

GROUP DYNAMICS AND DECISION MAKING:  
BACKCOUNTRY RECREATIONISTS IN AVALANCHE TERRAIN

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**ABSTRACT:** Although avalanche literature emphasizes group communication and decision making, little empirical evidence exists regarding how these groups communicate, interact, and make decisions and how particular behaviors influence decision outcomes. This paper presents a portion of the results of a PhD dissertation whose purpose was to describe and determine the prevalence of the decision-making characteristics of recreational backcountry groups when making a decision of where to travel and ride in avalanche terrain. Decision-making characteristics encompassed communication, decision-making processes, leadership, and group factors. Additionally, the study sought information on decision outcomes and group attributes and explored what relationships existed among the characteristics, outcomes, and attributes. This paper presents findings on attributes, decision-making characteristics, and decision outcomes and the relationships that were found to exist between the characteristics and outcomes. Cross-sectional survey research and a newly created and validated instrument were used in this study. Participants were asked to reflect on one 2009-2010 backcountry recreational outing in which they traveled with at least one other person in avalanche terrain. The study included 524 respondents with approximately 70% reporting on an outing that occurred in Colorado. Significant, positive relationships were found to exist between each of the decision-making characteristics and between the characteristics and decision outcomes.

## 1. INTRODUCTION

In most western states, avalanches account for the majority of deaths among all natural hazards (Tremper, 2008). From 1990 to 2007, 423 people died in avalanches in the United States (Tremper). The majority of these deaths occurred while people were recreating in the backcountry, and this number has been increasing over the years as more people have turned to backcountry skiing, snowboarding, and snowmobiling in avalanche terrain (Tremper). The majority of backcountry recreationists do not travel alone. A 2004 study reported that 60% travel in a group, 37% travel alone or in a group, and 1% travel alone in the backcountry at all times (Tase, 2004). Communication and decision making regarding avalanche hazard evaluation and route selection are expected among members of a backcountry group due to the fact they are traveling together and taking on risk in avalanche terrain.

Winter backcountry travel literature acknowledges and emphasizes the importance of group communication and decision making, offers a variety of common communication pitfalls, and provides some suggestions as to how groups should communicate and interact when making decisions. The literature, however, is slim in terms of empirical evidence that supports propositions regarding group communication, interaction, and how these dynamics influence a group's decision making and decision outcomes. Given the level of risk involved in the decisions backcountry groups are making, group decision making in this specific context warranted further research.

The purpose of this study was to describe and determine the prevalence of the decision-making characteristics of recreational winter backcountry groups when making a decision of where to travel and ride in avalanche terrain from the perspective of individuals. Decision-making characteristics encompass communication, decision-making processes, leadership, and group factors. To gain insight on this phenomenon, the study sought information on decision outcomes as well as knowledge of attributes of individual group members and groups as a whole. Additionally, the study sought to determine what relationships exist among group attributes, decision-making characteristics, and decision

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outcomes. To achieve the aforementioned purposes, the study developed an instrument to measure decision-making characteristics, decision outcomes, and attributes of recreational winter backcountry groups. This paper presents findings on attributes, decision-making characteristics, and decision outcomes and the relationships that were found to exist between the characteristics and outcomes.

## 2. CONCEPTUAL FRAMEWORK

When traveling in avalanche terrain and determining whether a slope is safe to ride, backcountry recreationists should consider three variables—snowpack, terrain, and weather (Fredston & Fesler, 1999). The recreationists can be considered a fourth variable in the evaluation process as they are assessing the snowpack, terrain, and weather (see Figure 1) (Fredston & Fesler).

