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Personality and risky downhill sports: Associations with impulsivity dimensions

Cynthia J. Thomson [a,*], Scott R. Carlson [b]

[a] School of Kinesiology, University of British Columbia, Vancouver, British Columbia, Canada
[b] Department of Psychology, University of Minnesota Duluth, Duluth, MN, USA

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ABSTRACT

Studies show high-risk sports participants report higher levels of Sensation Seeking compared to non-participants, but few have explored other aspects of impulsivity. Using principal component scores to summarize measures of Reward Sensitivity, Punishment Sensitivity, and Rash Impulsivity we compared downhill sport participants (both beginner and proficient) to non-participants in an undergraduate sample (N = 279, 50% female). Downhill sport participants scored significantly higher on Reward Sensitivity, possibly driven by the anticipatory approach facets of the BAS, and proficient participants scored significantly lower on Punishment Sensitivity than beginners and non-participants, driven by traits related more closely to fear than anxiety. No differences were found in Rash Impulsivity. Popular high-risk sports may serve as an important example of an exception to the co-occurrence of common impulsive traits.

1. Introduction

Downhill skiing, snowboarding, and mountain biking, are considered high-risk activities (Malkin & Rabinowitz, 1998), involving high speeds (Shealy, Ettlinger, & Johnson, 2005) and rugged terrain, which increase the chances of falls or collisions. Despite the known risks, their popularity has increased over the last few decades (Hudson, 2004). Risky behavior has been associated with a variety of impulsive traits. Impulsivity, however, is heterogeneous (e.g. Cross, Copping, & Campbell, 2011). Although, some studies of personality and high-risk sports have looked at subsets of traits, no studies to date have looked at estimates of dissociable impulsive traits by extracting specific factors that summarize the common variance across trait measures.

Several of these dissociable traits appear to arise from distinct biopsychological processes that may independently influence engagement in risky sport. Notably, the Reinforcement Sensitivity Theory (RST; Gray & McNaugton, 2000) suggests that risky behavior may result from either over-sensitivity to likely reinforcement (i.e., high Reward Sensitivity) or under-sensitivity to probable punishment (i.e., low Punishment Sensitivity). Further, factor analysis suggests that at least one dimension of impulsivity exists separately from these traits (e.g. Franken & Muris, 2006; Miller, Joseph, & Tudway, 2004). A general tendency to act without thinking of the consequences, called "Rash Impulsivity" (e.g. Dawe, Gullo, & Loxton, 2004) or "inadequate effortful control" (e.g. Cross et al., 2011) appears to reflect limitations on the functioning of the orbital and ventromedial prefrontal cortex necessary for executive control of behavior (Congdon & Canli, 2008). In addition to these three sets of traits, Cross et al. (2011) also distinguished a fourth dimension of Sensation Seeking which may emerge from the combination of high Reward and low Punishment Sensitivity. This trait, in particular, has been examined extensively in relation to risky sports.

Sensation Seeking is consistently reported as being higher in high-risk compared to low-risk sport practitioners and non-athletes (Goma-i-Freixanet, Martha, & Muro, 2012). It seems likely that aspects of Sensation Seeking related to Reward or Punishment Sensitivity would be related to high-risk sport given the excitement and risks of downhill sports. Rash Impulsivity, however, would likely lead to risk for injury on the slopes, limiting the potential for an individual to become proficient with them.

The RST provides a framework for understanding some personality influences on risky sports. It posits that there are individual differences in the average activity of Behavioral Approach (BAS) and Behavioral Inhibition (BIS) Systems. The former is thought to respond in a goal-directed manner to appetitive stimuli and to the removal of aversive stimuli, while the latter is involved in resolving goal conflicts that can arise between BAS activation and activation of a third system, the Fight-Flight-Freeze System (FFFS).

* Corresponding author. Address: Quest University Canada, 3200 University Boulevard, Squamish, British Columbia V8B 0N8, Canada. Tel.: +1 604 898 8000; fax: +1 604 815 0829.
E-mail address: cynthia.thomson@questu.ca (C.J. Thomson).

