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Factors Influencing Physical Risk Taking in Rock Climbing

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This study was designed to investigate factors influencing physical risk taking in the sport of rock climbing. Specifically, the relationships between physical risk taking, sensation seeking, spheres of control, and desirability of control were examined. One hundred five rock climbers from the United States completed a series of surveys measuring each of the above-mentioned psychological variables. As predicted, physical risk taking demonstrated significant positive relationships to both total sensation seeking and thrill/adventure seeking (TAS). The expected relationships between physical risk taking, personal control and desirability of control were not supported. As hypothesized, no substantive patterns were revealed between physical risk taking and interpersonal control or sociopolitical control. Finally, comparisons between high and low physical risk taking rock climbers revealed significant group differences for total sensation seeking, TAS, and disinhibition. The identification of predictors of physical risk taking is a key step toward identifying individuals likely to engage in high physical risk behavior, and under what circumstances they are likely to do so.

Rock climbing is a popular recreational activity with a growing number of participants worldwide. While it is an activity with numerous intrinsic challenges and rewards, it also carries inherent risks. Several studies have quantified the risk of accident or fatality associated with rock climbing and related mountain sports (Christensen & Lacsina, 1999; Malcolm, 2001; McLennan & Ungersma, 1983); however our understanding of the human factors influencing physical risk taking in rock climbing and related activities remains quite limited.

Physical risk taking behavior is a substantial public health concern with considerable economic ramifications. Millions of dollars are spent annually on search and rescue missions and emergency medical services related to adventure-based activities (Scott, 2003). Not only are physical risk takers increasing the likelihood for their own injury or death, but the members of rescue parties also must often perform in extreme environments in training for and conducting search and rescue operations, thereby risking their own health and lives. Thus, physical risk taking behavior is not only a significant financial and public health problem for risk takers themselves, but also for those who attempt to save their lives.

In their work on sensation seeking and risk behavior, Zuckerman and colleagues (Zuckerman, 1983; 1990; 1994; 2000) provide potential insight into risk



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taking in rock climbing. For instance, sensation seeking (Zuckerman, 1994) is described as the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences. According to Zuckerman, sensation seeking consists of four factors: Thrill and Adventure Seeking (TAS; desire to engage in risky and adventurous activities and sports), Experience Seeking (ES; seeking of stimulation through the mind and senses, through music, art, travel, and even psychedelic drugs), Disinhibition (Dis; seeking of sensation through drinking, gambling, etc.) and Boredom Susceptibility (BS; an aversion to repetitive experience). Not surprisingly, sensation seeking has been found to be a strong and consistent predictor of a general tendency to engage in risky types of behavior, including dangerous sports (Breivik, 1996; Cronin, 1991; Freixanet, 1991; Jack & Ronin, 1998; Zuckerman, 1983). While TAS has been linked most consistently to participation in risk sport (e.g., Zuckerman, 1983), research examining the relationship of the other components of sensation seeking to risk-taking behavior is less consistent.

Although sensation seeking is considered a leading explanation of risk engagement, some researchers (Slanger & Rudestam, 1997) have suggested that it leaves several essential components of risk taking unexplained. For instance, Slanger et al. argued that the sensation-seeking theory proposed by Zuckerman does not account for the possibility that people will take risks in some areas of their lives and not in others, nor does it adequately address desire for mastery and achievement, or factors related to disinhibition (i.e., lack of fear and cognitive recognition of danger). These researchers successfully differentiated between extreme and less extreme risk groups on measures of physical self-efficacy (perceived ability to accomplish desired physical tasks), thus introducing a promising new constituent in risk taking theory.

Extending Slanger and Rudestam's proposed link between physical self-efficacy and risk taking, it is also plausible that individuals may perceive a sense of control in a specific area, or "sphere" of life, and thus may judge themselves capable of handling the sphere-specific challenge, anticipate positive outcomes, and approach risky stimuli in some areas of life but not others. A line of research that may help to more fully explain this question is found in the work of Paulhus and colleagues (Paulhus, 1983; Paulhus & Christie, 1981; Paulhus & Van Selst, 1990). This work suggests

that an individual may have different expectancies of control in each of three different behavioral spheres, termed: a) *Personal Control*, which involves a perception of control over the nonsocial environment, as in personal achievement (e.g., climbing mountains); b) *Interpersonal Control*, which is characterized by a perception of control over other people in dyads or groups (e.g., taking charge of professional meetings); and c) *Sociopolitical Control*, which entails a sense of control over social and political events and institutions (e.g., running for office). Paulhus and colleagues argue that this approach to understanding control is advantageous in that it entails a "systematic partitioning of an individual's control expectancy in useful terms" (Paulhus et al., 1981, p. 167) and that it permits the development of a *control profile* for an individual. This model may be especially useful for further examining the perceptions of control that may underlie the willingness to engage in physical risk, as the individual may exhibit a control profile that is distinguishable from those who do not engage in physically risky activities.