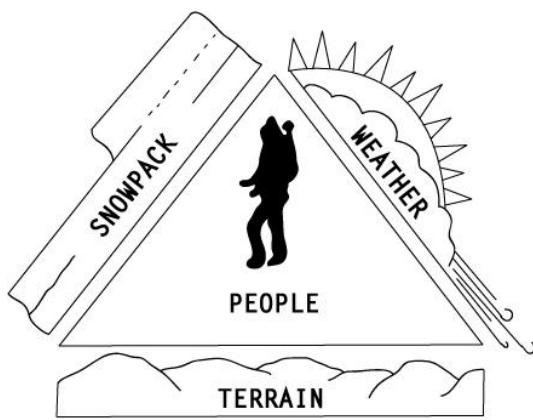


Figure 1. Four variables of avalanche hazard evaluation.\*

\* From *Snow sense: A Guide to Evaluating Snow Avalanche Hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1984 by J. Fredston and D. Fesler. Reprinted with permission from authors.

\*\* Adapted from *Snow Sense: A Guide to Evaluating Snow Avalanche Hazard* (p. 10), by J. Fredston and D. Fesler, 1999, Anchorage, AK: Alaska Mountain Safety Center. Copyright 1984 by J. Fredston and D. Fesler. Adapted with permission from authors. Adaptation consists of the addition of “group,” “communication,” “decision-making process,” “group factors,” and “leadership.”

As this study was concerned with the group aspect of avalanche hazard evaluation, a conceptual framework in which the group aspect is a fifth variable was developed. From a review of the avalanche literature, this study categorized the group aspect into four characteristics: decision-making process, communication, leadership, and group factors. A review of group decision-making literature in organizational studies as well as literature regarding group decision making in high-risk environments confirmed these four characteristics as appropriate for elucidating the phenomenon of group decision making among backcountry recreationists traveling in avalanche terrain. In a review of approximately 187 avalanche accident reports in the United States from January 1, 2004 to May 31, 2009, 41 contained information about group communication and decision making. An analysis of these reports confirmed the four characteristics as appropriate. With the group aspect as a fifth variable, the avalanche hazard evaluation model was adapted to include this variable and its characteristics as an extension of the people variable (see Figure 2).

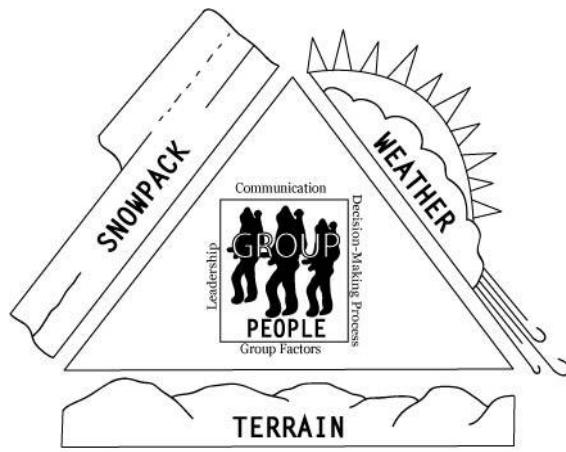


Figure 2. Five variables of avalanche hazard evaluation.\*\*

## 3. METHODS

This study consisted of cross-sectional survey research to establish foundational knowledge regarding groups and their decision-making characteristics as perceived by individuals.

### **3.1 Sampling and population**

The target population consisted of recreationists who travel in groups in the backcountry during the winter with the intent of accessing and recreating on angled slopes. Nonprobability sampling was used, and the criteria that defined the sample members included:

- The participant must have traveled with at least one other person in avalanche terrain during the 2009-2010 winter season.
- The participant's form of travel included telemark skiing, alpine touring (AT) or randonee skiing, cross-country skiing, snowboarding, snowshoeing, or snowmobiling.

### **3.2 Instrumentation**

The instrument was developed to assess the four characteristics of the group aspect. Avalanche hazard evaluation literature as well as that from the realm of organizational studies and decision-making in high-risk environments was used to develop the questionnaire. Four subject matter experts who work in the avalanche hazard evaluation field reviewed drafts and provided feedback on the instrument during its creation.

