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# To punish first and reward second: Values determine how reward and punishment affect risk-taking behavior

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# To punish first and reward second: values determine how reward and punishment impact risk taking behaviour.

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Abstract

The current study investigated whether manipulating participants' pre-exposure to reward and punishment affects the extent to which sensation seeking and values predict risk-taking behavior. Participants (n = 195) were randomly allocated to one of two conditions, defined by the order at which they were rewarded or punished for risk-taking behavior. Risk-taking behavior was measured in both conditions using the Balloon Analogue Risk Test, however this was set-up such that participants in group 1 were rewarded for risk-taking behavior prior to being punished, whereas participants in group 2 were punished for risk-taking behavior prior to being rewarded. Participants also completed questionnaires designed to measure sensation seeking and the values of 'stimulation' (the need for novelty and excitement) and 'hedonism' (the need for sensuous pleasure). It was found that stimulation predicted risk taking behavior in the 'reward-then-punishment' condition, whereas hedonism predicted risk-taking behavior in the 'punishment-then-reward' condition. Sensation-seeking was found to be an indirect predictor of risk-taking behavior in both conditions. It is tentatively concluded that the extent to which an individual's risk-taking behavior is guided by their values (hedonism, stimulation) largely depends on their prior exposure to the order of contingent reward and punishment.

Keywords*: personality, approach motivation, sensation seeking, BART, risk-taking behavior, hedonism, stimulation, values*

# To punish first and reward second: values determine how reward and punishment impact risk taking behaviour.

The propensity to take risks has been linked to several dysfunctional behaviors including (but not limited to) smoking, heavy drinking, drug use, unprotected sex, unsafe driving habits, and gambling (e.g. Davison & Chernoff, 1999; O'Connor & Jackson, 2008; Zuckerman & Kuhlman, 2000). Individuals who score highly on questionnaires designed to measure risk-taking behavior tend to show less self-control and tend to be less concerned about the welfare of others than those who do not score highly on such questionnaires (Davison & Chernoff, 1999). The propensity to take risks can therefore be regarded as a potentially problematic aspect of an individual's character. Research focusing on potential determinants of risk taking behavior therefore remains important.

Psychological research has sought to explain risk-taking behavior from multiple perspectives, including social, personality, cognitive, behavioral and psychodynamic. In this paper we focus on theories derived from behavioral and personality psychology. From a simple behavioral perspective, research indicates that contingent reward and punishment influence risk-taking behavior, such that when risky behavior is rewarded its likelihood is increased, and when it is punished its likelihood is reduced (Gottfredson, 2011; Ronay & Hippel, 2009). From a personality perspective, research tends to indicate that risk-taking behavior is largely dependent on personality and values including Novelty Seeking, Sensation Seeking, Hedonism and Stimulation (e.g. Cole et al., 2007; Cross, Copping & Campbell, 2011; Davison & Chernoff, 1999; Dollinger & Kobayashi, 2003; Schwartz, 1992).

In this paper, we suggest that contingent reward/punishment and personality likely interact in the prediction of risk-taking behavior. Indeed, much research indicates that sensitivity to rewards and punishments underlie approach and avoidance-based personality

traits (Cloninger, Svrakic, & Przybeck, 1993; Gray, 1982). For example, Cloninger argues that individuals with a genetic sensitivity to reward tend to develop high levels of 'Novelty Seeking' and that individuals with a genetic sensitivity to punishment tend to develop high levels of 'Harm Avoidance'. Several scholars have also argued that sensitivity to such reward and punishment systems underlie Extraversion and Neuroticism, respectively (e.g. Nichols & Newman, 1986; Patterson, Kosson, & Newman, 1987). Since traits related to reward-sensitivity have been found to be related to risk-taking behavior previously (e.g. Sensation Seeking; Lauriola, Panno, Levin, & Lejuez, 2014), in this paper we focus on the effects of traits and values that can be conceptualized as having a basis in reward-sensitivity or approach motivation.