Control-related concepts such as physical self-efficacy and the spheres of control may strengthen our understanding of why people take risks in some areas of life but not in others. While these constructs describe the *perception* of control, some researchers (Hammond & Horswill, 2002; Trimpop, Kerr, & Kirkcaldy, 1999) further suggest a link between risk engagement and *desirability* of control. Desirability of control is best understood as a desire to engage in effective interactions with the environment, in which one experiences him or herself as producing desired effects and preventing undesired effects (Skinner, 1996). While a small body of literature has consistently linked desirability of control to risk taking behavior in gambling environments (Burger, 1986; Burger & Cooper, 1979; Burger & Schnerring, 1982), much less research has examined the role of desirability of control in physical risk taking. The limited research in this area has focused on traffic behavior (Hammond & Horswill, 2002).

The central purpose of the present investigation was to identify factors influencing physical risk taking in rock climbing. To achieve this purpose, the variables of sensation seeking, perceptions of control (personal, interpersonal, and sociopolitical), and the desirability of control were examined as predictors of physical risk taking. Risk was operationalized as "the appraised likelihood of a negative consequence of be-

havior, characterized by personal significance, an uncertain outcome, and the distinct possibility of loss.” *Physical risk taking* was used to describe behavior that is potentially hazardous to one’s health, safety, or well being despite the appraised likelihood of a negative outcome.

Three general hypotheses were advanced in this study. First, it was expected that physical risk taking in rock climbing would have a positive relationship with total sensation seeking and TAS. Because of the equivocal nature of the present literature linking the remaining sensation seeking subscales to risk taking behavior, no specific hypotheses were made relative to these remaining subscales. Second, it was expected that physical risk taking in rock climbing would have a positive relationship with personal control and desirability of control, but not interpersonal or sociopolitical control. Third, it was also expected that participants demonstrating preferences for high physical risk would report higher levels of total sensation seeking, TAS, personal control, and desirability of control than those individuals low in physical risk taking, but that these groups would not differ relative to self-reported interpersonal or sociopolitical control.

Method

Participants

This study included 105 participants in the sport of outdoor rock climbing, recruited from rock climbing clubs and organizations primarily located in the southeast United States. Many participants were from or had climbed in diverse areas of the country as well as internationally. Participants were at least 18 years old, had been involved in the sport of outdoor rock climbing for at least 1 year. As demonstrated in Table 1, the majority of the study participants were male ($n = 80$, 76.2%), European American ($n = 86$, 81.9%), and between the ages of 26 and 35 ($n = 36$, 34.5%). The mean age for all participants was 33.61 ($SD = 10.84$). The majority of the participants ($n = 44$, 41.9%) devoted 3-4 days per week of training to their sport, while 39.0% ($n = 41$) devoted 1-2 days per week to training. Most participants ($n = 35$, 33.7%) possessed between 1 and 3 years of rock climbing experience, while an additional 29.8% ($n = 31$) possessed between 4 and 6 years of experience. The mean number of years of rock climbing experience for all participants was 7.99 ($SD = 8.46$).

With regard to climbing ability, all participants

reported being capable of negotiating outdoor rock climbing routes of at least 5.8 on the Yosemite Decimal System (YDS) (Graydon & Hanson, 1997). The YDS is the most widely used and widely accepted rating system in the American rock climbing community, and categorizes terrain according to the techniques and physical difficulties encountered while climbing. This system differentiates the difficulty levels of climbing routes, and also distinguishes between climbers of varying abilities. According to this system, difficulty levels 5.0-5.7 include climbing routes that are considered easy for experienced climbers, and are where most novices begin. Difficulty levels 5.8-5.9 are where most “weekend” climbers perform, and employ the skills of rock climbing, needed for moderately challenging terrain. Dedicated weekend climbers may achieve a difficulty level of 5.10, and levels 5.11-5.14 are typically characterized as the realm of true experts. Successful negotiation of these climbing levels involves a substantial amount of training, repeated working of a route, and appreciable ability (Graydon & Hanson, 1997).

