up being bored and entertain themselves by climbing trees and a fall and first aid type crisis eventuates. Similarly, a challenge that is too easy means that a valuable learning opportunity is lost; hence the crisis is a pedagogical one.

### **Resource Management**

Once a leader has identified from the available cues that an intervention is desirable and an option has been selected, the enactment of the decision requires management of the available social, environmental and other resources. In a team situation, the team may discuss the cues, expectancies and options before coming to an agreed conclusion and group implementation of a course of action. Where a leader is using a more autocratic leadership style (see Priest & Dixon, 1991), the leader may interpret the cues and choose the course of action, but articulation and sharing of the decision and the enactment is still required

The exact nature of the enactment is very dependent on the specific context and the environment often provides alternative options. Where non-engagement with the intended challenge takes place, for instance turning back from climbing a peak because of bad weather, alternatives need to be made available and this relies on a leader having the experience and a repertoire of other activities to smoothly move to a new option. It is useful therefore to carefully select environments that provide a wide range of options. Ideally this will allow for the eventuality that challenge may have to be increased or decreased, hence a hierarchy of difficulty is desirable.

In most cases, the cues will indicate that the activity only needs fine-tuning to ensure success, particularly to meet the needs of specific individuals. Examples would be providing additional social support before an abseil or setting up a mutual support system for a river crossing. To increase challenge levels it would be possible to find a more challenging part of a river to cross or to extend a cross-country ski trip to include an off-piste section. Providing social support is also an option to promote success. Once an option has been operationalised the situational assessment stage is re-entered, whereby the effects of the decision are monitored.

## Method

The purpose of the study was to provide case study support for the adventure decision-making model by documenting decisions made by experienced outdoor leaders in over and under challenging situations. The sample included four females and six males with an average age of 40, ranging from 28 to 54 years. The leaders were well qualified and highly experienced, with an average of 25 years of involvement per person in outdoor adventure leadership situations in New Zealand (Boyes, 1999).

The data was obtained using a process-tracing methodology where the goal was to record the unfolding of an incident including identification of the available cues and their meanings (Woods, 1993). The reports were obtained retrospectively and hence caution was exercised to obtain valid and reliable data by using the *critical decision method* (Klein, Calderwood & MacGregor, 1989). This methodology focuses on memorable and specifically recalled incidents, and cognitive probes are used to acquire information on the natural and sequential flow of events. Information is obtained at its most specific and meaningful level and questions sometimes inquire about strategies and bases for decisions.

A standardised interview guide approach was employed where a list of main questions was devised with an additional supply of possible consequential questions. The interview proceeded with establishing rapport and introducing the interview process. Informed consent was obtained and the participant was asked to recall a specific outdoor adventure incident where the goals had to radically change during the course of an experience. An unstructured account was obtained of the whole incident and a written timeline and other diagrams were developed to record this and also to assist with accurate memory recall. Probe questions were employed to fully develop the detail of the incident and to obtain some of the rationale and basis for the choice of action and the consequences.

Most of the interviews took 40–60 minutes and the data were tape recorded for transcription and analysis with the written transcriptions later returned to the interviewee for verification. The data were analysed using protocol analysis where a coding scheme was developed inductively from the data and this was then compared to the information categories of (Klein, 1989). The initial interview data supported Klein's work so *a priori* encoding categories were confirmed to guide subsequent interviews and analysis. These categories appear in condensed format in Tables I and II and include cues and expectancies, options and implications, and actions and consequences. Each protocol (transcription) was analysed using the SHAPA computer programme (James, Sanderson, & Seidler, 1990) to place key information in the categories and this process was verified with two independent coders recording cross reliability co-efficients of over .90 (Cohens kappa—where 1.0 represents absolute reliability).

## **Results**

From the case studies generated from the interview process, two have been selected as typical of over and under challenging situations. The first case is an example of an over challenging situation during a tramping expedition (hiking or backpacking) where an easier route option was chosen as it was felt the intended route was too demanding. In the second example, a cross-country skiing trip, it became clear not enough challenge had been planned; hence the intended activities were changed to increase the challenge level.

### **Case Study One—Over challenge**

This case study is represented in Figure II and involved a situation where the planned trip was too difficult. The context was a six-day summer tramping expedition walking up a valley in the Southern Alps, New Zealand before climbing onto a saddle and camping at altitude under a mountain peak. The intention was to complete an alpine pass crossing before descending down another valley to complete a loop. As can be seen from the cues and expectancies, the leader's overall impression gained from a range of information was that the planned route over the alpine pass was going to be too difficult. The cues from the group members were particularly salient and this led to a reappraisal of the options and an adjustment to the goals and route for the expedition. Once the leader had selected what he saw as the best option he presented the information to the group and encouraged them to come to the same decision. After discussion, the group members came to that conclusion, eventually felt positive about it and completed a very enjoyable trip.