In addition to personality traits, it is also likely that certain values will impact the effects of rewards and punishments on risk taking behavior. Hedonism and Stimulation are largely motivationally based 'approach' values (Schwartz, 1992) defined by a strong need for sensuous pleasure (Hedonism) and a strong need for novelty and excitement (Stimulation). It follows that those with high levels of Hedonism and Stimulation might be more sensitive to rewards (and less sensitive to punishments) than those with low levels of such values. Again it is also likely that such values will play a part in determining whether the order an individual experiences rewards and punishments affects their risk taking behavior.

In this paper therefore, we assess whether specific personality traits and values influence the extent to which contingent reward and punishment impacts risk-taking behavior. We specifically focus on risk-taking behavior when it is rewarded and punished, and assess whether the *order* at which risk-taking behavior is rewarded and punished affects an individual's overall level of risk-taking behavior. Indeed despite reflecting 'real-life' patterns of reinforcement, no research has examined whether the order of rewards and punishments affect overall risk-taking behavior. Furthermore, research has not considered

whether some individuals (based on their personality traits & values) are more sensitive to the order of rewards/punishments than others. This is important because it might explain why some people (based on personality traits or values) continue to take risks, long after such behavior is no longer rewarding. Therefore this research investigates whether the order of rewards and punishments affects risk-taking behavior in general, and more importantly whether it affects risk-taking behavior differently in different people (based on personality and values).

In the current study, we used the online laboratory at YWeDo.com (Jackson, 2010) to measure risk-taking behavior in two conditions. In condition 1, risk-taking was rewarded for a block of trials and then punished for a block of trials; in condition 2, risk-taking was punished for a block of trials *and then* rewarded for a block of trials. This allowed us to examine whether there was an effect of manipulating the order effects of rewards/punishments on risk-taking behavior. The Balloon Analogue Risk Test (BART) adapted from Lejuez et al. (2002) was used to both manipulate rewards/punishments and measure risk taking in this study. In the block of trials where risk-taking behavior was rewarded, there was a greater probability that risk-taking (i.e., inflating the balloon) would pay off. However there was still a small chance that it would not (i.e., inflating the balloon would lead to it bursting). In the block of trials where risk-taking behavior was punished, there was a greater probability that risk-taking (i.e., inflating the balloon) would be punished (i.e., lead to it bursting). However, there was still a small chance that it would not be punished (i.e., not burst). Measuring risk-taking behavior using BART in laboratory paradigm is generally found to be effective (Lauriola, Panno, Levin, & Lejuez, 2014).

We expect different results in the association of values of Hedonism and Stimulation and risk-taking behavior in the two conditions (groups 1 and 2). We argue that Group 1 (Reward then Punishment) and Group 2 (Punishment then Reward) will differ in overall

levels of risk taking, but also in terms of whether Hedonism or Stimulation is the better predictor of risk-taking (i.e., the relationship between risk-taking and values will *depend* on the order that punishments/rewards are presented).

The following model summarizes the hypothesized pathways between personality traits, values and risk-taking behavior. In the following section we provide a rationale for each of these proposed pathways.

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Insert figure 1 about here

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**Development of hypotheses**

First, we suggest that an approach-oriented personality trait (Sensation Seeking) will predict Hedonism and Stimulation over both conditions based on their common motivational bases. Indeed, there is emerging consensus amongst personality theorists that elements of personality are largely caused by underlying variation in approach and avoidance mechanisms. Sensation Seeking is thought to reflect an underlying, biologically based approach tendency, based largely on individual differences in reward sensitivity (see Zuckerman, 2014) and the tendency to engage in goal-directed behavior (O'Connor & Jackson, 2008). Similarly, Schwartz's (1992) Values Theory argues that human values reflect underlying motivational goals, such that Hedonism reflects the motivation to achieve 'pleasure and gratification' and Stimulation reflects the motivation to achieve 'excitement, novelty and challenge in life'. We suggest that this conceptual overlap between Sensation Seeking and the two values underpins the likely empirical relationship between these sets of variables. Furthermore, we suggest that Sensation Seeking can be thought of as a stable, personality based measure of general approach motivation, whereas the values Hedonism and Stimulation represent *consequences* of approach motivation. Therefore, from a structural

point of view, Sensation Seeking is considered a distal predictor of Hedonism and Stimulation.

