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Risk as Reward:
**Reinforcement Sensitivity Theory and Psychopathic Personality Perspectives on
Everyday Risk-Taking**

[ACCEPTED: Personality and Individual Differences]

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1 Risk as Reward: Reinforcement Sensitivity Theory and Psychopathic Personality

2 Perspectives on Everyday Risk-Taking

3 Highlights

- 4 • We studied risk-taking using impulsive, fearless and antisocial traits
- 5 • We find that Fearlessness (across models) related to ‘pro-social’ risks
- 6 • We find that Impulsivity (across models) related to health and ethical risks
- 7 • RST and callous-unemotional traits can be combined to represent psychopathic personality

8 Abstract

9 This study updates and synthesises research on the extent to which impulsive and antisocial
10 disposition predicts everyday pro- and antisocial risk-taking behaviour. We use the Reinforcement
11 Sensitivity Theory (RST) of personality to measure approach, avoidance, and inhibition dispositions,
12 as well as measures of Callous-Unemotional and psychopathic personalities. In an international
13 sample of 454 respondents, results showed that RST, psychopathic personality, and callous-
14 unemotional measures accounted for different aspects of risk-taking behaviour. Specifically, traits
15 associated with ‘fearlessness’ related more to ‘prosocial’ (recreational and social) risk-taking, while
16 traits associated with ‘impulsivity’ related more to ‘antisocial’ (ethical and health) risk-taking.
17 Further, we demonstrate that psychopathic personality may be demonstrated by combining the RST
18 and callous-unemotional traits (high impulsivity, callousness, and low fear). Overall this study
19 showed how impulsive, fearless and antisocial traits can be used in combination to identify pro- and
20 anti-social risk-taking behaviours; suggestions for future research are indicated.

21
22 **Keywords: Personality; Reinforcement Sensitivity Theory; Psychopathy; Callous-Unemotional**
23 **traits; Risk-taking.**

24

1 **1. Introduction**

2 Individuals prone to high risk-taking behaviour create problems for themselves and society
3 (Wilson & Daly, 1985). Research into early indicators of antisocial behaviours has highlighted the
4 importance of impulsivity (Bacon, Corr & Satchell, 2018; Carroll et al., 2006; Loeber et al., 2012;
5 Lynam, et al., 2000), sensation seeking (Mann et al., 2017; Pérez & Torrubia, 1985; Simó, & Pérez,
6 1991), and poor social understanding (Hepper, Hart, Meek, Cisek & Sedikides, 2013). All three of
7 these traits are relevant for explaining youth (e.g., Sitney, Caldwell & Caldwell, 2016) and adult (e.g.
8 Krstic et al., 2017; Shepherd, Campbell & Ogloff, 2016) offending behaviour. However, not all
9 societal problems are criminal in nature and risk-taking in financial, health and recreational domains
10 may also lead to negative social consequences. There has been caution regarding the application of
11 the *trait* models of personality to *state* and domain dependent risk-taking (Blais & Webber, 2006);
12 however, contemporary personality theorising has highlighted the importance of impulsivity and
13 fearlessness (see Corr, 2016). Both of which are, theoretically, antecedents to risk-taking behaviour.
14 This study investigated the extent to which personality theories can account for, and possibly help to
15 explain, risk-taking across multiple domains of pro- and antisocial behaviour.

16 The traits of impulsivity, risk-taking and antisociality are similar to those used to characterise
17 psychopathic personality (Lilienfeld, Lutzman, Watts, Smith & Dutton, 2014; Patrick, Fowles &
18 Krueger, 2009). The terminology used by different groups of psychopathy researchers may diverge,
19 but there is general consistency in a three trait model. For example, the Psychopathic Personality
20 Inventory may be considered in terms of three higher -order factors: Fearless Dominance (social
21 influence and low stress), Self-Centred Impulsivity (non-planful behaviour and rebelliousness) and
22 Coldhearted disconnection from other people (Lilienfeld et al., 2014; Lilienfeld & Widows, 2005). In
23 a similar manner, Patrick et al. (2009) consider a triarchic model of psychopathic personality
24 containing Boldness (“a tolerance for unfamiliarity and danger”), Disinhibition (“propensity toward
25 impulsive control problems”), and Meanness (“deficient empathy” and “callousness”). It is important
26 to note that there are differences in the detail of these three-part solutions (e.g., the social dominance
27 of Patrick et al.’s Meanness is explicitly separated out in Lilienfeld & Windows’s 2005 measure). The
28 popular Psychopathy Checklist (PCL-R, Hare, 2003) points to the existence of four factors:

1 Interpersonal ('grandiose self-worth'), Lifestyle (impulsivity and irresponsibility), Antisocial (poor
2 behavioural controls and adolescent antisocial behaviour) and Affective (shallow affect and lack of
3 empathy) deficits. There are conceptual (Patrick et al., 2009) and statistical (notable intercorrelations
4 between factors; Neumann, Hare & Pardini, 2014) reasons to be circumspect of the four-part solution
5 to the PCL-R; in fact, "the PCL-R interpersonal facet overlaps with the PCL-R's Affective, Lifestyle
6 and Antisocial facets" (Patrick et al., 2009, p. 927). For example, the PCL-R facet on Lifestyle
7 includes impulsivity as a criteria and the Antisocial facet includes the highly similar 'poor behavioral
8 control'. As others have argued (Patrick et al., 2009), it is possible to consider the widely-used PCL-R
9 in terms of the three facets described by others. As a generalisation these explanations of
10 psychopathic personality describe: (1) low fear or stress; (2) impulsive or nonplanful behaviour; and
11 (3) antisocial or socially manipulative disposition (Drislane, Patrick & Arsal, 2014; Patrick et al.,
12 2009, for a review). These three traits can be observed in the population at large and are distinct from
13 clinical diagnoses of psychopathy (Hall & Benning, 2006; Levenson et al., 1995; Skeem, Poythress,
14 Edens, Lilienfeld & Cale, 2003).