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The FFFS is activated upon presentation of aversive stimuli and cues predicting punishment (Gray & McNaugton, 2000).

Risky sports may be undertaken by individuals who are reward seekers driven by strong Reward Sensitivity (i.e., high tonic BAS activation) and less inhibited by Punishment Sensitivity (i.e., low tonic BIS-FFFS co-activation). Higher Reward and lower Punishment Sensitivity have been reported in skydivers compared to rowers (a low risk sport; Franken, Zijlstra, & Muris, 2006). Small differences have been reported between alpinists and controls in Punishment, but not Reward Sensitivity (Goma-I-Freixanet, 1991), although mountaineering provides less immediate excitement than downhill sports. Findings have been mixed in studies that have included measures of Rash Impulsivity; however, with some finding null (Goma-I-Freixanet, 1991, 2001) and others finding negative relationships (Llewellyn & Sanchez, 2008).

In the present study, we examined differences in traits between students living in western Canada who practice popular downhill sports recreationally, and those who do not. We used leading measures of impulsive traits and, with Principal Components Analysis (PCA), extracted oblique scores related to the dimensions hypothesized to underlie them. We then compared groups based on sport involvement in terms of these traits. We anticipated that Sensation Seeking measures would contribute positively to the approach-oriented Reward Sensitivity component, and negatively to the avoidance-oriented Punishment Sensitivity scores, consistent with the tripartite model of impulsive traits described by Cross et al. (2011). We hypothesized that individuals who become proficient at a downhill sport would score higher on Reward Sensitivity, and would score lower on Punishment Sensitivity. We did not expect to see differences in Rash Impulsivity. To our knowledge this is the first study to explore differences between multiple measures of Reward and Punishment Sensitivity, as well as Rash Impulsivity in mainstream risk sports. Furthermore, most studies on high-risk sports include male-only (or largely male) samples (Jensen & Guthrie, 2006) and we were able to recruit an equal representation of females.

2. Method

2.1. Participants

Undergraduate students ($n = 279$) participated for extra credit in a psychology course at a large university in western Canada. Carlson, Pritchard, and Dominelli (2013) reported on data from the same participants in a study of impulsivity and externalizing behaviors. Demographic data are presented in Table 1. Participants responded to an online posting of the study on a departmental website. Procedures were approved by the relevant institutional research ethics board and participants provided informed consent. Students completed questionnaires online using the website SurveyMonkey.com.

2.2. Measures

2.2.1. International personality item pool 50-item Big Five instrument (IPIP Big Five)

The IPIP Big Five is a 50-item measure of the higher-order traits in the Five Factor Model (Goldberg et al., 2006). The Cronbach alphas for our sample were as follows: Neuroticism (N; .88), Extraversion (E; .88), Openness to Experience (O; .76), Agreeableness (A; .78), Conscientiousness (C; .83). The Conscientiousness scale was reverse coded (C-rev) so that high scores indicated higher impulsivity. Each scale had 10 items scored using a 5-point Likert scale ranging from 1 (very inaccurate) to 5 (very accurate), and 25 items were reverse coded.

2.2.2. Behavioral Inhibition system and Behavioral Activation system scales (BIS/BAS)

The BIS/BAS (Carver & White, 1994) are comprised of 20 items scored on a 4-point scale ranging from 1 (strongly agree) to 4 (strongly disagree). The BIS scale ($\alpha = .80$) putatively measures an individual's sensitivity to punishment or avoidance motivation. Conversely, the BAS scale has three subscales: Drive (BAS-drive, $\alpha = .81$), Fun Seeking (BAS-FS, $\alpha = .80$), and Reward Responsiveness (BAS-RR, $\alpha = .81$). Scales were scored so that high scores indicate high BIS/FFFS or high BAS activity.