H1: Sensation Seeking positively predicts values of Hedonism and Stimulation in conditions of both Reward then Punishment (Group 1) and Punishment then Reward (Group 2).

Personality traits have been used to explain risk-taking behavior (Cooper, Agocha, & Sheldon, 2000). Sensation Seeking is largely defined by the inclination to take risks (Zuckerman, 2007). Sensation Seeking has been associated with high risk-taking behavior (Cross et al., 2011) and in particular, has traditionally been associated with dysfunctional and risk-taking behavior (Jackson, 2011; O'Jile, Ryan, Parks-Levy, Betz, & Gouvier, 2004). Since we argue that values of Hedonism and Stimulation are consequences of approach-motivation and are more directly related to risk-taking behavior, we argue that Sensation Seeking will indirectly predict risk-taking via the effect of Stimulation or Hedonism (depending on the condition, see hypotheses 3 and 4).

H2: Sensation Seeking will indirectly predict risk-taking behavior under both conditions.

Individuals who value Stimulation tend to be oriented towards excitement, novelty, and challenge and tend to engage in daring, exciting, and varied activities (Schwartz, 1992). It follows that such individuals might be more inclined to take risks, particularly when risk is likely to lead to excitement and novelty (i.e., reward). Indeed, both Eysenck (1967) and Zuckerman (1994) have suggested that risk-taking behavior is associated with stimulation and arousal.

Specifically in the context of rewards *and* punishments, we argue that individuals who value Stimulation will be less sensitive to risks not paying off, particularly when risk-taking behavior has been rewarded previously. We suggest that people who value Stimulation are highly sensitive to novelty and reward, and therefore are more likely to have goal formation tendencies that are resistant to punishment. Ordinarily, reward increases the probability of risk-taking behavior and punishment reduces the probability of risk-taking behavior (Rangel & Hare, 2010). However, it follows that individuals who set reward and novelty-oriented goals (i.e., individuals who value Stimulation) might be less attentive and sensitive to subsequent non-stimulation (i.e., aversive cues) on previously rewarded risky behavior.

Consistent with this logic, research has shown that Extraversion (which has significant conceptual overlap with Stimulation) is associated with passive avoidance errors, such that psychopaths and extraverted individuals tend to be less sensitive to punishment, particularly when the punished behavior has previously led to reward (Patterson et al., 1987). Furthermore, in a study comparing a group of introverts and extraverts, Nichols and Newman (1986) found that punishment likely enhances, rather than reduces, reward-seeking behavior in extraverts. Therefore, based on the above logic and empirical findings, we suggest that the association between Stimulation and risk-taking behavior is positive when reward is followed by punishment. We hypothesize that:

H3: The association between Stimulation and Risk-taking behavior is positive under the conditions of Reward then Punishment (Group 1)

Individuals who value Hedonism are, by definition, driven by pleasure, reward, general enjoyment of life, and the “sensuous gratification for oneself” (Schwartz, 1992, p. 8). It follows that such individuals might be more inclined to take risks in general, as individuals

who frequently engage in risky behavior are driven by the potential for reward even in conditions where danger (punishment) is possible (Leigh, 1999; Lupton & Tulloch, 2002). We argue that hedonistic individuals differ from non-hedonists, in that they are less deterred by punishment in their search for pleasure. We argue that hedonistic individuals are accustomed to obtaining their desires, and have developed a mindset that, in life, they will *tend to get what they want.* Consistent with this, individuals who value Hedonism tend to be from secure and prosperous backgrounds (Schwartz, 1992) and tend to be younger (Schwartz, 2006), and therefore have increased opportunities to indulge themselves.

Based on this logic, we suggest that hedonistic individuals are relatively undeterred (and possibly motivated) by punishment in their search for reward, such that the absence of pleasure switches on an intense search for pleasure that remains active in the presence of punishment. To reiterate, we argue that hedonistic individuals are likely to persist in risky behavior, despite the negative short-term consequences of such behavior, based on an underlying mindset/belief that they will eventually get what they want (i.e., their risk will eventually pay off).