15 General models of personality have been related to psychopathic disposition. One such
16 model, which addresses impulsivity and risk sensitivity, is the Reinforcement Sensitivity Theory
17 (RST) of personality (Corr, 2004; 2016). RST may be seen as complementary to theories of
18 psychopathic personality as both focus on reward and punishment (RST: Corr, 2016; Psychopathy:
19 Patrick & Bernat, 2009) and have a neuropsychological explanation (RST: Corr, 2004; Psychopathy:
20 Wahlund, & Kristiansson, 2009). To contribute to the growing body of work on normative (as
21 opposed to clinical) explanations of high risk behaviour, the current study brings together
22 contemporary measures of RST with measures of callous-unemotionality to predict psychopathic
23 personality and everyday risk-taking.

24 RST considers three main traits that attempt to account for personality factors that are
25 sensitive to contingencies in the environment. The tendency to avoid potential harm and react to
26 aversive stimuli is mediated by the Fight/Flight/Freeze System (FFFS) - an individual who has a
27 strong FFFS disposition is more likely to be phobic and overly avoid potential risks (Corr, 2008). The
28 Behavioural Approach System (BAS) manages the seeking and control of appetitive rewards in the

1 world - an individual whose personality is strongly influenced by the BAS is likely to be impulsive,
2 sensitive to novelty and more diligent in pursuing rewards (Corr & Cooper, 2016). These two
3 personality factors are moderated by a Behavioural Inhibition System (BIS), which is activated upon
4 detection of significant goal conflict (e.g., FFFS and BAS co-activation). A BIS individual is oriented
5 towards hesitancy and rumination, during which time the eliciting conflicting goal stimuli are
6 subjected to cognitive appraisal. The outcome is that stimuli are either classified as appetitive or
7 aversive – or, in more general terms, an attractor or repulsor (Corr & McNaughton, 2012) - or neither,
8 in which case control reverts to a ‘just checking’ neutral mode. A dominant BIS personality trait is
9 likely to lead to more everyday hesitancy, anxiety and worry (Corr, 2008). Although there is a well-
10 developed and growing RST literature, there is still limited evidence on its explanatory utility to
11 predict everyday behaviours. There has been some work along these lines, including educational
12 outcomes (Satchell, Hoskins, Corr & Moore, 2017), antisocial behaviour (Bacon et al., 2018) and
13 organisational behaviour (Corr et al., 2016), but little else. Indeed, RST has not been widely used to
14 explore everyday risk in any great detail, whilst other models (psychopathic personality research)
15 often explicitly focus on the broad behavioural outcome of risk-taking. Theoretically, RST is well
16 suited to describing risk-taking behaviour. The BAS tendencies to be impulsive and novelty seeking
17 should be expected to lead to more risk-taking, whereas the defensive nature of high trait FFFS
18 individuals and the cautiousness of high BIS individuals should lead to less risky behaviour.

19 There is evidence to suggest an overlap between RST and psychopathic personality traits.
20 There are key papers that define psychopathy in RST terms, such as Corr’s (2010) work on
21 identifying ‘primary’ psychopathy in terms of low functioning FFFS and BIS and ‘secondary’
22 psychopathy with high functioning BAS. The widely used Carver and White (1994) RST tool has
23 previously been related to measures of the triarchic model of psychopathy (Sellbom & Phillips, 2013)
24 and Levenson’s (Levenson, Kiehl & Fitzpatrick, 1995) primary and secondary psychopathy (Hughes,
25 Moore, Morris & Corr, 2012). However, the Carver and White (1994) measure was designed for the
26 original version of RST which did not differentiate FFFS and BIS processes and, even with revisions
27 to the analysis of the Carver and White tool (Heym, Ferguson & Lawrence, 2008), it still does not
28 capture fully the contemporary understanding of RST (Corr, 2016; Corr & Cooper, 2016). Our current

1 study updates the literature relating RST to psychopathic personality traits, but by using a more
2 comprehensive measure of RST (Corr & Cooper, 2016) and a measure of psychopathic personality
3 (Lilienfeld, 2004).

4 Unlike many personality models, such as the Big Five (see Soto & John, 2009), HEXACO
5 (Lee & Ashton, 2004) and the MMPI (Greene, 2000), the RST of personality does not have an explicit
6 focus on social and interpersonal interests. It has been shown that social behaviours are ‘rewarding’,
7 in both neuroendocrine (Dunbar & Shultz, 2007) and cognitive (Clark, 1993) terms, and sociality
8 could be expected to be associated with high reward seeking (BAS) and low fear (FFFS) and anxiety
9 (BIS) behavioural patterns. So, whilst RST has the potential to explore some facets of psychopathy in
10 more detail, it lacks the essential antisocial components to take the place of psychopathy.

11 A subset of psychopathic personality research has focused on, and refined, measures of
12 antisocial disposition. Measures of callous and unemotional traits were developed to explore lack of
13 empathy and coldheartedness in more detail (Frick, 2004; Essau, Sasagawa & Frick, 2006). Given the
14 shared lineage, it is unsurprising that the callous-unemotional trait measures correlate highly with
15 psychopathic personality (Kimonis, Branch, Hagman, Graham & Miller, 2013) and lowly with
16 anxiety (uncaring; Byrd et al., 2013). Recently, it has also been demonstrated that the original three
17 callous-unemotional traits are best represented by a core antisocial trait (Ray, Frick, Thornton,
18 Steinberg & Cauffman, 2016). This well-developed measure of antisocial tendencies provides a strong
19 framework to examine the extent to which callous-unemotional disposition relates to different
20 domains of risk-taking.