Climbers in the present study reported higher Yosemite Decimal System (YDS) climbing abilities for the “top rope” and “follow” climbing styles (each rock climbing style is defined in Table 1). Specifically, 65 climbers (63.1%) reported a climbing ability of 5.10-5.11 in the top rope style, 55 climbers (55.6%) reported this same range in the “follow” style, and, similarly, 53 climbers (56.4%) reported this highest range of climbing ability in the “lead-sport” style. Additionally, 40 participants (51.3%) reported a maximal performance level of 5.6-5.9+ for the “lead-trad” style. Finally, 59 climbers (56.2%) reported engaging in free-solo rock climbing (i.e., with no form of protection against falls) above a height of 20 feet (6.1 m) on at least one occasion. Of this subset of participants, the average number of free-solo climbing experiences was 14.49 ($SD = 21.70$).

Measures

Background and Demographic Information. Participants reported their age, gender, primary ethnic identity, frequency of training, rock climbing skill level, years of experience, and frequency of “free solo” climbing (i.e., with no form of protection against falls) in excess of a height of 20 feet (6.1 m).

Risk Taking in Rock Climbing Questionnaire (RTRCQ). The Risk Taking in Rock Climbing Questionnaire was designed specifically for use in the pre-

Table 1: Participant Demographics

Variable	Category	Frequency	Percent
Age (<i>N</i> = 104)	18-25	31	29.8
	26-35	36	34.6
	36-45	20	19.3
	> 45	17	16.3
Gender (<i>N</i> = 105)	Male	80	76.2
	Female	25	23.8
Ethnicity (<i>N</i> = 105)	African American	0	0.0
	European American	86	81.9
	Native American	2	1.9
	Asian	8	7.6
	Hispanic	2	1.9
	Other	7	6.7
Weekly Practice Days (<i>N</i> = 105)	5-7	3	2.9
	3-4	44	41.9
	1-2	41	39.0
	<2	17	16.2
Years of Experience (<i>N</i> = 104)	1-3	35	33.7
	4-6	31	29.8
	7-15	24	23.0
	>15	14	13.5
Climbing Ability (Top Rope)* (<i>N</i> = 103)	5.80-5.90+	8	7.8
	5.10-5.11+	65	63.1
	5.12-5.14+	30	29.1
Climbing Ability (Follow)** (<i>N</i> = 99)	5.60-5.90+	23	23.2
	5.10-5.11+	55	55.6
	5.12-5.13+	21	21.2
Climbing Ability (Lead-Sport)*** (<i>N</i> = 94)	5.60-5.90+	22	23.4
	5.10-5.11+	53	56.4
	5.12-5.13+	19	20.2
Climbing Ability (Lead-Trad)**** (<i>N</i> = 78)	5.60-5.90+	40	51.3
	5.10-5.11+	32	41.0
	5.12-5.13+	6	7.7
Free-Solo Experience (<i>N</i> = 105)	Yes	59	56.2
	No	46	43.8

Table 1 Continued: Participant Demographics

Variable	Category	Frequency	Percent
Frequency of Free-Solo ($N = 49$)	1-10	34	69.4
	11-20	6	12.2
	>20	9	18.4

* Describes a rock climbing method where an anchor system is placed at the top of the climbing route, in order to provide protection for the climber throughout the entire climb.

** Describes a rock climbing method where a lead climber belays, or provides roped protection for, a following climber from above.

*** Describes a rock climbing method where a climber places his or her own protection utilizing bolts that are placed permanently in the rock.

**** Describes a rock climbing method where a climber places his or her own protection throughout the climb placing traditional (i.e., “trad”) protective devices in rock cracks and crevices.

sent study. The investigators generated 12 questions intended to measure the extent to which individuals engage in physical risk during rock climbing. Question development was guided by the operational definition of physical risk taking described earlier: engagement in behavior that is potentially hazardous to one’s health, safety, or well being despite an appraised likelihood of a negative outcome (i.e., injury or death). Each item is scored on a 5-point Likert scale, ranging from 1 (does not apply) to 5 (applies very much). Higher scores on the RTRCQ reflect higher levels of physical risk taking.