Those who met the participant criteria and elected to complete the questionnaire were asked to use their most recent recreational group backcountry outing during the winter season of 2009-2010 as a frame of reference when responding to the questionnaire. As the questionnaire consisted of 25 items with many sub-parts, participants were asked to ultimately respond to 92 items. A majority of the items asked participants to select an option on a Likert-based agreement scale, and a fewer number of items provided multiple responses from which participants chose.

### **3.3 Data collection**

Targeted data collection methods were used to locate individuals who met the criteria. Those who did were invited to voluntarily complete the questionnaire. A website was created to serve as a portal for the questionnaire, which was hosted on [www.surveymonkey.com](http://www.surveymonkey.com). The website and the questionnaire were promoted throughout January 2010 on the Colorado Avalanche Information Center (CAIC) website; through emails to members of CAIC and the American Institute for Avalanche Research and Education; and with forum postings on the websites of Powderbuzz, Telemarktips, and Teton Gravity Research.

### **3.4 Data analysis**

Measures of frequency, central tendency, and spread were used for descriptive analysis purposes. Data reduction and correlation and comparison analysis methods were also utilized. The survey instrument was assessed with internal consistency reliability.

## **4. FINDINGS**

The total number of participants in the study was 524, with the number of responses for each questionnaire item varying from 524 to 459.

### **4.1 Attributes**

Approximately 70% of respondents lived in ( $n = 360$ ) and reported their outing occurred ( $n = 359$ ) in Colorado. A third ( $n = 191$ ) of the groups consisted of two members and one-quarter ( $n = 133$ ) consisted of three members. The rest of the groups ranged in size from four to 11+. Group attributes for up to 10 members of a group were assessed. Given the group size findings, group attributes were provided on 1,850 group members. The attributes were gender, age, form of travel, completion of Level One Avalanche training, years traveling in avalanche terrain, and whether the person completing the questionnaire had traveled in avalanche terrain with the other members of the group (see Table 1).

Attributes of Group Members	Number of Groups	Percent of Group Members	Average for Group Members
Gender	523	---	---
Female	---	19.2	---
Male	---	80.8	---
Age (years)	523	---	35
Level One Avalanche training (yes)	522	76.3	---
Traveled in avalanche terrain (years)	521	---	9.5
Traveled in avalanche terrain with person(s) before (yes)	521	81.4	---
Form of travel	522	---	---
Telemark	---	33.7	---
AT/Randonee	---	44.2	---
Snowboard or splitboard	---	9.9	---
Snowshoes or cross-country skis	---	6.6	---
Snowmobile	---	5.6	---

Table 1. Group members' attributes.

How many days respondents typically traveled/rode in avalanche terrain during a winter season was another attribute. Of the 485 who responded, 3.2% chose 1 – 5 days (n = 17), 11.5% chose 6 – 10 (n = 60), 27.9% chose 11 – 20 (n = 146), 20.6% chose 21 – 30 (n = 108), and 29.4% selected 31+ days (n = 154).

#### **4.2 Communication**

A variety of communication characteristics were assessed with 11 questionnaire items. The majority of the items were statements with a Likert agreement scale from which to choose. Some examples of the statements are:

- I shared all the aspects I thought were important to consider
- I felt the group was open to my perspective
- I was influenced by someone's nonverbal cues
- Some members of the group were resistant to different perspectives
- The group had inadequate communication
- Not everyone in the group was involved in the discussion because the group got spread out while traveling.

When responding to these statements regarding their group's communication, the responses with the highest percentage were typically that of strong agreement or disagreement, depending on the statement. Hence, participants reported their group communication to be free of likely errors and to include behaviors suggested in the literature.

#### **4.3 Decision-making processes**

Twenty-two statements with a Likert agreement scale were used to assess decision-making processes. Some examples are:

- The group attempted to reach consensus so that everyone agreed
- The group went with a decision that the majority of the group members supported
- The group's decision was based on the most cautious perspective in the group
- The group followed a specific decision-making process
- The group deferred to the member(s) with the most training to make the decision.

Most responses were agree or disagree rather than strongly agree or strongly disagree. This would be an indication groups and group members are tending toward behaviors suggested in the literature, but improvements could still be made.