H4: The association between Hedonism and risk-taking behavior is positive under Punishment then Reward condition (Group 2)

## Method

### Participants

Most of the 195 participants were recruited from the University of New South Wales, Australia. Students were paid AUD $20 to take part in the online study. All participants were aged between 18 and 47 years, with most students younger than 21 years (54.9%) and only a few older than 35 years (2.1%). Approximately 47% of participants were female, 45% were

male, and the remainder did not indicate their gender. Participants took approximately one hour to complete a battery of tests and results relevant to this study are presented here.

## Design

This experiment used a between subjects design. Participants were randomly allocated into one of two conditions; either the 'Punishment then Reward' condition, or the 'Reward then Punishment' condition. The IV's was Sensation Seeking, and the DV was 'risk-taking behavior'. It was expected that the relationship between values and 'risk-taking behavior' would depend on the experimental condition. Hence, the purpose of the manipulation was to assess whether the order of rewards and punishments would affect the likelihood that people with different values would engage in risk-taking behavior.

It is important to emphasize that in both conditions, participants were rewarded and punished the exact same number of times in total. The *only* difference between the two conditions was the order in which risk-taking behavior is rewarded or punished. Therefore any non-random differences between the two conditions (importantly in terms of relationships between values and risk-taking behavior) can only be due to the manipulation.

## Measures

### Risk-taking behavior

Risk taking behavior was measured in this study using the online BART module (at YWeDo.com) based on the Balloon Analogue Risk Tests (BART) of Lejuez et al. (2002). The test was administered on a computer monitor where participants were presented with simulated balloons and had the option of pressing one of two buttons (pumping vs stopping). In the BART, participants gain points by pumping up a balloon, which can burst if over-inflated. When the balloon bursts then points are lost. Risk taking behavior was measured in

this study using the number of exploded balloons, since those who take more risks, should explode more balloons on average. This is one of the indices of risk taking behavior used in the original BART development paper (see Lejuez et al., 2002) and has been found to yield almost identical results to the standard measure (mean number of pumps in unexploded balloons) (Schmitz, Manske, Preckel, & Wilhelm, 2016). High scores indicate high risk-taking behavior and low scores indicate low risk-taking behavior. In this study BART was adapted in order to define the conditions of 'Punishment then Reward' and 'Reward then Punishment'. Participants in the 'Punishment then Reward' condition were punished for taking risks in the first 10 trials, but were rewarded for taking risks in the final 10 trials. Participants in the 'Reward then Punishment' condition were rewarded for taking risks in the first 10 trials, but punished for taking risks in the final 10 trials. The reward segment of both conditions had the following probability of the balloon bursting for each of the 10 balloons:

$P[i] = (1/(20-i)/2)$

The punishment segment of both conditions had the following probability of the balloon bursting for each of the 10 balloons:

$P[i] = (1/ (20-i)x2)$

Based on these probabilities, when completing the series of reward trials, participants would generally be able to pump the balloon ten or more times before it burst (mean burst pump was 17 in the reward trials). On the contrary, when completing the punishment trials, the balloon would generally burst within the first 10 pumps (mean burst pump was 8 in the punishment trials). To provide an example of specific probabilities, for the first pump in a reward trial, balloons had a 1 in 38 ($p$ = .03) chance of bursting (i.e. 1/(20 -1)/2), whereas for the first pump in a punishment trial, balloons had a 2/19 ($p$ = .11) chance of bursting (i.e. 1/(20-1)x2).

We emphasize again that our modification of the BART did not affect the construct being measured (i.e., risk-taking behavior; see Lejuez et al., 2002). Instead, our modification allowed for the manipulation of the IV (reward-punishment vs punishment-reward condition), which we argue likely affects the *probability* of engaging in risk-taking behavior, depending on the personality/values of the participant. Indeed, we believe our manipulation reflects real-life behavior involving risk (i.e., the overall inclination to engage in risky behavior, when such behavior has mixed consequences). By using *all* trials in calculating the final 'risk taking' score, we ensure that the only difference over the two conditions is the order at which risk-taking behavior is rewarded/punished.