While adequate Cronbach alpha reliability (.74) was demonstrated for the initial 12 items in the present sample of rock climbers, a review of the item-total correlations suggested that the reliability coefficient could be further improved with the removal of one item. Specifically, the item, “I have been injured from a fall while rock climbing,” demonstrated poor item-total correlation ($r = .17$), and its deletion resulted in an improvement in Cronbach alpha reliability to .77. Item-total correlations for the remaining 11 items ranged from .29 to .50, and these items were enlisted as a general measure of physical risk taking in rock climbing. A total score was composed from the sum of each item score. Adequate validity of this scale was preliminarily suggested, as it successfully differentiated between high and low physical risk groups on number of free-solo rock climbing experiences ($t = -2.67, p < .01$), a credible marker of overt risk taking behavior.

Sensation Seeking Scale – Form V (SSS V) (Zuckerman, 1979). The SSS V is a 40-item self-report questionnaire that measures individual differences in optimal stimulation levels and optimal levels of arousal. The four subscales of the SSS V include: thrill and adventure seeking (TAS), boredom susceptibility (BS), experience seeking (ES), and disinhibition (Dis). Zuckerman (1979), Rowland and Franken (1986), and Ball et al. (1984) reported similar age and sex differences in sensation seeking, with men and younger people scoring higher. The total score of the SSS V is based on the sum of the four factor scales, and higher scores reflect higher levels of sensation seeking.

In the present data set, reliability analyses demonstrated adequate reliabilities for only 2 of the 4 SSS subscales. Specifically, while the TAS and Dis subscales demonstrated Cronbach alpha coefficients of .68 and .71, respectively; the BS and ES subscales demonstrated alphas of .43 and .57, respectively. Item analyses were conducted (by examining item-total correlations) in an attempt to identify more stable item combinations, yet were unfruitful for both of these subscales. For this reason, the BS and ES subscales were not considered independently in any of the analyses described in the preceding sections. Total sensation seeking, reflecting the sum of all four subscales, demonstrated adequate reliability (Cronbach alpha = .76). Regarding inter-scale correlations, TAS and Dis demonstrated a correlation of .30 ($p < .01$), while Total Sensation Seeking related significantly to both TAS ($r = .58, p < .01$) and Dis ($r = .83, p < .01$).

Spheres of Control Scale – Version 3 (SOC-3) (Paulhus & Van Selst, 1990). The SOC-3 is a 30-item self-report measure of perceived control in three behavioral spheres: personal control, interpersonal control, and sociopolitical control. Extensive psychometric testing has established the reliability and validity of the instrument (Paulhus, 1983; Paulhus, Molin, & Schucts, 1979). A series of factor analytic studies on the original scales (Paulhus et al., 1981) led to a 3-factor solution resulting in a clean separation between the three behavioral spheres, with alpha reliabilities of .75, .77, and .81 for personal efficacy (termed personal control in the present version of the instrument), interpersonal control, and sociopolitical control scales, respectively. More recently, confirmatory factor analysis was used to examine the three-factor model of the SOC-3, and 4 competing models, demonstrating that a three-factor structure was superior to any of the competing models (Paulhus, 1983). Additionally, the original Spheres of Control Scale has been correlated with the Machiavellianism Scale (Christie & Geis, 1970) and Rotter's (1966) Locus of Control Scale.

Reliability analyses in the present data set yielded adequate Cronbach alpha coefficients for two of the three Spheres of Control subscales. Specifically, the interpersonal control and sociopolitical control subscales demonstrated alphas of .78 and .81, respectively; and the personal control subscales demonstrated a coefficient of .44. Item analysis was conducted in order to identify a more internally stable combination of items. Optimal internal consistency was obtained with the deletion of five items (Items # 3, 6, 7, 9, and 10), with the remaining five items yielding an internal consistency (Cronbach alpha) coefficient of .72. Regarding inter-scale correlations, personal control demonstrated significant relationships to interpersonal control ($r = .45, p < .01$), while neither related significantly to sociopolitical control.

The Desirability of Control Scale (DCS) (Burger & Cooper, 1979). The DCS is a 20-item instrument designed to measure individual differences in the general level of motivation to control the events in one's life, with higher scores reflecting higher levels of desirability of control. Acceptable internal consistency (.80) and test-retest reliability (.75) have been demonstrated (Burger et al., 1979) as well as discriminant validity from Rotter's Internal-External Locus of Control Scale ($r = .11$) and the Marlowe-Crowne Social Desirability Scale ($r = -.19$). Examples of items included in the DCS are: "I prefer a job where I have a

lot of control over what I do and when I do it," "I consider myself generally more capable of handling situations than others," and "I am careful to check everything on an automobile before I leave for a long trip."