2.2.3. Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ)

The SPSRQ (Torrubia, Avila, Molto, & Caseras, 2001) is a 48-item measure, comprised of two subscales: Sensitivity to Punishment (SP; $\alpha = .85$) and Sensitivity to Reward (SR; $\alpha = .80$), each scored using a "yes/no" response format.

2.2.4. UPPS-P Impulsive Behaviour Scale

The UPPS-P included Whiteside and Lynam's (2001) original 45-item measure along with the 14-item Positive Urgency scale (Cyders et al., 2007). The associated Cronbach's Alphas observed: Premeditation (Pre; .88), Negative Urgency (NU; .88), Sensation Seeking (SS; .89), Perseverance (Pers; .85), and Positive Urgency (PU; .93). A 4-point scale ranging from 1 (agree strongly) to 4 (disagree strongly) was used. Three items were reverse coded. In order to make high scores indicative of greater impulsivity we reverse scored the Premeditation (Pre-rev) and Perseverance (Pers-rev) scales.

2.2.5. ZKPQ Impulsive Sensation Seeking Scale (ImpSS)

The ImpSS measures two factors, Impulsivity (Z-Imp; $\alpha = .84$) and Sensation Seeking (Z-SS; $\alpha = .91$), but is usually treated as a single scale (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). We substituted the original true/false response with a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

2.3. Data analysis

We conducted 3×2 analyses of variance (ANOVAs) separately for each scale described above with downhill sport participation (No-sport, Beginner, Proficient) and sex (male, female) as the factors. The sport groups were based on self-rating using a Likert scale (1 = beginner, 2 = novice, 3 = intermediate, 4 = advanced, 5 = expert). Individuals who did not participate in any downhill sport were in the "No-sport" group ($n = 104$), those who did but were less than intermediate in ability were "Beginners" ($n = 53$), and those who were intermediate or higher were in the "Proficient" group ($n = 122$). We applied a Bonferroni correction for testing multiple dependent variables, setting significance at $\alpha = .003$ ($\alpha = .05/16$ scales). Significant F-tests were followed up using least significant difference (LSD) tests.

We anticipated that there would be common variance in measures that relate to "Reward Sensitivity" (e.g. E, SS, Z-SS, BAS-drive, BAS-FS, BAS-RR, and SR), "Punishment Sensitivity" (e.g. N, BIS, SP), and "Rash Impulsivity" (e.g. C-rev, Pre-rev, Pers-rev, Z-Imp). We summarized the measures by extracting component scores using a PCA. We applied an Oblimin rotation to allow for correlation among components. We then conducted ANOVAs similar to those used with the individual scales, but with component scores as the quasi-dependent variables.

Table 1
Descriptive statistics for participant demographics.

Variable	Total sample	No sport	Beginner sport	Proficient sport
Sex, m/f	140/139	50/54	16/37	74/48
Ethnicity, %				
East Asian	46	61	51	31
European	42	29	40	53
Other	12	10	9	16
Age (yrs)	20.92 (2.41)	21.20 (2.79)	20.30 (1.51)	20.96 (2.35)
Years in university	2.85 (1.13)	2.89 (1.17)	2.58 (1.02)	2.92 (1.14)

Note. Mean (*SD*). Ethnic groups representing less than 5% of the group composition were combined in the "other" group.

3. Results

There were differences in the sex composition of the Beginner and Proficient groups (χ^2 (1, n = 175) = 13.73, p < 0.001) and we observed significant differences in ethnicity across the No-sport and Proficient groups (χ^2 (2, n = 226) = 21.01, p < 0.001).