**Zuckerman's Sensation Seeking Scale Version 5 (SSS-V) (Zuckerman, 1994).**

The SSS-V is a widely used multi-dimensional measure of Sensation Seeking comprised for four sub-dimensions (thrill and adventure seeking, disinhibition, experience seeking, boredom susceptibility). It is comprised of 40 forced choice items, e.g. an example item set is "I like to explore a strange city or section of town by myself, even if it means getting lost" vs "I prefer a guide when I am in a place I don't know well". There is very good evidence for the reliability and validity of the SSS-V over many years (see Zuckerman, 2007).

**Schwartz Value Scale (SVS) (Schwartz, 1992).**

The SVS inventory contains 56 single-value items representing 10 value dimensions based on 9-point scale, such as 7 = supremely important; 6 = Very important; 3 = Important; and 0 = Not important, -1 Opposed to my values. Total scores for each of the scale on this survey represent mean centered scores for each individual; these are calculated by subtracting the mean overall score (across all items) from each item, and then finding the mean of these

items for each scale (see Schwartz, 1992). Good reliability and validity has been reported with this measure (e.g. Schwartz & Sagiv, 1995).

**Procedure**

## Results

Table 1 shows means, standard deviation, alphas, and inter-scale correlations for all participants in Groups 1 and 2.

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Insert Table 1 about here

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The reliabilities for these scales ranged from 0.71 to 0.86 across the two samples. BART (risk taking) was positively associated with Hedonism ($r$ = -0.16, $p$< 0.05), indicating that overall, those with higher scores on Hedonism take greater risks on average. Sensation Seeking did not directly predict risk-taking behavior (see Table 1). As expected, there was a positive overall relationship between BART and Hedonism, but not between BART and Stimulation.

To assess the main effect of condition, a one-way ANOVA was conducted, with risk-taking behavior as the DV. There was a significant difference between the groups on risk-taking behavior; participants in the Reward then Punishment condition (M = 6.86, SD = 2.27) engaged in more risk-taking behavior on average (i.e. had more balloon bursts) than those in the Punishment then Reward condition (M = 8.30, SD = 246; $F$(1,1 93) = 16.46, $p$ < 0.005). One-way ANOVA's were also conducted for the measured variables across the two groups.

As expected with random assignment, there were no significant differences between the two groups on age, Sensation Seeking, Stimulation and Hedonism (see table 2).

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Insert Table 2 about here

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To investigate Hypotheses 1–4, a multi-group structural equation modeling (SEM; AMOS version 17.3) analysis was used to check whether the structural model was invariant (equal) across two groups (Arbuckle, 2003). Essentially, this technique is used to assess whether parameter estimates in structural models are different over different conditions. It has the advantage over ANOVA in that it tests for the equivalence of entire models over several conditions, as opposed to interaction terms which can only assess the equivalence of single relationships.

When evaluating the equivalence of such groups in multi-group SEM, it is usually important to identify the source of non-equivalence, should it occur. For this reason, the procedure generally involves initially testing an unconstrained model (configural invariance model) which produces a baseline chi square, reflecting a model where both groups are allowed to vary on all parameters. A series of further models are then tested, whereby more and more parameters are constrained at each step, such that a step which results in a significantly weaker fit includes constrained parameters that should not be constrained. At step 1 a ‘measurement weights’ model is generally tested, which constrains all of the factor loadings to be equal over all groups. The ‘structural weights’ model is generally tested at step 2, whereby all structural weights are constrained to be equal. In the ‘structural covariances’ model (step 3) all structural covariances are constrained to be equal. This process continues until models are fully constrained over all groups. This procedure therefore allows for a sensitive test of how groups differ.

In this study, we were interested in assessing whether the relationships Sensation Seeking, Hedonism, Stimulation, and risk-taking behavior are different under (i) Reward then Punishment and (ii) Punishment then Reward. In order to test for this effect, the 'measurement weights' model for the two groups was inspected. The measurement weights model was interpreted since it requires that measurement weights be fixed as 'invariant' across groups, leaving structural weights free to vary.

Prior to interpreting the analysis we checked for multivariate normality, which is an assumption of maximum-likelihood (ML) estimation, using Mardia's coefficient in AMOS. The critical ratio of this coefficient was beyond what would be expected by chance (assuming normality) in both groups (5.54, 4.01), indicating that multivariate normality assumptions were violated. To address this, all analyses were run using ML estimation to generate estimates, and then re-run using bootstrapping, which utilized bias corrected 95% confidence intervals in order to assess significance (estimates were regarded as significant at $p < .05$ when confidence intervals did not span zero).

