



The reinforcement sensitivity theory of personality in children: A new questionnaire

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ARTICLE INFO

Article history:

Received 16 February 2016

Accepted 15 June 2016

Available online xxx

Keywords:

Personality

Approach

Avoidance

Goal conflict

Reinforcement sensitivity theory

Children

ABSTRACT

We report the development of a self-report questionnaire of the reinforcement sensitivity theory (RST) of personality for use with children. Focus groups were held with children to sample their experiences of situations modelled on components of three RST systems: *fight-flight-freeze system* (FFFS, related to fear), *behavioural inhibition system* (BIS, related to anxiety), and *behavioural approach system* (BAS, related to approach). The thematic responses formed the conceptual anchors to the development of test items that were examined using exploratory factor analysis in a sample of 288 9–13 year olds. After eliminating items that did not load on their designated factor, or substantially cross-loaded across factors, the original 48 items were reduced to 21 items: 7 items for each of the BIS, FFFS and BAS factors extracted from the data. The separation of the BIS and FFFS items across two factors is consistent with the revised model of RST. We offer this new questionnaire as a RST measure of fundamental motivation and emotion traits in children.

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1. Introduction

There has been extensive investigation of the measurement of personality in children, drawing largely from the work of Rothbart and colleagues. One of the most widely used measures of temperament in children, The Children's Behaviour Questionnaire (CBQ; Rothbart, Ahadi, Hershey, & Fisher, 2001), is a parent report measure for children aged 3 to 7 years that has demonstrated strong convergence with behavioural tasks (Rothbart, Sheese, & Conradt, 2009). Three factors have been reliably identified: Negative affectivity, surgency/extraversion, and effortful control (Rothbart et al., 2001). This, and related measures, have been shown to predict personality traits in children and later psychopathology (Biederman et al., 1990; Rothbart, Derryberry, & Hershey, 2000). For this reason, the measurement of personality in children is important as it may enable the prediction of clinical disorders and assist in treatment planning – it is also likely to permeate all areas of children's school, family, and social life.

It is widely believed that underlying human personality are neurobehavioural systems responsible for appetitive and aversive motivation (Corr, 2013; for a review, see DeYoung and Gray, 2009). These theories tend to group the most important classes of motivational stimuli into “rewards” and “punishments”; and leading theories (e.g., Carver & Scheier, 1998) assume they reflect the operation of cybernetic systems with attractors and repulsors (positive and negative goals) that have evolved to promote survival and reproduction. Individual differences in these systems give rise to differences in personality (e.g., extraversion and neuroticism) and behaviour (e.g., social interaction and performance), and shape the trajectory of adult

personality and its effects, including the panoply of related behaviours, both normal and abnormal.

The revised ‘reinforcement sensitivity theory’ (RST) of personality (Gray & McNaughton, 2000; McNaughton & Corr, 2004, 2008; Corr & McNaughton, 2012) is one of the more prominent of such basic personality theories. In its most recent form, it assumes three major neuropsychological systems: the *behavioural approach system* (BAS), the *fight-flight-freeze system* (FFFS) and the *behavioural inhibition system* (BIS). The BAS is activated by appetitive stimuli of all kinds, including safety signals (i.e., associated with escape from threatening stimuli); the FFFS by all aversive stimuli (including frustrating ‘rewarding’ stimuli); and the BIS by all forms of conflicting goals (e.g., co-activation of FFFS and BAS; these may be explicit stimuli or more abstract cognitive goals, even of an existential nature giving rise to *angst*). A caveat here is that these stimuli are defined only after an initial valuation stage which categorizes stimuli as either indicating gain (‘rewarding’) or loss (‘punishing’) – these stimuli are then ‘attractors’ and ‘repulsors’, respectively – and it is then the contingencies of the situation that determine activation of the FFFS, BIS and BAS (Corr & McNaughton, 2012). This general theoretical framework increasingly is seen as offering an integrative model for the neurobiology of personality (e.g., Kennis, Rademaker, & Geuze, 2013). Summaries of this literature can be found in Corr (2013) and Corr, DeYoung and McNaughton (2013).

