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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.

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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, Latzman, 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 & Lilienfield, 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 βs	Ethical B [95% CI]	se	Financial βs	Financial B [95% CI]	se	Health βs	Health B [95% CI]	se	Recreational βs	Recreational B [95% CI]	se	Social βs	Social 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*** ΔR²= .12***			R^2= .13*** ΔR²= .12***			R^2= .30*** ΔR²= .29***			R^2= .38*** ΔR²= .37***			R^2= .32*** ΔR²= .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. βs = 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 β_s	Ethical B [95% CI]	se	Financial β_s	Financial B [95% CI]	se	Health β_s	Health B [95% CI]	se	Recreational β_s	Recreational B [95% CI]	se	Social β_s	Social 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
* $p < .05$, ** $p < .01$, *** $p < .001$