As can be seen in Figure 2 support was obtained for Hypothesis 1; Sensation Seeking positively predicted values of Hedonism and Stimulation in conditions of Reward then Punishment (Group 1) and Punishment then Reward (Group 2). Overall, there were significant relationships between Sensation Seeking and Hedonism ($p < 0.05$) and Sensation Seeking and Stimulation ($p < 0.05$) for both groups. Specific parameter estimates for these relationships were similar across groups as expected (i.e. the manipulation should not result in different relationships between such measured variables). Consistent with this, the fit of the measurement weights model was not significantly poorer than the configural invariance model (i.e., the completely unconstrained model; see Table 3).

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Insert figure 2 about here

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Partial support was obtained for Hypothesis 2. For group 1, the indirect effect from the Sensation Seeking to risk-taking behavior, via Hedonism and Stimulation were observed (*indirect effect* = 0.14, $p < 0.05$), however this was not significant for group 2 (*indirect effect* = 0.08, $p = 0.10$). This result is therefore partially consistent with our suggestion that 'approach' traits are related to risk-taking behavior, via their association with Hedonism and Stimulation.

In support of Hypothesis 3, Stimulation predicted risk-taking *(beta* = 0.20, $p < 0.05$) in group 1, but not group 2 (*beta* = 0.00, *ns*). The association between Stimulation and risk-taking behavior is therefore significantly positive under the conditions of Reward then Punishment (group 1) but not Punishment then Reward (group 2). In support of Hypothesis 4, Hedonism was found to be positively associated with risk-taking behavior (*beta* = 0.21, $p < 0.05$) in group 2 but not group 1 (*beta* = 0.11, *ns*). These results were consistent with hypotheses 3 and 4.

We note that model fit was not greatly reduced by constraining the structural weights between the two groups (i.e., paths that were hypothesized to differ over the two groups). This can be seen in the relatively good fit of the 'structural weights' model (see Table 3). This indicates we find little overall evidence that there were significant differences between the two groups (*chi-square difference* = 31.08 - 29.21 = 1.87, *df* = 2, *ns*). Chi-squared tests of difference were consistently non-significant across the models in Table 3. Nevertheless, there were noticeable differences in parameter estimates over the two conditions when models were unconstrained which we suggest provides some support for our hypotheses.

Therefore we tentatively suggest that values of Stimulation and Hedonism predict risk-taking behavior in group 1 (Reward then Punishment) and group 2 (Punishment then Reward) conditions, respectively. Our results also suggest that 'approach' traits indirectly

predict risk taking via Hedonism and Stimulation in both conditions. The 'measurement weights' model revealed that Hedonism and Stimulation differentially predict risk taking under the two conditions.

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Insert Table 3 about here

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## Discussion

In this research we explored the relationship between Sensation Seeking, values, and risk-taking over two conditions where the order at which participants were rewarded and punished for taking risks was altered. First, we found that overall, participants took more risks in the condition where punishment follows reward. We also found that Sensation Seeking indirectly predicts risk-taking via values in the condition where punishment follows reward. In terms of our key research question, we also found that Stimulation leads to risk-taking when punishment follows reward whereas Hedonism leads to risk-taking when reward follows punishment. This finding suggest that those high in Hedonism and Stimulation might engage in risk-taking behavior for different reasons.

Multi-group analysis structural equation modeling was used to test the four hypotheses specified in this study. Participants were divided into two groups: group 1 (Reward then Punishment) and group 2 (Punishment then Reward), in an attempt to understand how the approach trait Sensation Seeking and individual values predict risk-taking behavior over these conditions. Consistent with Hypothesis 1, Sensation Seeking positively predicted the values of Hedonism and Stimulation in conditions of both Reward then Punishment (group 1) and Punishment then Reward (group 2). As expected, the

manipulation (i.e., the order of reward and punishment trials) did not influence the association between Sensation Seeking and values of Hedonism and Stimulation.