#### **4.4 Leadership**

Questionnaire items regarding leadership addressed subtle and more overt aspects of leadership. Five items assessed leadership with a Likert agreement scale. Some examples are:

- The group deferred to the member(s) with the most experience to make the decision
- A group member (including you) really influenced the group's decision of where to travel/ride

- I played an active role in trying to get every group member to voice their opinion.
- One item consisted of multiple forced pairs, which asked respondents to choose one of two aspects on nine leadership traits that would best describe the person who assumed a formal or informal leadership role in their group. A typical leader was male, a high risk taker, took time and included group members in the decision-making process, was diplomatic, valued others' opinions, and had more backcountry experience, ability, and training.

While leadership was assessed with seven questionnaire items, the one item used in further analysis in this study asked whether a group member acted in a formal or informal leadership capacity and how he/she impacted decision making. The literature advised groups to have a leader who seeks opinions from everyone (Tremper, 2001), facilitates open communication (Ellis & Fisher, 1994), and follows a formalized decision process with various checkpoints (McClung & Schaefer, 2006). Less than 5% of participants, however, reported their group appointed a formal leader who facilitated group decision making. Rather, just over 30% reported that someone stood out as the informal leader who helped facilitate group decision making, and approximately 40% said no one stood out as a leader and the group made the decision as a whole.

#### 4.5 Group factors

Two specific decision-making errors were assessed in this study—groupthink and bounded awareness. Of the 12 questionnaire statements that assessed behaviors of groupthink, participants answered ten items indicating groupthink did not appear to be occurring in their group. The two items in which participants' answers tended toward groupthink were their group did not use a specific decision-making aid and went with a decision the majority supported.

The second group factor was bounded awareness, which refers to the circumstance in which a group is bounded by the information that ultimately becomes part of the discussion (Bazerman, 2006). Collectively groups possess more information than an individual does so it would be beneficial if every member of a group shared all the pertinent information he/she had (Bazerman). Research, however, has shown people do not pool all information and instead focus on information known to all members rather than information known to only one (Bazerman; Stasser & Titus, 1985). Three questionnaire items in this study assessed whether group members shared all of the information they had. For each item, participant responses indicated they were sharing all information and hence were not bounding the group's awareness.

#### 4.6 Decision outcomes

Eight questionnaire items assessed decision outcomes. Overall participants' responses indicated they felt comfortable with the decision their group made. They reported feeling very secure with the decision, not feeling like the decision was risky, believing the outcome was not due to just luck, and believing their group made an informed decision. Additionally, of 454 respondents, 59 (11.5%) reported their group triggered an avalanche, and of those, 19 reported someone in their group was caught in the avalanche.

#### 4.7 Reliability

Scale scores representing communication, decision-making processes, groupthink, bounded awareness, and decision outcomes were assessed in terms of Cronbach's alphas (see Table 2). For groupthink and bounded awareness the scores represented the lack of these group factors.

Scale	Number of Items	Number	Cronbach's Alpha
Communication	11	496	.80
Decision-making processes	9	480	.77
Groupthink	11	497	.71
Bounded awareness	3	513	.41
Group decision outcomes	5	505	.66

Table 2. Scale reliabilities for decision-making characteristics and decision outcomes.

Three of the Cronbach's alpha values were considered acceptable as they were above .70 (Field, 2009), and the alpha for group decision outcomes was just below the .70 threshold. The alpha for bounded awareness was lower at .41. The small number of items in this scale could have affected the value of alpha (Blaikie, 2003). The scale scores were used to assess the instrument's internal consistency reliability and in the analysis of relationships between the decision-making characteristics, decision outcomes, and attributes.

#### *4.8 Relationships among characteristics and outcomes*

Using the scale scores for group decision outcomes, communication, decision-making processes, groupthink, bounded awareness, and one leadership questionnaire item, associational analysis was conducted using Spearman's rho. The choices for the leadership item were coded to reflect preferred leadership actions within a group as recommended in the literature (see Table 3).