Although Burger et al. (1979) reported that the high internal reliability of the scale indicates that the scale can be used as an unidimensional measure, two factor analytic studies (Burger et al., 1979) have been conducted on the DCS, resulting in 4 and 5 subscales, respectively. In light of the disagreement between these two studies, the DCS was considered in the present study only as a unidimensional measure of a general desire for control. In the present dataset, the Cronbach alpha internal consistency coefficient for the unidimensional measure is .73.

Procedure

Initial telephone contact was made with the directors of several rock climbing organizations in the United States, during which the general purpose of the study and requirements for participation were explained, and permission was obtained to collect data from individual participants. Individual participants were then contacted by email and asked if they were willing to participate in the study. Willing participants were mailed the questionnaires with postage-paid, return envelopes (return rate = 76.1%). Participants were given clear, standardized instructions to complete the questionnaires, and were informed of their rights as human subjects. Each participant was assured that all responses would be kept in strict confidence. The Institutional Review Board for Human Subjects at the University of North Carolina – Greensboro approved all procedures of data collection.

Data Analysis

Descriptive statistics were conducted to determine the levels and variability of the participants' scores. Preliminary (exploratory) analyses were also conducted in order to examine the relationships of key demographic variables (e.g., gender, age) to the psychological variables of interest.

Pearson product-moment correlation analyses were conducted between Physical Risk Taking and Total Sensation Seeking, and also between Physical Risk Taking and each of the reliable sensation seeking subscales: TAS and Disinhibition. Pearson product-moment correlation analyses were also conducted between Physical Risk Taking, Personal Control, Interpersonal Control, Sociopolitical Control, and Desirability of Control.

To test the hypothesized differences between high and low physical risk takers, the high- and low-risk groups were determined by assignment to quartiles. Based on participant responses on the Risk Taking in Rock Climbing Questionnaire, the highest 25.7 percent of scores were selected to represent the high-risk group ($n = 27$, $M = 30.8$, $SD = 3.99$, average anchored Physical Risk Taking score = 2.7 out of 5) and the lowest 26.7 percent of scores were chosen to represent the low-risk group ($n = 28$, $M = 15.8$, $SD = 2.03$, average anchored Physical Risk Taking score = 1.4 out of 5). This “quartile” system was chosen in lieu of a median split technique in order to more fully maximize the differences between the high- and low-risk groups on the Risk Taking in Rock Climbing Questionnaire. Additionally, a Chi-square test of independence examined relative proportions of males and females across the high and low risk groups, followed by a multiple analysis of variance (MANOVA) to examine possible group differences in age, years of experience, and top rope climbing ability.

Another MANOVA was conducted with level of physical risk as the independent variable and Total Sensation Seeking, Personal Control, Interpersonal Control, Sociopolitical Control, and Desirability of Control as the dependent variables. A third MANOVA was conducted with level of physical risk as the independent variable and the reliable sensation seeking subscales (TAS and Dis) as dependent variables.

Results

Means and standard deviations of all measures are presented in Table 2. The participants in the present sample averaged a 2.1 of a possible 5 on the Likert Scale of the RTRCQ, signifying that these climbers took low to moderate risks and were somewhat safety conscious. Analyses were conducted to explore the relationships between key demographic variables (gender, age, top rope rock climbing ability, and years of rock climbing experience) and psychological variables (Physical Risk Taking, Total Sensation Seeking, TAS, Dis, Personal Control, Interpersonal Control, and Desirability of Control). Significant point-biserial correlations were demonstrated between gender and Total Sensation Seeking ($r = -.27$, $p < .01$), TAS ($r = -.23$, $p < .05$), Dis ($r = -.26$, $p < .05$), and Physical Risk Taking ($r = -.31$, $p < .01$), indicating that males were more likely to report higher levels of these characteristics. Pearson product-moment correlation analyses relating top rope climbing ability to each of the psy-

chological variables yielded only one significant relationship – with Physical Risk Taking ($r = .21$, $p < .05$), denoting a weak positive association between climbing skill levels and willingness to take physical risks. Age correlated significantly with Personal Control ($r = .23$, $p < .05$), implying that older participants possessed greater perceptions of control over themselves and their immediate environment. Finally, years of rock climbing experience related significantly to Total Sensation Seeking ($r = .22$, $p < .05$) and Dis ($r = .20$, $p < .05$), suggesting that rock climbers with more climbing experience tend to possess greater levels of sensation seeking, particularly relative to the characteristic of disinhibition.