21 Callous-unemotional traits lack the impulsivity and fearlessness aspects of a complete
22 psychopathic personality profile. There has been some previous research relating callous-unemotional
23 traits to RST in adolescents (Roose, Bijttebier, Claes & Lilienfeld, 2011); but this study, once again,
24 used the less-than-comprehensive Carver and White (1994) psychometric measures of RST. Roose et
25 al. (2011) reported that the callous-unemotional factor of the youth Psychopathic Traits Inventory
26 (Adershed, Kerr, Stattin & Levander, 2002) was negatively correlated with FFFS, BIS, and BAS
27 reward responsiveness. With callous-unemotional traits addressing the social tendencies that are
28 lacking in assessments of RST personality, it could be the case that combining these two models

1 produces an effective proxy of psychopathic personality, and one based in normally distributed
2 personality traits and processes. Furthermore, this research strategy allows us to explore the
3 relationship between antisocial traits and RST, using updated tools that have more psychometrically
4 robust trait measures (Corr & Cooper, 2016; Ray et al., 2016), than those used in Roose et al.'s (2011)
5 previous work.

6 This study has two principal aims. First, to demonstrate the expected overlap between
7 measures of psychopathic, RST and callous-unemotional personality traits. Secondly, to explore the
8 extent to which these three popular tools can predict everyday risk-taking in non-criminal domains.

9 We hypothesised the following. (1) Variance in psychopathic personality traits can be
10 explained by antisocial (callous-unemotional), fear and impulsivity (RST) traits - this effect would
11 largely be a replication of known effects and a synthesis of previous literature using contemporary
12 tools. (2) Risk-taking should be predicted by high RST impulsivity (BAS) and low FFFS. (3) High
13 fearless and impulsive psychopathic personality should also predict risk-taking, as should (4) a
14 callous-unemotional disposition. In addition, it is of further interest to explore the differences between
15 the correlates of pro- and antisocial domains of risk-taking which, themselves, may show differential
16 associations with the personality and psychopathic measures.

17 **Method**

18 **2.1 Participants.** Respondents were recruited using websites that advertise academic
19 research. To motivate engagement with the study, they were told that they would receive a
20 personalised summary of their BIS, BAS and FFFS trait scores. They were informed during briefing
21 that incomplete data would be considered as withdrawal from the study and incomplete datasets
22 would not be retained for analysis. In total, there were 732 individuals who clicked on the study;
23 however, only 454 respondents provided complete data for analysis and to respect participant
24 withdrawal from the study all incomplete data were deleted.

25 This sample had more females ($n = 277$) than males ($n = 161$, with prefer not to say, other or
26 missing = 16). The average age was 26.80 years old ($SD_{Age} = 8.21$, $Min_{Age} = 18$, $Max_{Age} = 65$, 27 did
27 not report). Other sample characteristics included: heterosexual ($n = 297$; bisexual = 89, homosexual
28 = 26, other/prefer not to say = 42); speaking English as a first language ($n = 357$, as a foreign

1 language = 97); and engaging in optional education (mandatory pre-16 only = 28, post 16 years old =
2 121, undergraduate = 193, postgraduate = 112). Respondents reported if they lived in the UK ($n =$
3 199), outside the UK but inside the EU ($n = 85$) or outside the EU ($n = 250$).

4 **2.2 Procedure and materials.** After giving informed consent, respondents completed four
5 questionnaires presented in chronological order, as shown below. Descriptive, reliability and
6 normality statistics for the traits can be found in Table 1. It should be noted that, as would be expected
7 with these risk-taking and antisocial traits, many of the distributions were skewed and non-normal.

8 **2.2.1 The Reinforcement Sensitivity Theory Personality Questionnaire (RST-PQ).** The 65-
9 item RST- PQ (Corr & Cooper, 2016) contains a series of statements that may describe the
10 respondents (e.g., “*I am very open to new experiences in life*” & “*I find myself doing things on the*
11 *spur of the moment*”). Participants are asked “how accurately does this statement describe you?”, and
12 respond on a scale of *Not at all* (0) to *Slightly* (1), *Moderately* (2) to *Highly* (3) in each case. The
13 RST-PQ has the following scales: Fight/Flight/Freeze System (FFFS), Behavioural Inhibition System
14 (BIS), and Behavioural Approach System (BAS) - the BAS is divided into four subdomains of
15 novelty attractiveness (BAS-Reward Interest), spontaneity of behaviour (BAS-Impulsivity), long-term
16 planning (BAS-Goal-Drive Persistence) and sensitivity to gains (BAS-Reward Reactivity).

17 **2.2.2 Psychopathic Personality Inventory – Revised: Short Form (PPI-R:SF).** The 56-item
18 PPI-R:SF (Lilienfeld & Widows, 2005) assesses eight subdomains of a psychopathic personality
19 which can be analysed in three higher-order factors and also yields an overall psychopathic
20 personality score (Lilienfeld et al., 2014). The Fearless Dominance domain contains such behaviours
21 as low resting stress, low fearlessness and social control. Self-Centred Impulsivity reflects blaming
22 others, carelessness, non-conformity and ego driven behaviour. Cold-heartedness is a smaller domain
23 that is focused on lack of interest in social and interpersonal issues. Respondents answer these
24 questions using by stating how true the statements are for them on a scale of *True* (3), *Mostly True*
25 (2), *Mostly False* (1) and *False* (0). See Table 1 for descriptive statistics and reliabilities of the traits.