3.1. Data reduction

Three components derived from the PCA had eigenvalues >1 and accounted for 65.20% of the variance. As reported in Table 2, component 1 was most related to the subscales hypothesized to reflect Rash Impulsivity (C-rev, Pre-rev, Pers-rev, PU, NU, Z-Imp). Component 2 included high positive loadings for Punishment Sensitivity traits (N, BIS, SP) along with weak to moderate negative loadings for three Reward Sensitivity traits (E, SS, and Z-SS). Finally, component 3 reflected all of the Reward Sensitivity traits (BAS-drive, BAS-FS, BAS-RR, E, SS, Z-SS, SR), though E, SS, and Z-SS loaded more strongly with Punishment Sensitivity (negative loadings) than they did with Reward Sensitivity, and Z-SS also loaded moderately with Rash Impulsivity. There were no significant correlations between Rash Impulsivity and either Punishment or Reward Sensitivity (r(277) = −.05, p = .41; and r(277) = .04, p = .51; respectively). There was a weak negative correlation between Punishment and Reward Sensitivity (r(277) = −.23, p < .001).

3.2. Sport group differences

Results of the ANOVAs for subscales are provided in Table 3. There were no significant interactions or sex differences in any of the ANOVAs and these are not reported on further. There were significant differences between sport groups for all of the measures we identified with Reward Sensitivity, with the exception of BAS-RR. Only one of the subscales that we hypothesized to be related to Punishment Sensitivity, SP, differed significantly. There were no significant differences involving Rash Impulsivity scales.

Results of the ANOVAs with component scores are provided in Table 4. There were significant main effects for sport group for both Reward Sensitivity and Punishment Sensitivity. The No-sport group scored significantly lower on Reward Sensitivity than both the Beginner and Proficient groups and the Proficient sport group scored significantly higher on Punishment Sensitivity than both the Beginner and No-sport groups. No other effects were statistically significant at α = .017 (corrected for testing three variables), including those involving sex.

The sport groups differed significantly in ethnic composition. To test whether the associations described above were present when we remove ethnicity as a confound we matched a random subsample of participants across sport groups. Each balanced sport group included 24 participants of East Asian descent, 21 of European descent, and 5 of "other" descent. The No-sport and Proficient groups were matched for ethnicity and sex, whereas we were limited by the small number of European male beginners and only able to match the Beginner group for ethnicity. The ANOVA results (with individual scales and component scores) for the balanced sample were largely the same as the results for the whole sample. Reward and Punishment Sensitivity were significantly associated with sport participation (Reward: F(1,144) = 4.27, p = .02, η_p^2 = .06; Punishment: F(1,144) = 9.01, p < .001, η_p^2 = .11), and there was no association between sport participation and Rash Impulsivity (p = .20). Sport participants (beginner and proficient) scored higher than non-participants on Reward Sensitivity and proficient

Table 2
Principal components analyses.

Scale	Oblimin pattern matrix		
	Rash Impulsivity	Punishment Sensitivity	Reward Sensitivity
UPPS-P Premeditation (Rev)	**.70**	−.31	−.12
UPPS-P Perseverance (Rev)	**.70**	.18	−.41
UPPS-P Positive Urgency	**.78**	.08	.13
UPPS-P Negative Urgency	**.79**	.35	.19
ZKPQ impulsivity	**.85**	−.14	.02
IPIP Conscientiousness (Rev)	**.71**	.21	−.32
ZKPQ Sensation Seeking	**.53**	−.47	.24
BAS Drive	−.06	−.04	**.73**
BAS Fun Seeking	.41	−.26	**.57**
BAS Reward Responsiveness[a]	−.15	.20	**.85**
SPSRQ Sensitivity to Reward	.46	−.07	**.53**
IPIP Extraversion	−.03	−**.51**	.44
UPPS-P Sensation Seeking	.31	−**.56**	.36
BIS	−.10	**.83**	.38
IPIP Neuroticism	.39	**.71**	−.07
SPSRQ Sensitivity to Punishment	.11	**.83**	−.09
Eigenvalue	4.63	3.89	1.91
% Of variance	28.96	24.32	11.92

Note. N = 279. Loadings in bold font are nominally the highest for a given scale.
[a] Square transformation applied prior to PCA due to a skewed and lepto-kurtotic distribution.

Table 3
Descriptive statistics and ANOVA results for all scales.