Leadership Action	Code
The group appointed a formal leader who didn't make a decision but helped facilitate group decision making	4
Someone stood out as the informal leader who helped facilitate the group decision making	3
No one stood out as the formal/informal leader; group made decision as a whole	2
Someone stood out as the informal leader who influenced the decision of the group	1
Someone stood out as the informal leader who made the decision for the group	1
The group appointed a formal leader who made the decision for the group	1
No one stood out as a formal/informal leader; group didn't really make a decision; we just traveled/rode where we wanted to go	1

Table 3. Coding of leadership actions based on literature review.

The choice coded with 4 is the most recommended action in the literature. Those coded 3 and 2 are not recommended as often as that coded 4, yet they are preferred actions over those coded 1. The findings of the correlation analysis are reported in Table 4.

The associations between all of the decision-making characteristics as well as between the decision-making characteristics and group decision outcomes were positive and significantly related. The correlations between communication and decision-making processes (.59), groupthink (.75), and bounded awareness (.78) were larger than typically found in studies in applied behavioral sciences (Morgan et al., 2006), as were those between decision-making processes and groupthink (.68) and bounded awareness (.58). In terms of effect size, these correlation coefficients represent strong relationships between the variables (Morgan et al., 2006). The associations between leadership and the other decision-making characteristics (.09, .12, .13, .22) and decision outcomes (.16) were smaller than typically found and indicative of weak relationships (Morgan et al.). The associations between the group decision outcomes and the decision-making characteristics (.16, .27, .37, .37, .45) ranged from smaller than typical to typical and indicated weak to medium relationships.

Leadership's relationship with the decision-making characteristics and group decision outcomes was assessed by conducting a one-way ANOVA. For this analysis, the leadership item was coded into four categories that represented four types of decision making—leader facilitating group decision making (4), no leader and group making decision as whole (3), leader making or influencing the decision (2), and no leader and no real decision (1). The ANOVA indicated a significant difference of leadership with all of the decision-making characteristics and decision outcomes, and effect sizes ranged from weak to medium. See Table 5.

A significant linear trend existed for each relationship as well. See Figure 3 for these results.

Decision Characteristics and Outcome	Communication			Decision-Making Processes			Groupthink			Bounded Awareness			Leadership			Decision Outcomes		
	<i>r<sub>s</sub></i>	<i>p</i>	n	<i>r<sub>s</sub></i>	<i>p</i>	n	<i>r<sub>s</sub></i>	<i>p</i>	n	<i>r<sub>s</sub></i>	<i>p</i>	n	<i>r<sub>s</sub></i>	<i>p</i>	n	<i>r<sub>s</sub></i>	<i>p</i>	n
Communication	1																	
Decision Processes	.59	.00	523	1														
Groupthink	.75	.00	524	.68	.00	523	1											
Bounded Awareness	.78	.00	524	.57	.00	523	.71	.00	524	1								
Leadership	.09	.04	513	.22	.00	513	.12	.01	513	.13	.01	513	1					
Decision Outcomes	.37	.00	514	.45	.00	514	.27	.00	514	.37	.00	514	.16	.00	513	1		

Table 4. Correlations between decision-making characteristics and group decision outcomes.

The leadership category with a formal or informal leader who helped facilitate group decision making had the highest scores in decision-making processes, lack of groupthink, and group outcomes. This finding provides support for the leadership recommendation in the literature that groups have a leader who encourages communication and helps facilitate decision making (McClung & Shaerer, 2006; Tremper, 2001). The literature also recommended groups make collective decisions (McClung, 2002). In this study, groups who made a decision as a whole without a leader had the highest communication and lack of bounded awareness scores. This is interesting as it could be thought that groups with a leader who deliberately facilitates communication and decision making would score higher on communication and bounded awareness. The specific behaviors of the leader in these groups and the functioning of the groups without a leader, however, were not explicitly known and hence limited further interpretation. Nevertheless, these two types of leadership scored high with all the characteristics and group outcomes, whereas groups who had a leader who really influenced or made the

decision for the group and those groups who did not really make a decision scored much lower.