### **Case Study Two—Under Challenge**

This case study is an example of a situation where too little challenge was apparent. Cross-country skiing formed the context and the cognitive task analysis is charted in Figure III. This leader knew the area very well and had an excellent all round knowledge of the environment including all the trails, off trail features, location of emergency shelters, local snow conditions, local weather patterns and changing weather signals. The group was a school party and the individuals were well known to each other and the leader.

**Figures II Cognitive Task Analysis of Alpine Pass Case Study**

<b>DECISION: Cross the Pass?</b>			
<b>CUES</b>	<b>EXPECTATIONS</b>	<b>OPTIONS</b>	<b>IMPLICATIONS</b>
<p>Had two fine days Forecast was for another fine day, then NW wind with wind &amp; rain</p> <p>Made really slow progress up to the Saddle. Took about 3 hours longer than normal. Some not experienced in steep terrain. Took time for them to find their feet. Some didn't move well, with clumsy movements. Not happy in this terrain. Had to lighten 2 packs on the way up. One with crook ankle. OK though.</p> <p>Group went well together Had tons of gear</p> <p>Could see a hard scree slope ahead of us Couple of snow patches too Checked it out - pretty tricky Pass was harder again We checked out the Pass; very steep, lots of loose rocks, hard to find footing in places</p>	<p>Good weather conditions Should get another good day, then we need to be off the tops</p> <p>Not a strong group on the ground Really worried about their ability to handle the pass The scree slope before it is as bad</p> <p>Lovely group to get on with Really supportive of each other</p> <p>Was going to take time to get group across scree Could fall or be hit by rock in the Pass Would need to belay them down Could get them down but will scare the shit out of them Too rough for this group</p>	<p>Cross the alpine pass</p> <p>Return via the same route</p> <p>Descend via another way</p> <p>Stay put</p>	<p>Would have taken a full day Ground can freeze - may delay start If fail we could get caught out with bad weather coming Would really scare them, some might not return Too rich for this group</p> <p>Some might have seen it as a failure A couple of the guys weren't too happy Still a challenge to get down Another big day, going down harder than up Was hot, dry and dusty Good to be off the tops if the weather clags in</p> <p>Need to pick our way down Is a longer walk, wide valley system Would have added on another day Could be boring but safe Is a new valley though A big problem with transport as our vehicles were at the other car park</p> <p>Could have stayed up there and watched the weather and pulled out fast if things got rough Give folks a rest day, plenty to do Could have done some minor peaks, nice walks from the saddle Might get caught out by the weather</p>
<b>ACTIONS</b>			
<p>We spent a lot of time on it and realised the Pass was not on. Thought about the other valley but transport was a hassle. So went back down the same valley</p>			
<b>CONSEQUENCES</b>			
<p>Seemed quite happy to return and some were relieved, so we were on the button. Had a great trip.</p>			



On the day in question the group arrived at the ski field and began skiing as a group around some of the easier trails. About mid morning the leader realised that he did not have enough planned for the day and that a decision was needed as to extend the trip or not. In defining this situation several cues were recognised. The most important ones centred on observation of individuals where it seemed people were skiing well and could easily handle the conditions. In addition, skiing and weather conditions were conducive to providing more challenge. Consequently, the leader praised the students and extended the trip hence increasing the challenge and providing a positive experience for the participants.

## Discussion

In both of these case studies the leaders already had a good deal of information before the experience began in that they knew their activity and specific environments very well and thus were aware of the dangers and challenges that were present. This enabled them to know valid options both in terms of harder and easier routes and also sites for other activities like camping, snow caving and tubing. In the case of the cross-country skiing trip the participants were very well known to the leader and in the tramping trip less so but still enough to recognise verbal and non-verbal cues and to interpret their meaning. The goals of the trip were established well ahead of time so this information was also part of prior knowledge. In effect, the leaders were pre-primed (McLennan & Omodei, 1996) hence in a sound position to make cognitive decisions in response to changing conditions.