Scale	Descriptive statistics						*Group main effect*		
	No sport $n = 104$		Beginner $n = 53$		Proficient $n = 122$				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	η_p^2
BAS-drive	10.70[a,b]	2.29	11.51[a]	2.07	11.75[b]	1.99	6.56	**.002**	**.05**
BAS-FS	11.24[b]	2.41	12.02	2.52	12.56[b]	2.41	7.59	**.001**	**.05**
BAS-RR[d]	16.77	2.76	17.28	2.58	17.32	2.10	1.38	.25	.01
E	32.23[b]	6.77	34.17[c]	6.58	36.52[b,c]	6.53	12.12	**<.001**	**.08**
SS-U	30.86[a,b]	6.60	34.40[a,c]	6.32	37.86[b,c]	6.43	29.63	**<.001**	**.18**
SS-Z	32.48[b]	8.55	34.19[c]	9.49	37.69[b,c]	8.71	9.15	**<.001**	**.06**
SR	10.92[a,b]	4.56	13.53[a]	4.37	13.49[b]	4.56	9.78	**<.001**	**.07**
N	27.02	7.16	27.09	6.95	24.92	7.73	1.50	.23	.01
BIS	21.27	3.74	21.51	2.99	20.02	3.84	2.79	.06	02
SP	13.36[a]	5.67	13.04[a,c]	4.84	10.23[c]	5.34	9.11	**<.001**	**.06**
Pre-Rev	33.14	5.15	33.70	4.93	34.66	5.79	3.04	.05	.02
Pers-Rev	21.53	5.26	21.87	5.28	20.88	5.18	0.30	.74	.002
PU	28.11	8.35	29.17	8.67	28.84	8.77	0.13	.88	.001
NU	27.65	6.60	29.72	6.98	28.19	6.61	0.74	.48	.005
Imp-Z	19.92	5.42	20.09	5.41	20.76	5.06	0.95	.39	.007
C-Rev	26.49	6.80	27.94	6.13	25.93	6.18	1.88	.16	.014

Note. LSD = least significant differences, degrees of freedom for all ANOVAs = (2, 273). LSD are shown for $p < .05$.
Values shown in bold font are significant at the corrected threshold (alpha = .003).
[a] No sport different from Beginner.
[b] No sport different from Proficient.
[c] Beginner different from Proficient.
[d] Square transformation applied due to a skewed and lepto-kurtotic distribution (descriptive statistics on raw scores).

Table 4
Means, standard deviations, and ANOVA results for impulsive personality scores by downhill sport group.

Scale	Descriptive statistics						Group main effect		
	No sport $n = 104$		Beginner $n = 53$		Proficient $n = 122$				
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	η_p^2
Rash Impulsivity	−0.16	1.01	0.10	1.02	0.09	0.97	1.93	15	.014
Punishment Sensitivity	0.31[b]	0.93	0.23[b,c]	0.77	−0.37[c]	1.03	12.97	**<.001**	**.087**
Reward Sensitivity	−0.34[a,b]	1.03	0.10[a]	0.98	0.24[b]	0.91	9.78	**<.001**	**.067**

Note. Means and standard deviations are from standardized component scores, degrees of freedom for all ANOVAs = (2, 273). LSD are shown for $p < .05$.
Values shown in bold font are significant at the corrected threshold (alpha = .017).
[a] No sport different from Beginner.
[b] No sport different from Proficient.
[c] Beginner different from Proficient.

athletes scored lower than beginner and non-participants on Punishment Sensitivity. We repeated ANOVAs using two sport levels only (No-sport *vs*. Proficient sport; matched for sex *and* ethnicity), and the overall results, for both individual and component scores, were the same (Reward: $F(1,96) = 8.17$, $p = .005$; Punishment: $F(1,96) = 12.21$, $p = .001$; Impulsivity: $p = .12$).