## 5. CONCLUSIONS

The information gained from this study contributes to the foundational knowledge of the dynamics and decision making of recreational backcountry groups. Many of the study's findings provide support for the literature's recommendations of how groups can best interact and make decisions so as to lessen the risk of being caught and injured or killed in an avalanche. Additional analyses could be conducted with the data from this study, and it is hoped findings from this study serve as a catalyst for additional research on this important topic.

## 6. ACKNOWLEDGEMENTS

Special thanks to Ethan Greene and Spencer Logan at the Colorado Avalanche Information Center, Tom Murphy and Brian Lazar at the American Institute for Avalanche Research and Education, and to Ian McCammon and Knox Williams.

Decision Characteristics/Decision Outcomes	df	F	<i>p</i>	$\omega^2$
Communication	3, 509	16.50	.000	.29
Decision Processes	3, 509	25.27	.000	.35
Groupthink	3, 509	7.58	.000	.19
Bounded Awareness	3, 509	12.44	.000	.25
Group Decision Outcomes	3, 509	15.01	.000	.28

Table 5. ANOVA results of leadership categories with decision characteristics and outcomes.

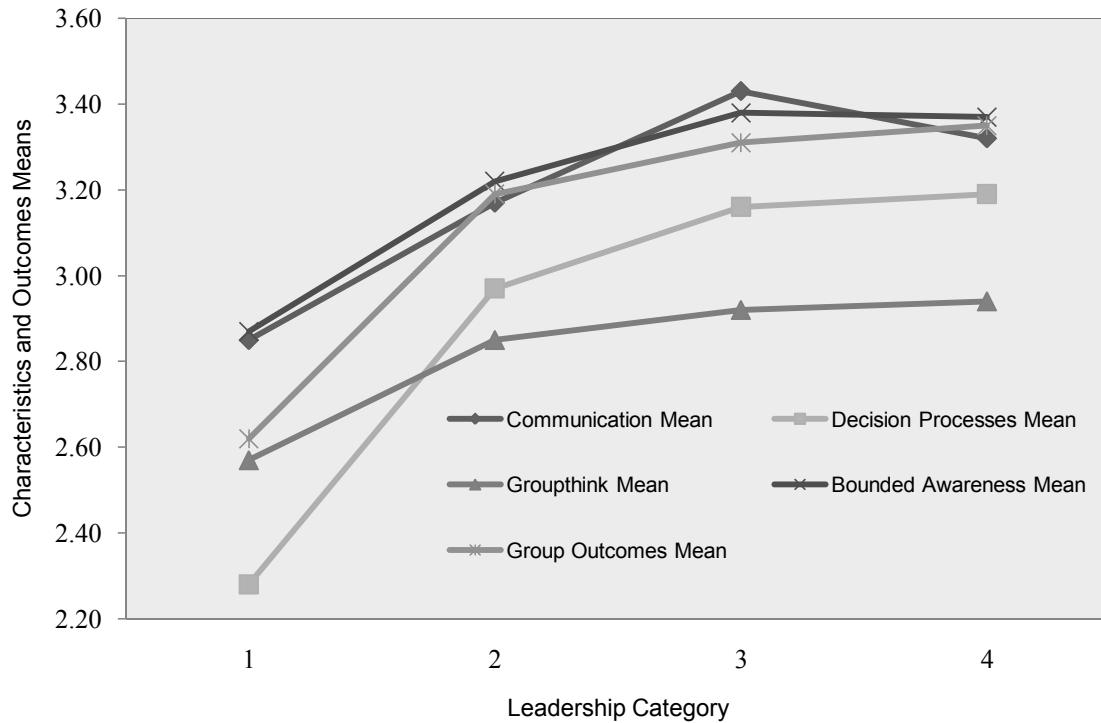


Figure 3. Linear relationship of decision-making characteristics and decision outcomes with leadership.

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