The Chi-square test of independence examining relative proportions of males and females across the high and low risk groups was significant ($\chi^2 [1, N = 55] = 8.80$, $p < .01$), indicating a disproportionately higher number of men in the high-risk group (men, $n = 26$ versus women, $n = 1$) as compared to the low risk

Table 2: Descriptive Statistics

Variable	<i>N</i>	<i>M</i>	<i>SD</i>	Range
Risk Taking	105	22.81	6.14	11 - 40
Thrill/Adventure Seeking	104	8.03	1.97	2 - 10
Disinhibition	102	4.97	2.42	0 - 10
Total Sensation Seeking	102	23.48	5.41	6 - 34
Personal Control	105	28.70	3.99	10 - 35
Interpersonal Control	105	50.41	8.22	17 - 64
Sociopolitical Control	105	41.44	9.60	15 - 64
Desirability of Control	105	103.95	10.60	65 - 131

Note. Experience Seeking and Boredom Susceptibility subscales of the Sensation Seeking Scale – Form V are not reported because of inadequate internal reliabilities. The Personal Control subscale of the Spheres of Control Scale – Version 3 reported here reflects only five of its original 10 items because of internal reliability problems found with the original ten items.

group (men, $n = 18$ versus women, $n = 10$). The MANOVA exploring differences between high and low risk groups on age, years of rock climbing experience, and top rope climbing ability was not significant.

Pearson product-moment correlations between Physical Risk Taking, Total Sensation Seeking, and TAS (Table 3) revealed significant positive relationships between Physical Risk Taking and Total Sensation Seeking ($r = .42, p < .001; R^2 = .18$), and also between Physical Risk Taking and TAS ($r = .29, p < .001; R^2 = .08$). Physical Risk Taking also related positively to Dis ($r = .39, p < .001; R^2 = .15$). (Sensation seeking subscales BS and ES were not considered because of inadequate internal reliabilities). As evidenced in Table 3, Physical Risk Taking did not significantly relate to any of the constructs of control.

Comparison of High versus Low Physical Risk Takers

The MANOVA on Total Sensation Seeking and the constructs of control demonstrated a significant overall effect, $F(5,48) = 7.40, p < .001, \eta^2 = .44$, observed power = .99. Follow-up univariate analyses

revealed a significant effect in the expected direction for Total Sensation Seeking, $F(1,52) = 22.51, p < .001, \eta^2 = .30$, observed power = .99, as well as a noteworthy trend for Desirability of Control, $F(1, 53) = 3.47, p = .07, \eta^2 = .06$, observed power = .45 (See Table 4). As expected, high physical risk takers reported higher scores than low physical risk takers on Total Sensation Seeking. Also, low physical risk takers reported greater Desirability of Control than high physical risk participants. The univariate analyses demonstrated nonsignificant effects for Personal Control. Since gender was significantly related to Physical Risk Taking in the previously reported Chi-square analysis, it was considered whether or not it should serve as a second predictor in these analyses. However, such a design would have yielded a total of only 11 females (10 in the high-risk groups, and one in the low-risk group), so it was not included as a predictor in this analysis.

In the next MANOVA with Physical Risk Taking as the independent variable and the sensation seeking subscales of TAS and Dis as the dependent variables

Table 3: Correlation Matrix of Psychological Variables

	RT	T-SS	TAS	Dis	PC	IC	SPC	DOC
RT	.77							
T-SS	.42*	.76						
TAS	.29*	.58*	.68					
Dis	.39*	.83*	.30	.71				
PC	-.10	.06	-.04	-.06	.72			
IC	-.10	.10	.15	.04	.45*	.78		
SPC	-.03	.18	.07	.18	.09	.17	.81	
DOC	-.14	.06	.20	-.01	.59*	.55*	.17	.73

Note. Experience Seeking and Boredom Susceptibility subscales of the Sensation Seeking Scale – Form V are not considered in these analyses because of inadequate internal reliabilities. The Personal Control subscale of the Spheres of Control Scale – Version 3 reported here is composed of only five of its original 10 items due to internal reliability problems associated with the original 10 items. Cronbach Alpha Internal Consistencies are reported on the matrix diagonal. RT = Physical Risk Taking; TAS = Thrill & Adventure Seeking; Dis = Disinhibition; T-SS = Total Sensation Seeking; PC = Personal Control; IC = Interpersonal Control; SPC = Sociopolitical Control; DOC = Desirability of Control.