4. Discussion

We compared students who reported participation in downhill sports and those who do not and found differences related to Reward and Punishment Sensitivity, but not Rash Impulsivity. Demographic variables did not appear to account for the observed differences. A PCA suggested distinct dimensions of Rash Impulsivity, Reward Sensitivity and Punishment Sensitivity consistent with previous findings (Franken & Muris, 2006). Most of the subscale loadings satisfied our hypotheses. Interestingly, Sensation Seeking, the trait most commonly associated with high-risk sport participation (e.g. Goma-i-Freixanet et al., 2012), loaded only moderately on the Reward Sensitivity component, and loaded more negatively on Punishment Sensitivity. Sensation Seeking not only involves seeking out exciting experiences (in line with Reward Sensitivity), but also the willingness to try potentially dangerous activities, perhaps due to punishment insensitivity. The loadings for Extraversion were almost equal in magnitude, but of opposite sign, for Reward and Punishment Sensitivity consistent with past arguments that this trait reflects the balance between BAS and BIS/FFFS function (Corr, 2004).

High-risk sport participants are consistently low on measures of Punishment Sensitivity (Castanier, Le Scanff, & Woodman, 2010a, 2010b; Franken et al., 2006; Goma-I-Freixanet, 1991). We also observed this in the current study, although only for the component score and the Sensitivity to Punishment subscale. In the RST, there is a distinction between the sources of high levels of fear-related and anxiety-based traits (Corr, 2004). Fear is a function of FFFS-levels, while anxiety and Neuroticism are results of BIS functioning. Our lack of differences in the BIS and Neuroticism scales suggests the possibility that it may be more fear- than anxiety-relevant aspects of Punishment Sensitivity that differed across the downhill sports groups. An individual that reports more generalized or chronic fear may be less inclined to participate in a risky sport.

Older versions of the RST considered Reward and Punishment Sensitivity to be orthogonal traits due to separable neural subsystems, but revisions to the RST now articulate circumstances, under the Joint Subsystems Hypothesis (JSH), in which BAS and BIS/FFFS functioning would have antagonistic effects (Corr, 2004) leading potentially to an exaggeration of approach over avoidance tendencies than would be found from the additive influences of separable subsystems. Arguably, this may explain the modest inverse correlation we observed between our Reward and Punishment

Sensitivity components. The JSH predicts antagonistic effects when rapid shifts of attention between appetitive and aversive stimuli are required. Arguably such shifts on the slopes could lead to antagonistic state effects, but individual differences in the typical context in which appetitive and aversive stimuli occur during the sport, although relevant, may be lost in the process of aggregating across skiing (and non-skiing) experiences as in our data.

In terms of other conditions where the JSH predicts antagonistic effects, it is likely that phenotype-environment correlations may cause individual differences in relevant environmental circumstances to vary with the level of personality traits. Antagonistic effects are not predicted for those extremely high in tonic BAS or extremely low in tonic FFFS/BIS co-activation. Arguably those drawn to downhill sport are likely more extreme in both types of motivational tendencies. Our data are consistent with this, and therefore antagonistic effects of the JSH are arguably less likely to hold for the more proficient skiers. Further, the JSH predicts that antagonistic effects are less likely with intense aversive or appetitive stimuli, and stimulus intensity typically encountered on the slopes is likely to vary with the level of Punishment and Reward Sensitivity. In other words, those higher on Reward Sensitivity and lower on Punishment Sensitivity are predicted to take more risks and therefore have more intense thrills, but also experience more intense threats. Again, for those who are more proficient skiers the conditions of the JSH are less likely to hold. Taken together we may predict that the antagonistic effects between subsystems under the JSH are less likely for the proficient group than for the other two, less experienced groups.