A lot of time was spent on situational assessment with the cues being accurately perceived to build up an understanding of the situation. In the alpine pass scenario, this process occurred over an extended time frame and enabled a projection that there was going to be too much challenge in what was proposed for the next day. Similarly, the understanding of the relatively low level of challenge for the cross-country skiing scenario took place over a morning. This is consistent with Endsley's (1995) and Klein's (1989) positions where experts spend more time on understanding the situation and a lot less time in making the decision. In each case key environmental and people cues were detected and a process of projection of the future implications of the cues can be clearly seen in the task analyses. In the alpine pass scenario, evidence is presented to demonstrate how a leader can influence a participant's perception of the risk factors by reducing pack weight to improve confidence on steep ground and by bolstering feelings of confidence with peer and leader support.

When it came to consideration of the options, both scenarios provide guarded support for the concept of serial processing (Klein, 1989). In the alpine pass scenario the key aspect seemed to be deciding whether to persevere with the planned route or not. All of the attributes of this option were thought through in light of the cues from the group members. Once it was decided that the pass was not an option then other alternatives were considered. At this stage the considerations seemed to be more concurrent where the advantages and disadvantages of each remaining option were weighed. The value of expertise is seen clearly in this scenario as knowledge of the route options and how different groups have reacted in the past was an invaluable part of the leader's knowledge. For the skiing scenario, the leader recognised there were problems with the planned route and activity so a change of plan was needed. In a serial process, the next option thought of was to extend the route and once the implications of this had been thought through, this was adopted. The other available options were not mentioned without a question from the interviewer, so were not a conscious part of the decision itself. Rather, these were part of the tacit knowledge of the expert.

Both case studies had route-based alternatives available to change the demand and risk levels posed for the participants. Initially, the perceived balance of challenge was manipulated by providing adjustments and social support, particularly in the alpine pass situation. Once the situations were interpreted as needing more than that, a decision point was reached beyond which the situations could have deteriorated, eventually to crisis level. Interestingly, in both scenarios the nature of a possible crisis was anticipated (e.g. falling), and this information appears as part of the expectancies and implications. The solution for the alpine pass scenario involved the availability and selection of an easier route, while the skiing group took an extended and harder option. In both cases goals were changed in response to judgements regarding the matching of personal competence and environmental demand in potentially risky situations.

The groups were involved in the process of the decision as per Orasanu's (1990) model of team decision making. While the leader made the decision in the alpine pass scenario, a shared group discussion fully acquainted the group members with the details and implications of the dilemma and encouraged them to come to the decision that was in the leader's mind. In this case skilful but seemingly democratic management of the group gained full support for the action required to implement the decision. This is appropriate for a tertiary group but may be less so for the school skiing group at a younger age level. Here the leader involved the group in the decision making by commending them for their progress and attitude and offered them some extension options to choose from. The consequences were that the extension was completed comfortably and all had a good trip.

## **Conclusions**

This paper presents a model of outdoor adventure decision making that recognises the complexity of leadership situations where groups of individuals are in interaction with a recreational environment with risks and dangers present. It is proposed that one of the ongoing aims of the experienced leader in these environments is the maintenance of a balance of risk and competence to ensure a safe and quality experience for participants. Failure to recognise or act on critical information can lead to crises. The case studies provide anecdotal support for these overall propositions of the model.

The perspective of naturalistic decision making (NDM) was used to retain the reality, context and complexity of decisions made in the outdoors. A compatible methodology was employed to trace the process of leaders' making decisions in under and over-challenging situations and the critical decision method (Klein et al., 1989) has been effective in obtaining full and detailed data. These have been structured into cognitive task analyses of the decisions and have been an effective method of presenting the information. This method provides a way to document decisions and can be employed as a blueprint for examining a range of decisions across the sector.

The case studies are compatible with the work of Klein (1989), where recognition-primed decision making follows a process of the recognition of cues from the physical and social environment as typical of a kind of situation experienced before. This leads to mental projection of the expectancies derived from the cues, the generation of an option for action and the mental simulation of the implications of that option. The leaders depicted in the case studies generally considered options serially before acceptance or rejection, although in part of one case, evidence is presented of

concurrent consideration. The social context of the outdoor adventure situation is supported by the work of Orasanu & Salas (1993) and the case studies provide examples of these processes in action.

The model has also been subjected to quantitative research processes and forthcoming publications will present and discuss the empirical research support. The contribution of the research is in describing and deepening our understanding of decisions made in adventure contexts, to improve the standard of outdoor decision making, and to support the growth of expertise gained from direct experiences. This information will be useful in the design of support and training systems and in the production of teaching resources. It may also make it possible to reduce the time frame and expense needed to develop leader competency and ultimately improve safety in the outdoors.

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