* $p < .001$ (Bonferroni adjustment for multiple comparisons)

(Table 4), the multivariate test was significant, $F(2,51) = 14.27, p < .001, \eta^2 = .36$, observed power = .99), and follow-up univariate ANOVAs yielded significant effects in the expected directions for both TAS, $F(1,53) = 8.87, p < .01, \eta^2 = .14$, observed power = .80 and Dis, $F(1,52) = 21.41, p < .001, \eta^2 = .29$, observed power = .99), with high physical risk takers scoring higher than low physical risk takers on both subscales.

Discussion

This study's aim was to identify factors influencing physical risk taking in the sport of rock climbing. As expected, both Total Sensation Seeking and the TAS subscale demonstrated significant positive relationships to Physical Risk Taking. It was expected that Physical Risk Taking would positively relate to Personal Control and Desirability of Control, but these predictions were not supported. As expected, no substantive patterns were revealed between Physical Risk Taking and Interpersonal Control or Sociopolitical Control. Finally, comparisons between high and low physical risk taking groups revealed significant group differences for Total Sensation Seeking, TAS, Dis, and a noteworthy trend for Desirability of Control. The group differences identified for Desirability of Control, however, were in the opposite direction of

what was anticipated, and no significant effects were shown relative to Personal Control, Interpersonal Control or Sociopolitical Control.

In both correlational analyses and group comparisons, Physical Risk Taking demonstrated significant positive relationships to Total Sensation Seeking and the TAS subscale. These findings are consistent with a substantial literature linking the sensation-seeking trait to engagement in high physical risk activities, such as hangliding, autoracing (Straub, 1982) and skiing (Connolly, 1981). Other research has found similar results in the sport of mountaineering (Breivik, 1996; Cronin, 1991; Fowler, von Knorring, & Orelund, 1980; Freixanet, 1991; Rossi & Cereatti, 1993).

The role of the remaining subscales (ES, BS, and Dis), however, remains unclear, as the research linking each of them to physical risk engagement is equivocal. In addition to clear relationships between Total Sensation Seeking, TAS, and Physical Risk Taking, the present study strongly suggests that the sensation seeking subscale of Dis demonstrates a robust influence on engagement in physical risk. Specifically, a substantial correlation was identified between Dis and Physical Risk Taking, and this factor was also an important differentiating variable in high versus low risk group comparisons, as evidenced in follow-up univariate

Table 4: Comparisons of High ($n=27$) and Low ($n=28$) Physical Risk Taking Rock Climbers on Sensation Seeking and Constructs of

Scale	High Risk		Low Risk		F	η^2
	M	SD	M	SD		
	$n = 27$		$n = 28$			
T-SS	26.94	4.17	20.70	5.37	22.51**	.30
TAS	8.88	1.22	7.46	2.24	8.12*	.14
Dis	6.43	2.04	3.79	2.14	21.41**	.29
PC	28.11	4.13	30.03	4.11	2.93	.09
IC	49.02	9.07	51.79	6.34	1.70	.03
SPC	39.11	10.68	42.39	9.02	1.49	.03
DOC	101.42	9.87	106.76	11.09	3.47	.06

Note. T-SS = Total Sensation Seeking; TAS = Thrill & Adventure Seeking; Dis = Disinhibition; PC = Personal Control; IC = Interpersonal Control; SPC = Sociopolitical Control; DOC = Desirability of Control.

* $p < .01$ ** $p < .001$

analysis. More research is needed to corroborate these findings relative to the Dis subscale.

Contrary to predictions, Physical Risk Taking did not bear significant relationships to any constructs of control in either analysis. To our knowledge, this is the first investigation of the relationship between physical risk taking and the Spheres of Control variables, although at least one study has investigated the Spheres of Control in sport contexts (Paulhus et al., 1979).