Revisions to the RST, also suggest that the BAS may reflect several, related, but distinguishable subprocesses leading to different facets (Corr & Cooper, 2013). Notably, two broad phenomena, called Reward Interest and Goal-Planning/Drive-Persistence, involve anticipatory approach and pursuit of potential reward and differ from another facet, Reward Reactivity, that reflects variability in emotional response to reinforcement and the positive emotional experience of reward anticipation. Our analyses of the individual scales, suggest that the facets of Reward Sensitivity related to approach towards anticipated reward, motivation to form goals in pursuit of reward, and persistence in pursuit are possibly more relevant to downhill sport participation than is Reward Reactivity. Of all the scales that loaded primarily on the Reward Sensitivity component, only BAS-RR, putatively reflecting Reward Reactivity, did not differ across groups. Traits reflecting anticipatory approach, including Extraversion and Sensation Seeking, and to some extent the SR scale, differed across groups and had the biggest effect sizes of the Reward Sensitivity scales.

We have conceptualized Rash Impulsivity as reflecting poor executive control of behavior distinct from Reward Sensitivity. Our PCA resulted in a separate component involving scales consistent with Rash Impulsivity. Further, consistent with our conceptualization were the near zero correlations between this component and Punishment and Reward Sensitivity, despite an oblique component rotation. We did not observe any significant differences across downhill sport groups in Rash Impulsivity, either in terms of the summary component score or at the level of individual scales. This was not surprising given that a majority of studies examining risk-taking through sport similarly found no associations (Goma-I-Freixanet, 1991, 2001). Conversely, studies comparing degrees of proficiency or risk-taking within high-risk sport participants found inverse relationships between both factors and impulsivity. For example, amateur risk-sport practitioners scored lower on Impulsivity than professional athletes (e.g. mountain guides) (Cazenave, Le Scanff, & Woodman, 2007) and risk-taking in rock climbing was inversely related to Impulsivity (Llewellyn & Sanchez, 2008). Both findings make sense with respect to self-preservation, where impulsive decisions may lead to death.

In revisions to the RST, the term "Impulsivity" is used to reflect an aspect of the BAS in a manner different from our conceptualization of Rash Impulsivity. This conceptualization reflects a tendency to act abruptly in the presence of reward, in order to obtain reinforcement (Corr & Cooper, 2013). Fast action, can actually be related to good effortful control of behavior and low, not high, Rash Impulsivity, especially if that action is dependent on successful inhibition of a prepotent response (e.g. Young et al., 2009). Of note, a putative indicator of RST Impulsivity, BAS-FS (Corr & Cooper, 2013), loaded more strongly on Reward Sensitivity than Rash Impulsivity (although with a moderate loading here as well). Unlike the Rash Impulsivity scales, it did differ significantly across the sport groups. It is possible, however, that the Pre-Rev, Pers-Rev and Urgency subscales related to Rash Impulsivity could partially reflect Goal-Planning/Drive-Persistence aspects of the BAS. It may be that our Rash Impulsivity component was tapping aspects of this construct. However, the BAS facets are hypothetically correlated with each other. We did not find a correlation between our Rash Impulsivity and Reward Sensitivity components. This suggests that our Rash Impulsivity component may be different from either RST Impulsivity or Goal-Planning/Drive-Persistence consistent with Rash Impulsivity being distinct from BAS-related traits (e.g. Cross et al., 2011; Dawe et al., 2004).

5. Conclusion

We replicated past findings of downhill sport participation being positively related to Reward Sensitivity, negatively related to Punishment Sensitivity, and not related to Rash Impulsivity. We extended the literature in two important ways. One, most past work has been focused on men and we had an equal representation of both sexes. Two, past research used measures that often share variance with measures of putatively different aspects of impulsivity and we used component scores derived from the common variance across related scales. Notably, our Rash Impulsivity summary score was distinct from the Reward and Punishment Sensitivity measures. The specificity of relationships underscores the importance of looking at dissociable facets of impulsivity when considering how personality influences risky behavior especially in the context of sport.

Ethical statement

We have complied with all American and Canadian Psychological Association ethical standards for the conduct and reporting of research with human subjects. The procedures were further approved by an institutional ethics review board at the University of British Columbia. All subjects provided informed consent. The authors do not have a conflict of interest, financial or otherwise, in the conduct or reporting of this research.

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