26 **2.2.3 Inventory of Callous-Unemotional (ICU) traits.** Respondents completed the ICU
27 (Essau et al., 2006) which is a tool that assesses antisocial tendencies. This involves tendencies to be
28 Callous (not caring attitude towards others, e.g., “*I do not care who I hurt to get what I want*”),

1 Uncaring (not caring attitude towards performance, e.g., the revised “*I work hard on everything I*
2 *do*”), and Unemotional (not emoting openly, e.g., “*I do not show my emotions to others*”).
3 Respondents are asked if the statement is true for them: *Definitely True (3)*, *Mostly True (2)*, *Slightly*
4 *True (1)* or *Not at all True (0)*. In line with the latest recommendations for analysis, we computed one
5 overall factor to reflect ICU responding (Ray, et al, 2016). The reliability and distribution of scores
6 can be found in Table 1.

7 **2.2.4 Domain-Specific Risk-Taking scale (DOSPERT).** The Blais and Weber (2006)
8 DOSPERT measures the propensity to risk take in differing domains: Ethical Risk (e.g., “*Having an*
9 *affair with a married man/woman*” and “*passing of somebody else’s work as your own*”); Financial
10 Risk (e.g., “*Betting a day’s income at the horse races*” and “*Investing 10% of your annual income on*
11 *a new business venture*”); Health Risk (e.g., “*Engaging in unprotected sex*” and “*Riding a motorcycle*
12 *without a helmet*”); Recreational Risk (e.g., “*Taking a skydiving class*” and “*Piloting a small plane*”);
13 and Social Risk (e.g., “*Disagreeing with an authority figure on a major issue*” and “*Admitting that*
14 *your tastes are different from those of a friend*”). We assessed the responses to this measure by asking
15 respondents how likely they were, on a scale of *Extremely Unlikely (1)* through *Not Sure (4)* to
16 *Extremely Likely (7)*, to engage with the risk behaviours. We find the internal reliability for the
17 Ethical and risk-taking to only be moderate (see Table 1). Financial, Recreational and Social risk-
18 taking showed greater internal reliability.

19 As expected in a general sample, the DOSPERT responses presents a profile of, on average,
20 ‘Unlikely’ to engage in risk-taking behaviour. The notable exception is Social risk-taking where mean
21 responses are comfortably within the “likely” range.

22 **[Insert Table 1 here]**

23 **2.3 Analyses.**

24 There are two aims in this paper. First to explore covariance in the trait models and secondly
25 to investigate extent to which the trait models predict risk-taking behaviour. To analyse shared
26 variance in the trait domains, we conducted pairwise correlations between the trait measures. We
27 further conducted an oblimin (oblique) exploratory factor analysis using the R package ‘psych’

1 (Revelle, 2017). The factor number fit solutions were investigated using parallel analysis and model
2 fit indices.

3 The effectiveness of the trait measures at predicting risk-taking behaviour was analysed using
4 regression models. To investigate how the RST-PQ trait measures predicted risk-taking, hierarchical
5 regressions were built with a null model containing sex and age (for their known relationship with
6 antisociality) then, a second model containing the RST-PQ personality traits of interest and then a
7 third model was built containing the additional psychopathic and callous-unemotional personality
8 traits. This would provide information as to the importance of antisocial oriented personality traits are
9 needed to explain risk-taking behaviour and if the RST-PQ traits are sufficient to explain risk-taking.
10 We also conducted pairwise correlations between the risk-taking domains and the trait measures.

11 **3. Results**

12 **3.1 Shared variance in psychometric measures.** We initially analysed the relationship
13 between the psychometric measures of RST personality (from the RST-PQ), dispositional callous-
14 uncaringness (from the overall score of the ICU) and psychopathic personality (from the PPI-R:SF).
15 The correlation between these variables can be found in Table 2. The ICU general trait positively
16 correlated psychopathic Coldheartedness, and negatively with RST BAS factors (predominantly
17 Reward Reactivity). As would be expected, BAS Impulsivity positively correlated with PPI-R:SF
18 impulsivity and fearlessness negatively correlated with RST fear (FFFS) and anxiety (BIS).
19 Interestingly, there were negative correlations across RST domains of BIS, FFFS and BAS-Reward
20 Reactivity and PPI-R:SF Coldheartedness. As RST lacks an explicit social facet, these correlations
21 (distinct to those with the ICU traits) are informative about the roles of anxiety, fear and reward
22 sensitivity to social disconnection.

23 These results were supplemented with a factor analysis to explore the smallest number of
24 factors that explain these similar trait domains. All RST-PQ traits, the ICU summary trait and three
25 domains of the PPI-R:SF were entered into the exploratory factor analysis.

26 **[Table 2 about here]**

27 A parallel analysis ('fa.parallel', Revelle, 2017) suggested a four factor solution, however the
28 model fit indices were not optimal (RMSEA= .11, 95% CI [.08, .13], Tucker Lewis index= .86). A

1 five factor model was built, achieving a good model fit (RMSEA= .06, 95% CI [.02, .10], Tucker
2 Lewis index= .96). The factor loadings of this five factor model are found in Table 3. The analysis
3 grouped the ‘impulsive factors’ of RST-PQ’s BAS Impulsivity and the PPI-R:SF’s Self-Centred
4 Impulsivity (BAS-Reward reactivity also reasonably loading onto this factor). The ‘antisocial factors’
5 of the PPI-R:SF’s Coldheartedness and the ICU overall trait. The non-impulsive RST-PQ BAS traits
6 of Goal-Drive Persistence, Reward Interest and Reward Reactivity loaded on the same factor. The
7 RST-PQ’s BIS strongly positively loaded onto a factor with the negatively loaded PPI-R:SF’s
8 Fearless Dominance. The RST-PQ’s FFFS trait strongly loaded onto a fifth factor, and there was some
9 evidence that the PPI-R:SF’s Fearless Dominance also negatively loaded onto this factor.