The separation of FFFS/fear and BIS/anxiety is the most important alteration in revised RST. Emphasis is placed on their different, and often opposing, functional properties. Specifically, unlike the simpler FFFS which is concerned with active avoidance of, and escape from, stimuli evaluated as threatening and dangerous (that is *moving away* from aversive stimuli), the BIS has evolved to detect goal conflict and it attempts to resolve it by engaging processes entailing (a) the inhibition of prepotent conflicting behaviours, (b) the

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engagement of risk assessment processes, (c) scanning of memory and the environment to gather relevant information, (d) an increase in attention, and (e) an increase in arousal such that consequent behaviour has increased vigour. In typical animal learning situations, BIS activation allows entries to a dangerous situation (i.e., leading to cautious 'risk assessment' behaviour) or to the withholding of entrance (i.e., passive avoidance) – at high levels of the BIS, passive avoidance is so great that normally adaptive entrance is inhibited. There is extensive neuropsychopharmacological evidence to support the functional and neural separation of the FFFS and BIS (Corr & McNaughton, 2012; McNaughton & Corr, 2004, 2008). The evidential bases for the separation of the FFFS and BIS have been summarized in Corr and Cooper (in press).

As the FFFS, BIS and BAS have been implicated in psychopathology seen in childhood, these developments in RST are potentially of high importance (Bijttebier, Beck, Claes, & Vandereycken, 2009); however, the absence of appropriate self-report psychometric measures of the FFFS and BIS, not only in children but also adults, has been a significant obstacle to research progress (Sylvers, Lilienfeld, & LaPrairie, 2011). Recent efforts at questionnaire development in the adult RST literature, however, have redressed this issue to some extent (Corr & Cooper, in press; Jackson, 2009; Reuter, Cooper, Smillie, Markett, & Montag, 2015; Smederevac, Mitrovic, Colovic, & Nikolasevic, 2014).

In the case of RST questionnaires specifically for children, efforts have largely involved the modification of existing adult RST scales for both child self-report (e.g., Muris, Meesters, de Kanter, & Eek Timmerman, 2005) and caregiver reports on children (e.g., Colder et al., 2011; Vervoort et al., 2015). The child version of the BIS/BAS scales have been widely used and validated, however these scales were developed in the context of unrevised RST and were originally shown to have a two factor structure (i.e., a BIS and BAS factor; Muris et al., 2005). Vervoort et al. (2010) showed a two factor structure in the BIS items from the child BIS/BAS scales, but the internal reliability of the putative FFFS factor was very low, as it was comprised of only two items. Thus, the usefulness of these scales is limited in the context of revised RST. Colder and O'Connor (2004) developed a caregiver-report RST measure for children based on the adult Sensitivity to Punishment and Sensitivity to Reward scales (SPSRQ; Torrubia, Ávila, Moltó & Caseras, 2001). Colder et al. (2011) attempted further to develop this measure in line with revised RST. They extracted a separate fear/shyness and anxiety factor from the data, as well as three BAS-related factors (two additional factors extracted did not appear to be psychometrically robust). While the separation of the fear and anxiety factors is potentially consistent with revised RST, the fear factor appeared to only tap a relatively narrow spectrum of FFFS-related behaviour, with many of the items loading on this factor relating to shyness. Further, it is unclear to what extent the factor structure generated in caregiver reports will replicate to self-reporting by children.