The expected difference between high and low physical risk takers relative to Desirability of Control was not confirmed. In fact, while it was expected that the high-risk group would demonstrate higher scores on this measure than low physical risk participants, a noteworthy trend in the opposite direction was shown. The present hypothesis was derived from a series of studies (Burger et al., 1979; Burger et al., 1982; Wolfgang et al., 1984; Burger, 1986) suggesting that individuals high in desire for control may be more likely to take risks in a gambling environment when predisposed to a condition of increased perceptions of control, although this pattern was inconsistent across types of gambling environments, and may further depend on additional factors, such as task familiarity or the presence of extrinsic rewards. Additional research suggests that individuals high in desire for control are more likely to engage in risky behavior, as evidenced by performance on simulated driving tests (Hammond et al., 2002), and by performance on a self-report measure of risk taking (Trimpop et al., 1999). This group of studies, then, links the desire for control to risk engagement across a variety of experimental conditions, from gambling environments to traffic situations, the latter providing limited evidence that desire for control may predispose an individual to *physical* risk engagement. It is not immediately clear why the results in the present study are contrary to this body of research, especially the findings of Hammond et al. Aside from obviously different environments (traffic driving versus rock climbing), one key difference between these two studies is that, while Hammond et al. measured *intended* or imagined behavior, the present study measured actual risk taking, albeit via self report. Another possibility lies in the homogeneous nature of the present sample of rock climbers, whereas the previous samples may have possessed greater variability, more adequately representing the extremes of both high and low physical risk takers. Clearly, more research is needed to better understand the desirability

of control that may underlie physical risk taking in adventure sports, as well as other environments.

Several limitations of the present study should be noted. First, this study is based on self-report data, which should be interpreted with caution. That said, it is difficult to conceive of another method that could more effectively address the specific questions proposed in the present study. Another limitation for this research is that a unified definition of risk taking is difficult to achieve. Yet another limitation of the present study is the strength of the correlations identified between Physical Risk Taking and the psychological variables of interest. Among those relationships with clear statistical significance, the amount of variance accounted for in risk taking ranged from only 8%-18%. Although not atypical for behavioral science research, this obviously leaves a great deal of variance unaccounted for, and future research should seek to identify factors that will explain additional variance in physical risk taking. For example, other psychological variables that may potentially help to explain physical risk taking include self-efficacy, narcissism, death anxiety, and repression. Additionally, several physiological and genetic predispositions toward risk taking have already been suggested (Lusher, Chandler, & Ball, 2001; Okuyama et al., 2000; Ronai et al., 2001), which would be worthy of further investigation. Finally, one of the most important analyses in this study concerned the high and low risk groups and their differences in key psychological variables of interest. Although the differences between groups were sufficient to support statistical analyses, they were not "maximally" contrasted. Specifically, when considering the 5-point anchored scoring system, the high physical risk group averaged 2.8 of a possible 5 points, while the low risk group averaged 1.4 of a possible 5 points. In future research, it may be desirable to have more maximally contrasted groups to better demonstrate differences between high and low risk participants.

Despite these limitations, key strengths of this study should also be recognized. To begin, this sample permits the study of physical risk taking behavior specifically in a relatively homogeneous sample of rock climbers. Second, this study allows researchers to look beyond the theory of sensation seeking, toward other possible explanations for the motivation to engage in physical risk. Namely, this study provides a starting point for researchers hoping to clarify the link between physical risk engagement and the many important con-

structs of control.

Although the present findings were consistent with the literature linking Physical Risk Taking to both Total Sensation Seeking and TAS, more research is needed to confirm the robust positive relationship found between Physical Risk Taking and the Dis subscale. Furthermore, the trend suggesting that participants low in Physical Risk Taking score higher in Desirability of Control is inconsistent with a small group of studies suggesting that Desirability of Control varies positively with risk behavior in gambling environments, as well as traffic / driving behavior. Finally, more research is needed to elucidate the desirability of control that may underlie physical risk taking in adventure sports, as well as other environments.

A clear understanding of risk taking behavior may have positive implications for professional environments where a certain level of physical risk taking is necessary and desirable. Clearly, for many professions, such as military Special Forces, firefighting, and tactical aviation, physical risk taking is intrinsic to the job responsibilities. In such cases, special insight into the characterization of physical risk taking behavior may facilitate candidate evaluation and selection. Relevant organizations may seek to identify and recruit individuals who are best suited for performance in these environments. Specifically, such organizations may seek to characterize the “optimal level” of physical risk engagement; that is, to discern intelligent, calculating risk takers from dangerous individuals or mere “adrenaline junkies.” Information gained in the present study could be woven into standardized behavioral and personality batteries that might be used to profile, characterize, and screen candidates. On a related note, information gained in the present study can help high-risk professional organizations integrate into their training curricula psychological skills training programs which are designed to help individuals perform optimally under high physical risk conditions. A keen understanding of factors influencing physical risk engagement, then, will have direct practical implications for organizations selecting and training candidates for high physical-risk occupations.

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