10 The difference between the five factor solution and the four factor solution (suggested by
11 parallel analysis), was that the RST-PQ factors of BIS and FFFS and the PPI-R:SF’s Fearless
12 Dominance loaded onto a single factor in the four factor model.

13 These results support our first hypothesis and the work of the extant literature. Due to the
14 RST lacking a social facet and the ICU not including impulsivity or risk taking, neither scale fully
15 accounted for psychopathic personality. However, the RST-PQ fear and impulsivity traits and the ICU
16 trait accounted for psychopathic personality. It was the case that most BAS factors were largely
17 separate to psychopathic and callous-unemotional personality.

18 **[Table 3 about here]**

19 **3.2 Predicting risk-taking behaviour.** We computed correlations between the risk-taking
20 domains and the traits in this study (see Table 4). For the RST-PQ, BIS and FFFS negatively
21 correlated with risk-taking and the BAS domains positively correlated with risk-taking (BAS-
22 Impulsivity showed the strongest relationships for the RST-PQ overall).

23 Coldheartedness in the PPI-R:SF did not relate to risk-taking in general, with the exception of
24 a positive relationship with ethical risk. The overall callous-unemotional trait from the ICU was
25 similar, correlating positively with ethical risk and negatively with social risk. The PPI-R:SF Fearless
26 Dominance and Self-Centred Impulsivity positively correlated with all risk-taking domains (both pro-
27 and anti-social).

28

1 **[Table 4 about here]**

2 In regression analyses, demographic, RST-PQ and psychopathic traits were used to predict
3 each risk-taking domain at a time (see Table 5). The Model 2s, containing RST-PQ traits explained
4 more variance than the Model 1s (containing sex and age) and the Model 3s (additionally containing
5 psychopathic and callous-unemotional traits) were further improvements in explaining variance (see
6 table 5).

7 Only in the cases of DOSPERT ethical and social risk-taking did Model 1 explain sufficient
8 variance. In these models, male sex was a predictor of ethical risk-taking and older age was predictive
9 of social risk-taking. In both cases these were weak predictors of the risk-taking (table 5).

10 For the second Models, noteworthy predictors varied across risk-taking domain. BAS-
11 Impulsivity was a predictor of ethical, health, recreational and social risk-taking behaviours.
12 Heightened sensitivity to trait FFFS led to a decrease in health, recreational and social risk-taking
13 behaviour. There was also evidence that BAS Reward Interest was a notable predictor of pro-social
14 (recreational and social) risks. This finding supports our second hypothesis that high BAS-Impulsivity
15 and low FFFS would relate to risk-taking. However the findings also indicate the importance of RST
16 BAS-Reward Interest as indicative of risk-taking behaviour.

17 The third Models investigated the benefit of further including psychopathic and callous-
18 unemotional traits in predicting risk-taking behaviour. In most cases the inclusion of these new traits
19 decreased the prediction power of the RST-PQ. In ethical, health and social risk-taking, the PPI-R:SF
20 Self-Centred Impulsivity trait became a dominant predictor, more than the RST-PQ traits. In a similar
21 way, the Fearless Dominance psychopathic personality trait was a strong predictor for recreational
22 risk-taking. Coldheartedness positively predicted (antisocial) ethical risk-taking and negatively
23 predicted (pro-social) recreational risk-taking. This provides support for our third hypothesis. The
24 Callous-Unemotional trait was the strongest predictor of financial risk taking but was only a small
25 predictor of other domains of risk-taking, partially supporting our fourth hypothesis. Even with
26 incorporating psychopathic and callous traits into the model, the RST traits of BIS, FFFS and BAS-
27 Impulsivity BAS-Reward Interest predicted risk-taking behaviour.

1 Overall, RST and psychopathic personality traits explain different domains of risk-taking
2 behaviour. Ethical risk-taking was defined by impulsivity and sensitivity to gains. Financial risk-
3 taking was also related to reward reactivity but also callous-unemotional disposition. Health risk-
4 taking was defined by low fearlessness and high impulsivity. Pro-social recreational risk-taking
5 positively related to fearlessness, reward seeking and, somewhat unexpectedly, dispositional
6 rumination. Social risk-taking was predicted by low fear, low anxiety, self-centred impulsivity and
7 high reward seeking. Age and sex were negligible predictors with the personality factors considered.

8 **[Table 5 about here]**

9 **4. Discussion**

10 The results of the current study showed how RST, psychopathic personality and callous-
11 unemotional traits all related to risk-taking behaviours. The strongest predictors, across measures,
12 were the impulsive, fearless and callous traits, which were all indicative of risk-taking behaviour. In
13 the simplest terms, impulsivity and sensitivity to appetitive stimuli generally predicted antisocial risks
14 and pro-social risks were more defined by fearlessness and sensation seeking.

15 We demonstrated the expected convergence between the RST-PQ, ICU and PPI-R:SF.
16 Notably, psychopathic personality can be expressed as low inhibition, low fearlessness, high
17 impulsivity, sensation seeking and callousness. The factor analysis in this study grouped the trait
18 models in the study into five domains. In line with the three factor model of psychopathy (see
19 Drislane et al., 2014), there was a socially detached or antisocial factor, an impulsivity factor and
20 factors containing low anxiety and fear traits. Interestingly, the RST-PQ's distinction between anxiety
21 (BIS) and fear (FFFS) traits created two unique factors, with which the Fearless Dominance
22 psychopathic personality showed relatively similar loadings. Anxiety (generated by unresolved
23 evaluation of a stimulus) and fear (the response to an aversive stimulus) are distinct processes in the
24 RST model (see Corr, 2016), but not so in the PPI-R:SF. The correlations between BIS, FFFS and the
25 PPI-R:SF's 'Fearless' Dominance here suggest that future psychopathic personality research would
26 benefit from exploring the distinction in low fear and low anxiety behaviour, perhaps by also using
27 the RST-PQ.