Our aim in the current study was to develop a short self-report questionnaire for children consistent with revised RST. Rather than seek to modify an existing scale for adults, as previous studies have sought to do, we looked to develop a novel set of theoretically derived items. Our approach here was modelled on the process undertaken for the development of the reinforcement sensitivity theory of personality questionnaire (RST-PQ; Corr & Cooper, in press), a recently developed RST self-report measure for adults. First, we used theoretically driven items to guide development, based on the most up-to-date version of RST (see Corr & Cooper, in press). Secondly, we avoided the ambiguity associated with saturation of factors with specific emotion words. Thirdly, we used a variety of methods to

generate test items, including focus groups with children to discover what they associate with specific defensive and approach situations. This structured approach ensured we remained faithful to the fundamental components of revised RST, as well as to the everyday experiences of children.

2. Method

2.1. Participants

Two hundred and eighty-eight school children were recruited from one public state school and seven independent schools in Brisbane, Australia. The number of children recruited from each school ranged from 22–72 ($M = 36.13$, $SD = 16.39$). The children's mean age was 11.01 ($SD = 0.92$), ranging from 9–13 years, and 159 (55.21%), were female (2 children did not report their gender). There was no significant difference in age across gender, $t(284) = 0.50$, $p = 0.62$.

2.2. Item development

The FFFS was designed to measure a child's propensity to engage in fear-related behaviours, specifically: Fight, Flight, Freeze, and Active Avoidance. The BIS was designed to measure a child's propensity to engage in anxiety-related behaviours, specifically: Risk Assessment, Goal Conflict Resolution, Behavioural Inhibition/Motor Inhibition, and Worry/Rumination. The BAS was designed to measure a child's propensity to engage in activities associated with reward, specifically: Incentive Interest/Reward Responsiveness, Appetitive Drive, and Active Approach. These facets were explored in the focus groups (see Supplementary Material), around which test items were written. Children responded to the 48 items on a 4 point Likert scale: 'Never', 'Sometimes', 'Often', 'Always'. (The full 48 items are shown in Supplementary Materials.)

Items were written using standard guidelines for clear and comprehensible self-report personality measures (e.g., Osterlind, 2009) that were unambiguous, short statements, without compound clauses and reflecting unipolar activity of the relevant system. The use of reverse worded items was avoided because these may cause spurious multidimensionality in responses by confusing participants (van Sonderen, Sanderman, & Coyne, 2013) – this is especially a concern with children.

2.3. Procedure

Primary schools in Brisbane, Australia, were approached. The schools which chose to participate were situated in areas of average to high socioeconomic status. The school distributed the consent forms to all children to obtain parental consent. Approximately 910 consent forms were distributed and 314 consent forms were returned (34.5% response rate).

Of the 314 consent forms returned, 26 children did not participate due to other school commitments. Schools set aside 45 min to 1 h for each group of children to complete the questionnaires – these were completed in groups of 15–30. The sessions were run in a spare classroom, library or art room. All children were given the same instructions and the researcher was present throughout these sessions. Children were instructed to answer all questions and to ask the researcher for assistance if they were unsure how to answer a specific question. They were told that there were no right or wrong answers and that they were to choose the answer that best described them. They were instructed to cross out an answer if they had made a mistake and circle the appropriate answer.

3. Results

The 48 test items were subjected to exploratory factor analysis using Principal Axis factoring with a direct oblimin rotation. Three factors were extracted and items were retained that loaded on their designated *a priori* factor - items that initially loaded on different factors or cross-loaded were eliminated. This iterative process resulted in the removal of 27 items in total. A final exploratory factor analysis was run on the reduced set of 21 items. In the reduced solution, three factors (eigenvalues: 4.87, 2.53, 1.53; and the fourth 1.07) accounted for 33% of the total variance, and with seven items each showing a primary loading on the BIS, FFFS and BAS factors. The factor loadings of the items on their designated factors are shown in Table 1. There were no secondary loadings $>|0.30|$ in the reduced solution.