In partial support of Hypothesis 2, Sensation Seeking indirectly predicted risk-taking behavior via values in both in group 1 but not group 2 (although this was approaching significance at $p = .1$). These results suggest that, consistent with theory, Sensation Seeking underpins the values of Stimulation and Hedonism and indirectly influence risk-taking via these values, particularly in situations where taking risk is rewarded (note, initial bivariate associations are not required for indirect effects).

Hypothesis 3 proposed that the association between Stimulation and risk-taking behavior would be positive under the conditions of Reward then Punishment (i.e., group 1). This hypothesis received partial support; parameter estimates in the measurement weights model varied in accordance with the hypothesis, such that stimulation predicted risk-taking behavior in condition 1 but not condition 2. However, the fit of the model was not significantly reduced when these parameters were constrained to be equal over the two groups. We therefore tentatively interpret these findings to support our hypothesis, but suggest that more research is needed before any firm conclusions can be reached. Hypothesis 4 also received partial support; parameter estimates were in line with the prediction; however, again a comparison of the measurement and structural weights model revealed that constraining parameters to be equal did not significantly affect model fit. We therefore tentatively suggest, consistent with Hypothesis 4, that the association between Hedonism and risk-taking behavior is positive under Punishment then Reward (group 2).

Results from hypotheses 3 and 4 are consistent with previous research findings that punishment seems to enhance reward seeking behavior in some individuals (Nichols & Newman, 1986). While Nichols and Newman found that subsequent punishment enhances reward-seeking behavior in extraverts, we found that punishment enhances risk taking when

it follows reward in individuals who value Stimulation. Interestingly, when punishment precedes reward, risk-taking is enhanced in individuals who value Hedonism. Therefore, the findings of this study are consistent with previous research whilst also adding some extra perspectives.

Overall, we suggest that individuals high in Sensation Seeking are likely to develop approach-type values (i.e., Hedonism, Stimulation consistent with hypotheses 1 and 2), as such values are consistent with their underlying sensitivity to reward. We then suggest that the development of specific values leads to a different likelihood of risk-taking under different conditions (consistent with hypotheses 3 and 4). We suggest that individuals who value Stimulation (or 'stimulative' individuals) are highly insensitive to punishment when risk-taking behavior has been previously rewarded. We argue that individuals who score high on Stimulation are so motivated by potential reward, that that they may be less attentive and therefore less sensitive to non-reward and punishment. This explanation is consistent with our findings and findings by Patterson et al. (1987), who found that extraverts are less likely to reflect on punishment than introverts. Importantly, we argue that stimulative individuals require *prior reward* in order to engage in risky behavior when such behavior is punished. It is likely that prior reward focuses their attention on such reward, which makes them subsequently less attentive to punishment.

We also suggest that individuals who value Hedonism are highly insensitive to punishment when it precedes rewards. We speculate that because hedonistic individuals tend to come from prosperous backgrounds (Schwartz, 2006), they have grown accustomed to having their needs met quickly, and in general getting what they desire. It follows that such individuals likely have an underlying mindset that they will *eventually* get what they want, and therefore take little notice when they do not *initially* get what they want (i.e., non-reward or punishment). Indeed, their eventual receipt of reward likely reinforces this mindset. In

contrast to stimulative individuals, therefore, hedonistic individuals do not need pre-exposure to reward to focus their attention on reward (and therefore become less attentive to punishment), since they are highly focused on reward to begin with.

Also in contrast to stimulative individuals, hedonistic individuals do not seem to engage in risky behavior when punishment is preceded by reward. We argue that this makes sense in terms of the above logic. As argued above, hedonistic individuals engage in risky behavior when they initially do not get the rewards they expect, based on a belief they will eventually be rewarded. In contrast, when they are initially rewarded for engaging in risky behavior they have rapidly achieved what they desire, and no longer need to operate at such high levels of risk.