1 The factor analysis suggested a further group of traits, separate to the psychopathic
2 personality domains, of non-impulsive BAS. In part, the allocation of BAS-Impulsivity to a separate
3 factor could be due to large amounts of shared variance with the other trait explicitly testing for
4 impulsivity (PPI-R:SF Self-centred Impulsivity). However, other work has noted that there are
5 differences between BAS traits focused on immediate rewards ('Now' BAS traits of Impulsivity and
6 Reward Reactivity) and planning-oriented long term reward seeking behaviour ('Future' BAS traits of
7 Goal-Drive Persistence and Reward Interest; see Satchell, Moore & Corr, 2017). The factor loadings
8 for BAS-Reward Reactivity were similar for the impulsive and non-impulsive summary factors and it
9 could be considered that signs of Now and Future BAS are found in the current data. Future BAS
10 traits are known to principally relate to the Big Five's Conscientiousness whereas the Now BAS relate
11 more prominently to the Big Five's Extraversion (Corr & Cooper, 2016; Satchell, Hoskins et al.,
12 2017). Separation of BAS in this way also explains sex differences in antisocial behaviour tendencies,
13 with male antisociality being better predicted by Future BAS and female antisociality being predicted
14 by Now BAS (Bacon et al., 2018). In the current study of risk-taking behaviour, this distinction is
15 particularly relevant. Future BAS traits (particularly Reward Interest) were correlated with more pro-
16 social risk-taking (recreational and social), whereas Now BAS traits correlated more with the
17 antisocial risk-taking (ethical and financial). Future research could consider the importance of
18 dispositional goal-orientation associated with risk-taking behaviour, investigating how pursuit of
19 future versus immediate rewards may encourage risk-taking.

20 Our results add to the growing research using the contemporary RST trait measure, the RST-
21 PQ. Whilst other studies have demonstrated a relationship between older RST tools and varying
22 measures of psychopathic personality (Hughes et al., 2012; Sellbom & Phillips, 2013; Roose et al.,
23 2011), the current work uses a tool developed on the basis of the latest thinking on RST personality
24 traits (Corr & Cooper, 2016). Here, the contemporary RST personality measure tool, again, finds
25 evidence that psychopathic personality can be expressed as low fearlessness, low anxiety and high
26 impulsivity. This replication is important in the context of the wider personality literature: a better
27 synergy between work on normative brain variability in RST (Corr, 2004) and distinct neurological
28 deficits in psychopaths (Wahlund & Kristiansson, 2009).

1 We also considered how psychopathy may predict risk-taking behaviour. Dispositional
2 fearless dominance most strongly predicted pro-social risk-taking behaviour (recreational and social),
3 self-centred impulsivity predicted ethical and health risk-taking (which both carry antisocial
4 implications), and cold-heartedness was generally a minimal predictor of risk-taking. This result
5 highlights that not all aspects of psychopathic personality are inherently antisocial. Fearlessness
6 dominance appears to act in the interest of others and wider social bonding. In part, this could be part
7 of psychopathic manipulation, but we note the analysis of the ICU at predicting DOSPERT
8 behaviours suggests that social risk-taking is associated with *caring* and *emotional* traits. As
9 assessments of typical populations' psychopathic personality become more common, research should
10 focus on the extent to which sub-domains of psychopathic traits express antisociality, and how some
11 psychopathic tendencies may have pro-social implications.

12 It is important to consider that our results are affected by the similar nature of the tools we
13 used. For example, responses to measures in this study, as would be expected from general population
14 assessments of high risk behaviour, were skewed towards more pro-social attitudes and non-normal
15 distributions. Some of the inventories share similar language especially in terms of shared factors such
16 as impulsivity, long term planning, fear and worry (especially in the RST-PQ and PPI-R:SF). This
17 explains how much of the psychopathy measures were explained in combining the environmental
18 reactivity (RST-PQ) and antisociality (ICU) traits. The convergence of measurement may not be the
19 same as convergence of the theoretical interests and more research using different behavioural
20 measures of impulsivity, risk-taking and antisociality, would be of interest in future research (see
21 Furr, 2009).

22 The current study serves as an update and expansion of the personality and psychopathy
23 literature, especially as it relates to risk taking. We are not unique in bringing together RST, callous-
24 unemotional and psychopathic personality theories, but our use of contemporary measures brings this
25 research up to date.

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Table 1. *Descriptive statistics, number of items and internal reliability of the measures*

Trait	No. of items	Mean	SD	α	Skew	K-S Test
Reinforcement Sensitivity Theory - Personality Questionnaire						
BIS	23	1.73	0.60	.92	-.16	.06**
FFFS	10	1.17	0.60	.78	.36	.09***
BAS-Imp	8	1.18	0.60	.76	.19	.06***
BAS-RR	10	1.62	0.56	.83	-.11	.07***
BAS-RI	7	1.41	0.63	.82	.15	.08***
BAS-GDP	7	1.72	0.73	.89	-.18	.07***
Psychopathic Personality Inventory – Revised: Short Form						
Fearless Dominance	21	1.42	0.51	.86	-.00	.04
Self-Centred Impulsivity	29	0.91	0.39	.83	.54	.07***
Cold-heartedness	7	1.15	0.61	.76	.39	.07***
Overall Psychopathy	56	1.06	0.33	.86	.32	.04
Inventory of Callous-Unemotional Traits						
Overall Score	22	0.86	0.38	.82	.56	.06***
Domain-Specific Risk-Taking Scale						
Ethical risks	6	2.41	0.94	.58	.86	.11***
Health risks	6	3.07	1.19	.67	.51	.08***
Financial risks	6	2.42	1.00	.74	.95	.10***
Recreational risks	6	3.40	1.55	.84	.31	.09***
Social risks	6	5.28	1.03	.69	-.65	.09***

Note.