Mean scores and their standard deviation for the three final scales for this sample are also shown in Table 1. Cronbach's alpha for the three scales (BIS = 0.80; FFFS = 0.76; BAS = 0.68) were adequate. Skewness and kurtosis values for the three scales were also acceptable. As predicted, the FFFS and BIS were positively, but only moderately, correlated ($r = 0.53$, $p < 0.001$ – Corr & Cooper, in press, report a similar magnitude for their adult samples, 0.40/0.56) and the BAS was uncorrelated with both the FFFS ($r = -0.07$) and the BIS

Table 1

Factor loadings for the reduced set of items defining the FFFS, BIS and BAS factors and descriptive statistics for the total scores.

Items	FFFS	BIS	BAS
FFFS			
I would be frozen to the spot if there was a snake or spider in the bathroom with me.	0.57		
I would be frozen to the spot if I saw a large shadow when swimming in the ocean.	0.57		
I would run away if I saw a spider or snake.	0.54		
I would freeze if I thought a bird was going to attack me.	0.52		
I would freeze if I heard strange noises when in bed at night time.	0.52		
I would run away from an animal if it was making me feel scared.	0.47		
I would run back upstairs if there were no lights on downstairs.	0.40		
BIS			
I am careful when doing something that might hurt me.		0.75	
I would be careful when playing a game or sport.		0.68	
I would stop what I was doing if I thought there was physical danger or I might hurt myself.		0.65	
I would stop what I was doing if I thought it was too risky to keep going.		0.64	
I worry about what would happen if I was hurt.		0.46	
I would stop and think before going down a hill on a skateboard, rollerblades, bike etc.		0.44	
I would think carefully about trying out for something (e.g., sports team, school captain etc.) in case I didn't make it in.		0.44	
BAS			
I am training to be better at sport/things I like doing.			0.54
I work hard to do well at the things I like doing.			0.54
I like to practise something I like doing so I can get better.			0.54
I put in lots of effort to achieve a goal (or get where I want).			0.54
I want to keep on improving (getting better) at my favourite things.			0.44
I am interested in exploring places.			0.43
I like to do new and exciting things.			0.41
Mean	9.44	12.25	17.89
SD	4.69	4.57	2.76
Skewness	0.16	-0.19	0.92
Kurtosis	-0.54	-0.64	0.65
Alpha	0.76	0.80	0.68

Note. Only factor loadings > 0.30 are displayed in this table.

($r = 0.07$). There were no significant correlations between age and the FFFS and BAS scales, and a modest negative correlation between age and the BIS ($r = -0.17$). Gender was uncorrelated with the three scales.

4. Discussion

Our aim was to develop a self-report measure appropriate for children that was consistent with revised RST. After generating an initial candidate pool of items, we used factor analysis to generate a final set of 21 items. The development of items was made on the basis of theoretical considerations of revised RST, as well as psychometric considerations. This final set of items was shown to load across three separate factors: a BIS, FFFS and BAS factor. The separation of the FFFS and BIS items across two factors is clearly important in the context of revised RST. Previous attempts to develop child RST measures have either potentially conflated items related to the BIS and FFFS within one factor (Muris et al., 2005), or have only shown separate BIS and FFFS factors in caregiver reports, rather than child self-reports (Colder et al., 2011). Previously developed RST measures for children have also focused on adapting existing adult RST scales. The strength of our approach is that we developed new items specifically for children, and used focus groups with children to help generate item content and gain a better understanding of emotions and behaviours relevant to RST in children.

Regarding the procedure to retain and delete items, it should be noted that it is difficult to write unambiguous FFFS items because even apparently straightforward ones may contain a significant degree of goal conflict and, thus, should relate to the BIS. It is notable that FFFS items that survived this culling process were specific fears, with animal fears prominent; however, these items also contained elements of freezing, flight, avoidance and so does not just reflect specific fears: This FFFS factor entails unambiguous and immediate threat. In contrast, the BIS is more concerned with the future and the possibility of harm that can be avoided from the exercise of caution, worry and rumination. The distinction between immediate unambiguous threat (FFFS-related) and abstract, more distant threat (BIS-related) is exactly the distinction made by the Blanchards' in their ethoexperimental analysis of defensive behaviour in the rodent (Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; for a summary, see McNaughton & Corr, 2004, 2008) on which revised RST is based. The relevance of this fundamental ethoexperimental research has been confirmed in humans (e.g., Blanchard et al., 2001; Perkins, Cooper, Abdelall, Smillie & Corr, 2010; Perkins & Corr, 2006) and it is not difficult to discern its presence in our three-factor solution.