**Theoretical and practical implications**

This research helps us to understand the conditions under which different individuals are likely to engage in risky behaviors. As noted previously, we found that individuals who value Hedonism are more likely to engage in risky behavior when rewards follow punishment, and individuals who value Stimulation are more likely to engage in risky behavior when rewards precede punishment. We note that such results were found only in laboratory conditions, but see no reason as to why they would not apply to risk-taking behavior outside the laboratory. Indeed, if our results can be extended to risk-taking behavior outside the laboratory, they offer a new framework for understanding the mechanisms of excessive risky behavior in different individuals. We believe that this area of research has potential implication in areas of psychopathology involving risk, such as problem gambling.

**Limitations**

We acknowledge a number of limitations in this study. First, our measure of risk taking (number of explosions) was calculated over all trials rather than in each block.

Although we were primarily interested in overall levels of risk taking, this measure is limited in that group differences could have been secondary to differences in one section (i.e. the block of reward trials or the block of punishment trials). Such a measure would have given us a more refined understanding of how groups differ and consequently we encourage future research to measure behavior at this level (we did not do this in the current study).

Second, in the current study we had two experimental conditions (defined by Reward then Punishment and Punishment then Reward) but no control condition. A control condition would have been desirable in the current study, as it would have allowed us to determine whether our Reward then Punishment condition increased risk taking behavior, or whether our Punishment then Reward condition reduced such behavior. A control condition could have been formed based on a set of trials whereby the risk of the balloon popping in each trial, was the average of that specified for the reward trials and punishment trials (i.e. to pop on average on the $12^{th}$ trial). Nevertheless, in the current study, we speculate that having a punishment trial before a risk trial lowers risk-taking behavior. This is based on the level of risk-taking behavior being lower in our study (Punishment then Reward) than in comparable reward and punishment only conditions using the same DV (number of explosions) reported in the original BART study by Lejuez et al. (2002).

Third, the sample size was relatively small (195 participants), considering the statistical technique used. Due to the relatively small sample size, gender differences were not examined (or controlled). Finally, since we conducted only one study, our results have not been replicated. We suggest that future research could address some of these issues.

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Table 1

*Descriptive statistics and inter-correlations among risk-taking behaviors, approach personality traits, and values (N = 195)*

| | Mean | SD | Alpha | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| 1.Sensation Seeking | 16.52 | 5.75 | 0.86 | | | |
| 2. BART Explosions | 7.77 | 2.48 | | 0.01 | | |
| 3. Stimulation | -1.65 | 3.27 | 0.83 | 0.45** | 0.08 | |
| 4. Hedonism | -0.76 | 3.60 | 0.83 | 0.29** | 0.16* | 0.24** |

*Note. *p<.05. **p<.01*

Table 2

*Means, standard deviations and difference tests for mean scores on focal variables across groups.*

| | Condition | | |
|---|---|---|---|
| Variable | Punishment then Reward | Reward then Punishment | ANOVA |
| Age | 23.10 (5.49) | 22.78 (5.51) | $F(1,193) = .15$, $p = .70$ |
| Sensation Seeking | 16.25 (5.55) | 16.68 (5.88) | $F(1,193) = .24$, $p = .62$ |
| Stimulation | -1.90 (3.36) | -1.51 (3.22) | $F(1,193) = .61$, $p = .43$ |
| Hedonism | -.91 (3.77) | -.68 (3.52) | $F(1,193) = .19$, $p = .67$ |
| BART Explosions | 6.86 (2.27) | 8.30 (2.46) | $F(1, 193) = 16.46$, $p < .001$ |

Table 3

*Fit Indices for the Proposed Relationships between Approach Traits, Risk-Taking Behavior and Values*

| Model | $\chi^2$ | Df | *P* | Bollen-Stine *P* | GFI | AGFI | SRMR |
|---|---|---|---|---|---|---|---|
| Independence | 35.21 | 40 | 0.46 | .55 | 0.95 | 0.93 | 0.09 |
| Structural covariance | 31.30 | 33 | 0.51 | .60 | 0.95 | 0.93 | 0.09 |
| Structural weights | 31.08 | 32 | 0.51 | .59 | 0.96 | 0.93 | 0.09 |
| Measurement weights | 29.21 | 30 | 0.55 | .63 | 0.96 | 0.92 | 0.08 |
| Configural invariance | 23.99 | 24 | 0.69 | .80 | 0.97 | 0.92 | 0.07 |