BIS= Behavioural Inhibition System; FFFS = Fight/Flight/Freeze System; BAS = Behavioural Approach System, Imp = Impulsivity, RR = Reward Reactivity, RI = Reward Interest, GDP = Goal-Drive Persistence.

K-S Test = Kolmogorov-Smirnov Test for normality with Lilliefors' significance correction

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 2. *Correlations between the trait measures used in this study*

	ICU Overall	Coldheartedness	PPI-R:SF Traits Fearless Dominance	Self-Centred Impulsivity
ICU Overall	1.00	.55***	-.04	.22***
Reinforcement Sensitivity Theory – Personality Questionnaire				
BIS	.06	-.22***	-.61***	.16**
FFFS	-.06	-.20**	-.48***	-.02
BAS-Imp	-.08	-.08	.34***	.60***
BAS-RR	-.43***	-.28***	.30***	.18***
BAS-RI	-.27***	-.10*	.52***	.24***
BAS-GDP	-.34***	-.08	.29***	-.08

Note.

$N = 454$. * $p < .05$, ** $p < .01$, *** $p < .001$

ICU = Overall score from the Inventory of Callous-Unemotional traits

BIS = Behavioural Inhibition System; FFFS = Fight/Flight/Freeze System; BAS = Behavioural Approach System, Imp = Impulsivity, RR = Reward Reactivity, RI = Reward Interest, GDP = Goal-Drive Persistence.

Table 3. *The factor loadings of the exploratory factor analysis for the trait measure arranged by strongest loading trait*

Measure	Trait	Factor				
		1	2	3	4	5
RST-PQ	BAS-Imp	.80	-.06	.09	-.02	.12
PPI-R:SF	Self-Centred Impulsivity	.80	.12	-.09	.12	-.07
ICU	Callous-Unemotional Trait	.04	1.00	.00	.02	.03
PPI-R:SF	Coldheartedness	-.09	.58	.05	-.20	-.06
RST-PQ	BAS-GDP	-.18	.01	.81	.01	.01
RST-PQ	BAS-RI	.25	-.03	.68	-.01	-.11
RST-PQ	BAS-RR	.32	-.26	.38	-.12	.22
RST-PQ	BIS	.07	-.01	.02	.97	-.01
PPI-R:SF	Fearless Dominance	.37	.00	.15	-.47	-.34
RST-PQ	FFFS	.06	.02	-.02	.01	.84

Note.

Bold= Absolute strongest loading factor

RST-PQ= Reinforcement Sensitivity Theory – Personality Questionnaire

PPI-R:SF= Psychopathic Personality Inventory-Revised: Short Form

ICU = Inventory of Callous-Unemotional traits

BIS= Behavioural Inhibition System; FFFS = Fight/Flight/Freeze System; BAS = Behavioural Approach System, Imp = Impulsivity, RR = Reward Reactivity, RI = Reward Interest, GDP = Goal-Drive Persistence.

Table 4. Pearson *r* correlations between the trait variables and the risk taking behaviour domains in the study

	Domain-Specific Risk-Taking scale				
	Ethical	Financial	Health	Recreational	Social
Reinforcement Sensitivity Theory – Personality Questionnaire					
BIS	.01	-.19***	-.01	-.17***	-.29***
FFFS	-.04	-.15***	-.21***	-.47***	-.33***
BAS-Imp	.32***	.17***	.45***	.27***	.28***
BAS-RR	.12*	.20***	.18***	.13**	.21***
BAS-RI	.10*	.25***	.20***	.41***	.44***
BAS-GDP	-.04	.09	-.05	.11*	.25***
Psychopathic Personality Inventory – Revised: Short Form					
Coldheartedness	.23***	.06	.01	.03	-.06
Fearless Dominance	.20***	.31***	.35***	.60***	.49***
Self-Centred Impulsivity	.51***	.20***	.50***	.29***	.28***
Inventory of Callous-Unemotional Traits					
ICU Overall	.27***	.09	.09	.04	-.13**

Note.

N = 454. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5. Regression models built using the RST-PQ traits and participants' demographics, predicting DOSPERT scores