Turning to the issue of defensive fight, none of these items survived our pruning process. This is less of a problem than might be thought. The position of a fight factor (in both its defensive and instrumental modes) is complex in RST (for more discussion, see Corr, 2013, and Corr & Cooper, in press). Empirical evidence confirms that it is more strongly associated with the BAS than the FFFS (Harmon-Jones, 2003; Smits & Kuppens, 2005), therefore its omission in the current RST-PQ does not undermine the FFFS scale. In the adult RST-PQ (Corr & Cooper, in press), a separate scale of fight needed to be developed – even though designed to be largely defensive in nature this was strongly associated with the BAS. This correlation with BAS, rather than with other FFFS domains, is typical in adult RST measures (Corr, 2016).

In relation to the BAS, which tends to decompose in to multiple factors in adult samples, the unitary scale we recovered seems to tap a combination of goal-drive persistence and achievement striving, but also the exploration of new places and the enjoyment of new things,

which reflects some degree of reward interest. The child BIS/BAS scales also have a unitary BAS scale (Muris et al., 2005). In caregiver report measures, multiple BAS factors tend to be recovered, but some of these factors do not appear to be particularly robust or replicable (Colder et al., 2011; Luman, van Meel, Oosterlaan & Guerts, 2012). It is possible that multi-factorial BAS structures are simply less stable in child samples. Impulsivity items were not represented in our final measure. In adults samples, both theoretically (e.g., Dawe & Loxton, 2004) and empirically (e.g., Quilty & Oakman, 2004; Smillie, Jackson, & Dalgleish, 2006), impulsivity is distinct from reward sensitivity/reactivity, and for this reason future studies should include a standard measure of impulsivity to complement the reward-related BAS scale we have developed. This might be particularly important when considering the scales in relation to forms of externalising psychopathology.

The major limitation of the study is the lack of evidence for validation, but this is a tricky issue because comparing the measure with established measures of 'fear' and 'anxiety' relies upon the assumption that these emotion measures reflect their seemingly parallel constructs in RST. But there is considerable confusion over this issue. For example, the Fear Survey Schedule (Wolpe & Lang, 1977) has specific fears (animals and tissue damage, that should be expected to relate to the FFFS), but also social 'fear' which, as it entails goal conflict, in RST terms, is BIS-related social 'anxiety'. There is empirical evidence for these claims (Cooper, Perkins, & Corr, 2007). Thus, care needs to be taken when exploring the convergent and discriminant validity of these scales. Clearly, the next step in their development should involve establishing validity against appropriate self-report, behavioural and observational markers. Research on the developmental trajectory of these systems would also be useful. Of note, our scales had zero or very low correlations with both age and gender, and so would appear to be unconfounded by these factors. This may prove useful when examining relationships between these factors and other developmental variables of interest.

In sum, we report the development of a new psychometric measure of the revised reinforcement sensitivity theory of personality for children. This new measure contains three scales, one each for the FFFS, BIS, and BAS. The differentiation of these two defensive systems in a self-report measure for children is novel and should facilitate empirical investigation of their respective functions in a range of behaviours, ranging from everyday social, academic and family to internalising and externalising disorders – there is evidence for the involvement of these constructs in such disorders (Corr & McNaughton, in press). The child RST questionnaire is offered as an instrument to explore further the implications of approach and avoidance processes in children's personality.

Appendix A. Supplementary Material

Supplementary material to this article can be found online at <http://dx.doi.org/10.1016/j.paid.2016.06.028>.

References

- Biederman, J., Rosenbaum, J.F., Hirshfeld, D.R., Faraone, S.V., Bolduc, E.A., Gersten, M., 1990. Psychiatric correlates of behavioural inhibition in young children of parents with and without psychiatric disorders. *Archives of General Psychiatry* 47, 21–26. <http://dx.doi.org/10.1001/archpsyc.1990.01810130023004>.
- Bijttebier, P., Beck, I., Claes, L., Vandereycken, W., 2009. Gray's reinforcement sensitivity theory as a framework for research on personality-psychopathology associations. *Clinical Psychology Review* 29, 421–430. <http://dx.doi.org/10.1016/j.cpr.2009.04.002>.
- Blanchard, D.C., Hynd, A.L., Minke, K.A., Minamoto, T., Blanchard, R.J., 2001. Human defensive behaviors to threat scenarios show parallels to fear- and anxiety-related

- defence patterns of non-human mammals. *Neuroscience and Biobehavioral Reviews* 25, 761–770. [http://dx.doi.org/10.1016/S0149-7634\(01\)00056-2](http://dx.doi.org/10.1016/S0149-7634(01)00056-2).
- Carver, C., Scheier, M., 1998. *On the self-regulation of behavior*. Cambridge University Press, New York.
- Colder, C.R., O'Connor, R.M., 2004. Gray's reinforcement sensitivity model and child psychopathology: Laboratory and questionnaire assessment of the BAS and BIS. *Journal of Abnormal Child Psychology* 32, 435–451. <http://dx.doi.org/10.1023/B:JACP.0000030296.54122.b6>.
- Colder, C.R., Trucco, E.M., Lopez, H.I., Hawk, L.W., Read, J.P., Lengua, L.J., ... Eiden, R.D., 2011. Revised reinforcement sensitivity theory and laboratory assessment of BIS and BAS in children. *Journal of Research in Personality* 45, 198–207. <http://dx.doi.org/10.1016/j.jrp.2011.01.005>.
- Cooper, A.J., Perkins, A., Corr, P.J., 2007. A confirmatory factor analytic study of anxiety, fear and behavioral inhibition system measures. *Journal of Individual Differences* 28, 179–187. <http://dx.doi.org/10.1027/1614-0001.28.4.179>.
- Corr, P.J., 2013. Approach and avoidance behavior: Multiple systems and their interactions. *Emotion Review* 5, 286–291. <http://dx.doi.org/10.1177/1754073913477507>.
- Corr, P.J., 2016. Reinforcement sensitivity theory of personality questionnaires: Structural survey with recommendations. *Personality and Individual Differences* 89, 60–64. <http://dx.doi.org/10.1016/j.paid.2015.09.045>.
- Corr, P.J., Cooper, A.J., n.d. 2016. The reinforcement sensitivity theory of personality questionnaire (RST-PQ): Development and validation. *Psychological Assessment* <http://dx.doi.org/10.1037/pas0000273> (in press).
- Corr, P.J., DeYoung, C.G., McNaughton, N., 2013. Motivation and personality: A neuropsychological perspective. *Social and Personality Psychology Compass* 7, 158–175. <http://dx.doi.org/10.1111/spc3.12016>.
- Corr, P.J., McNaughton, N., 2012. Neuroscience and approach/avoidance personality traits: A two stage (valuation–motivation) approach. *Neuroscience and Biobehavioral Reviews* 36, 2339–2354. <http://dx.doi.org/10.1016/j.neubiorev.2012.09.013>.
- Corr, P.J., McNaughton, N., 2016. Neural mechanisms of low trait anxiety and risk for externalizing behaviour. In: Beauchaine, T., Hinshaw, S. (Eds.), *Oxford handbook of externalizing spectrum disorders: A developmental psychopathology perspective* (in press). Oxford University, Oxford (in press).