Predictor	Ethical			Financial			Health			Recreational			Social		
	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se
Model 1		$R^2 = .02^*$		$R^2 = .01$			$R^2 = .01$			$R^2 = .01$			$R^2 = .04^{***}$		
Sex	.13	.11** [.03, .19]	.04	.08	.07 [-.02, .15]	.04	.10	.10 [.00, .20]	.05	.07	.10 [-.03, .23]	.07	.07	.07 [-.02, .16]	.04
Age	-.04	-.00 [-.02, .01]	.01	-.01	-.00 [-.01, .01]	.01	.01	.00 [-.01, .02]	.01	.00	.00 [-.02, .02]	.01	.18	.02*** [.01, .03]	.01
Model 2		$R^2 = .14^{***}$ $\Delta R^2 = .12^{***}$		$R^2 = .13^{***}$ $\Delta R^2 = .12^{***}$			$R^2 = .30^{***}$ $\Delta R^2 = .29^{***}$			$R^2 = .38^{***}$ $\Delta R^2 = .37^{***}$			$R^2 = .32^{***}$ $\Delta R^2 = .28^{***}$		
Sex	.13	.11** [.03, .18]	.04	.07	.06 [-.02, .15]	.04	.06	.06 [-.02, .15]	.04	.00	.00 [-.11, .11]	.05	.04	.04 [-.04, .11]	.04
Age	-.07	-.01 [-.02, .00]	.01	-.09	-.01 [-.02, .00]	.01	-.05	-.01 [-.02, 0.1]	.01	-.10	-.02* [-.03, .00]	.01	.06	.01 [.00, .02]	.01
BIS	-.01	-.02 [-.17, .14]	.08	-.15	-.25** [-.41, -.08]	.08	.02	.04 [-.13, .22]	.10	.01	.03 [-.18, .24]	.11	-.14	-.23** [-.39, -.08]	.08
FFFS	-.07	-.11 [-.26, .05]	.08	-.08	-.14 [-.30, -.03]	.09	-.29	-.56*** [-.74, -.38]	.10	-.44	-1.12*** [-1.34, -.90]	.11	-.23	-.39*** [-.55, -.24]	.08
BAS-Imp	.35	.55*** [-.38, .73]	.09	.08	.13 [-.05, .32]	.09	.47	.92*** [.73, 1.11]	.10	.15	.38** [.14, .62]	.12	.18	.31*** [.14, .48]	.09
BAS-RR	.04	.06 [-.13, .24]	.10	.12	.20* [.00, .40]	.10	.06	.12 [-.10, .33]	.11	-.03	-.08 [-.34, .18]	.13	-.02	-.04 [-.22, .15]	.09
BAS-RI	-.02	-.03 [-.23, .16]	.10	.17	.27* [.06, .47]	.11	.00	.00 [-.21, .22]	.11	.36	.87*** [.06, 1.14]	.14	.28	.46*** [.27, .65]	.10
BAS-GDP	-.06	-.08 [-.22, .07]	.08	-.05	-.07 [-.23, .08]	.08	-.11	-.18* [-.34, -.02]	.09	-.11	-.24* [-.44, -.04]	.10	.04	.06 [-.08, .21]	.07

Note. β_s = Standardized Beta weights, se = standard error, B = unstandardized Beta weights

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5 (continued). Regression models built using the RST-PQ traits and participants' demographics, predicting DOSPERT scores

Predictor	Ethical			Financial			Health			Recreational			Social		
	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se	β_s	B [95% CI]	se
Model 3		$R^2 = .32^{***}$ $\Delta R^2 = .18^{***}$			$R^2 = .17^{***}$ $\Delta R^2 = .04^{**}$			$R^2 = .36^{***}$ $\Delta R^2 = .06^{***}$			$R^2 = .52^{***}$ $\Delta R^2 = .14^{***}$			$R^2 = .36^{***}$ $\Delta R^2 = .05^{***}$	
Sex	.05	.05 [-.03, .12]	.04	.04	.04 [-.05, .12]	.04	.03	.03 [-.06, .11]	.04	-.03	-.04 [-.13, .06]	.05	.04	.03 [-.04, .11]	.04
Age	-.03	-.00 [-.01, .01]	.01	-.05	-.01 [-.02, .01]	.01	-.03	.00 [-.02, .01]	.01	-.09	-.02* [-.03, .00]	.01	.04	.01 [.00, .02]	.01
BIS	-.03	-.04 [-.22, .14]	.10	-.10	-.15 [-.36, .06]	.11	.08	.15 [-.06, -.22]	.11	.28	.70*** [.46, .95]	.12	-.12	-.20* [-.39, -.01]	.10
FFFS	-.02	-.03 [-.18, .13]	.08	-.04	-.07 [-.25, .12]	.09	-.21	-.41*** [-.60, -.22]	.10	-.26	-.66*** [-.87, -.45]	.11	-.17	-.30** [-.46, -.13]	.08
BAS-Imp	.05	.08 [-.10, .27]	.10	-.11	-.02 [-.24, .20]	.11	.28	.54*** [.32, .77]	.11	-.01	-.03 [-.28, .23]	.13	.04	.07 [-.13, .27]	.10
BAS-RR	.14	.22* [.05, .40]	.09	-.17	.30** [.09, .51]	.11	.07	.14 [-.08, .35]	.11	-.05	-.12 [-.37, .12]	.12	-.07	-.13 [-.30, .06]	.10
BAS-RI	-.04	-.06 [-.23, .12]	.09	.14	.22* [.01, .43]	.11	-.06	-.12 [-.33, .10]	.11	.23	.55*** [.30, .79]	.12	.22	.35*** [.16, .55]	.10
BAS-GDP	.01	.01 [-.23, .14]	.07	-.02	-.03 [-.19, .13]	.08	-.08	-.13 [-.29, .03]	.08	-.10	-.21* [-.39, -.02]	.09	.05	.07 [-.07, .21]	.07
Coldhearted -ness	.18	.27** [.12, .43]	.08	-.05	-.08 [-.27, .10]	.09	-.02	-.05 [-.23, .14]	.10	-.09	-.22* [-.43, .00]	.11	-.08	-.13 [-.30, .03]	.08
Fearless Dominance	-.01	-.02 [-.27, .23]	.13	.14	.26 [-.04, .56]	.15	.20	.45** [.14, .76]	.16	.61	1.78*** [1.43, 2.13]	.18	.16	.32* [.05, .59]	.14
Self-Centred Impulsivity	.43	1.06*** [.78, 1.34]	.14	.05	.13 [-.20, .45]	.17	.23	.70*** [.36, 1.04]	.17	.01	.05 [-.34, .43]	.20	.19	.51** [.21, .81]	.15
Callous- Unemotional	.11	.27 [-.02, .56]	.15	.19	.48** [.15, .82]	.17	.03	.09 [-.26, .43]	.18	.08	.34 [-.05, .73]	.20	-.09	-.26 [-.56, .05]	.16

Note. β_s = Standardized Beta weights, se = standard error, B = unstandardized Beta weights

* $p < .05$, ** $p < .01$, *** $p < .001$