- Dawe, S., Loxton, N.J., 2004. The role of impulsivity in the development of substance use and eating disorders. *Neuroscience and Biobehavioral Reviews* 28, 343–351. <http://dx.doi.org/10.1016/j.neubiorev.2004.03.007>.
- DeYoung, C.G., Gray, J.R., 2009. Personality neuroscience: Explaining individual differences in affect, behavior, and cognition. In: Corr, P.J., Matthews, G. (Eds.), *The Cambridge handbook of personality psychology*. Cambridge University Press, New York, pp. 323–346.
- Gray, J.A., McNaughton, N., 2000. *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*, 2nd ed. Oxford University Press, Oxford.
- Jackson, C.J., 2009. Jackson-5 scales of revised reinforcement sensitivity theory (r-RST) and their application to dysfunctional real world outcomes. *Journal of Research in Personality* 43, 556–569. <http://dx.doi.org/10.1016/j.jrp.2009.02.007>.
- Harmon-Jones, E., 2003. Anger and the behavioral approach system. *Personality and Individual Differences* 35, 995–1005. [http://dx.doi.org/10.1016/S0191-8869\(02\)00313-6](http://dx.doi.org/10.1016/S0191-8869(02)00313-6).
- Kennis, M., Rademaker, A.R., Geuze, E., 2013. Neural correlates of personality: An integrative review. *Neuroscience and Biobehavioral Reviews* 37, 73–95. <http://dx.doi.org/10.1016/j.neubiorev.2012.10.012>.
- Luman, M., van Meel, C.S., Oosterlaan, J., Guerts, H.M., 2012. Reward and punishment sensitivity in children with ADHD: Validating the sensitivity to punishment and sensitivity to reward questionnaire for children (SPSRQ-C). *Journal of Abnormal Child Psychology* 40, 145–157. <http://dx.doi.org/10.1007/s10802-011-9547-x>.
- McNaughton, N., Corr, P.J., 2004. A two-dimensional neuropsychology of defense: Fear/anxiety and defensive distance. *Neuroscience and Biobehavioral Reviews* 28, 285–305. <http://dx.doi.org/10.1016/j.neubiorev.2004.03.005>.
- McNaughton, N., Corr, P.J., 2008. The neuropsychology of fear and anxiety: A foundation for reinforcement sensitivity theory. In: Corr, P.J. (Ed.), *The reinforcement sensitivity theory of personality*. Cambridge University Press, Cambridge, pp. 44–94.
- Muris, P., Meesters, C., de Kanter, E., Eek Timmerman, P., 2005. Behavioural inhibition and behavioural activation system scales for children: Relationships with Eysenck's personality traits and psychopathological symptoms. *Personality and Individual Differences* 38, 831–841. <http://dx.doi.org/10.1016/j.paid.2004.06.007>.
- Osterlind, S.J., 2009. *Modern measurement: Theory, principles and applications of mental appraisal*, 2nd ed. Pearson, Boston, MA.
- Perkins, A.M., Cooper, A., Abdelall, M., Smillie, L.D., Corr, P.J., 2010. Personality and defensive reactions: Fear, trait anxiety and threat magnification. *Journal of Personality* 78, 1071–1090. <http://dx.doi.org/10.1111/j.1467-6494.2010.00643.x>.
- Perkins, A.M., Corr, P.J., 2006. Reactions to threat and personality: Psychometric differentiation of intensity and direction dimensions of human defensive behavior. *Behavioural Brain Research* 169, 21–28. <http://dx.doi.org/10.1016/j.bbr.2005.11.027>.

- Quilty, L.C., Oakman, J.M., 2004. The assessment of behavioral activation: The relationship between impulsivity and behavioral activation. *Personality and Individual Differences* 37, 429–442. <http://dx.doi.org/10.1016/j.paid.2003.09.014>.
- Reuter, M., Cooper, A.J., Smillie, L.D., Markett, S., Montag, C., 2015. A new measure for the revised reinforcement sensitivity theory: Psychometric criteria and genetic validation. *Frontiers in Systems Neuroscience* 9, 38. <http://dx.doi.org/10.3389/fnsys.2015.00038>.
- Rothbart, M.K., Ahadi, S.A., Hershey, K.L., Fisher, P., 2001. Investigations of temperament at three to seven years: The children's behavior questionnaire. *Child Development* 72, 1394–1408. <http://dx.doi.org/10.1111/1467-8624.00355>.
- Rothbart, M.K., Derryberry, D., Hershey, K., 2000. Stability of temperament in childhood: Laboratory infant assessment to parent report at seven years. In: Molfese, V.J., Molfese, D.L. (Eds.), *Temperament and personality development across the lifespan*. Erlbaum, Hillsdale, NJ, pp. 85–119.
- Rothbart, M.K., Sheese, B.E., Conradt, E.D., 2009. Childhood temperament. In: Corr, P.J., Matthew, G. (Eds.), *The Cambridge handbook of personality psychology*. Cambridge University Press, New York, NY.
- Smederevac, S., Mitrovic, D., Colovic, P., Nikolasevic, Z., 2014. Validation of the measure of revised reinforcement sensitivity theory constructs. *Journal of Individual Differences* 35, 12–21. <http://dx.doi.org/10.1027/1614-0001/a000121>.
- Smillie, L.D., Jackson, C.J., Dalgleish, L.I., 2006. Conceptual distinctions among Carver and White's (1994) BAS scales: A reward-reactivity versus trait impulsivity perspective. *Personality and Individual Differences* 40, 1039–1050. <http://dx.doi.org/10.1016/j.paid.2005.10.012>.
- Smits, D.J.M., Kuppens, P., 2005. The relations between anger, coping with anger, and aggression, and the BIS/BAS system. *Personality and Individual Differences* 39, 783–793. <http://dx.doi.org/10.1016/j.paid.2005.02.023>.
- Sylvers, P., Lilienfeld, S.O., LaPrairie, J.L., 2011. Differences between trait fear and trait anxiety: Implications for psychopathology. *Clinical Psychology Review* 31, 122–137. <http://dx.doi.org/10.1016/j.cpr.2010.08.004>.
- Torrubia, R., Ávila, C., Moltó, J., Caseras, X., 2001. The sensitivity to punishment and sensitivity to reward questionnaire (SPSRQ) as a measure of Gray's anxiety and impulsivity dimensions. *Personality and Individual Differences* 31, 837–862. [http://dx.doi.org/10.1016/S0191-8869\(00\)00183-5](http://dx.doi.org/10.1016/S0191-8869(00)00183-5).
- Van Sonderen, E., Sanderma, R., Coyne, J.C., 2013. Ineffectiveness of reverse wording of questionnaire items: Let's learn from cows in the rain. *PloS One* 8, e68967. <http://dx.doi.org/10.1371/journal.pone.0068967>.
- Vervoot, L., Vandeweghe, L., Vandewalle, J., Van Durme, K., Vandevivere, E., Wante, L., ... Braet, C., 2015. Measuring punishment and reward sensitivity in children and adolescents with a parent-report version of the BIS/BAS scales. *Personality and Individual Differences* 87, 272–277. <http://dx.doi.org/10.1016/j.paid.2015.08.024>.
- Vervoot, L., Wolters, L.H., Hogendoorn, S.N., de Haan, E., Boer, F., Prins, P.J.M., 2010. Sensitivity of Gray's behavioral inhibition system in clinically anxious and non-anxious children and adolescents. *Personality and Individual Differences* 48, 629–633. <http://dx.doi.org/10.1016/j.paid.2009.12.021>.
- Wolpe, J., Lang, P.J., 1977. *Manual for the fear survey schedule*. Educational and Industrial Testing Service, San Diego, CA.