

PUNISHMENT AND REWARD SENSITIVITY IN CHILDREN AND ADOLESCENTS: A PARENT-  
REPORT VERSION OF THE BIS/BAS-SCALES

1 MEASURING PUNISHMENT AND REWARD SENSITIVITY IN CHILDREN AND ADOLESCENTS  
2 WITH A PARENT-REPORT VERSION OF THE BIS/BAS-SCALES

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1 **ABSTRACT**

2 The present study examined the validity and reliability of the parent-report version of Carver and  
3 White's BIS/BAS-scales for children, measuring Punishment and Reward Sensitivity (PS and RS). Gender  
4 and age differences in PS and RS were explored. Mothers (n=546, 62% girls, 2-18 years) completed the  
5 BIS/BAS parent-version and other instruments assessing PS/RS, personality and psychopathology.  
6 Reliability of most (sub-)scales was at least acceptable. The BIS/BAS-scales had meaningful relationships  
7 with other instruments assessing PS/RS, personality and psychopathology. There were significant age  
8 differences on BIS/BAS-scores, but no significant gender differences. The BIS/BAS parent-version is a  
9 valid and reliable parent-report PS/RS instrument for children and adolescents.

10 **Keywords:** Reinforcement Sensitivity Theory; Punishment Sensitivity and Reward Sensitivity; parent-  
11 report; children and adolescents; validity and reliability

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1 **INTRODUCTION**

2 Gray's Reinforcement Sensitivity Theory (RST) inspired research into human behavior in adults and  
3 children. The original version (oRST) of this neuropsychological theory (Gray, 1982) states that behavior  
4 originates from activity in at least two major brain systems, sensitive to different types of stimuli. The  
5 Behavioral Approach System (BAS) reacts to appetitive, rewarding stimuli, the Behavioral Inhibition  
6 System (BIS) to aversive, punishing or novel stimuli. Activity in both systems has differential behavioral  
7 and affective consequences. BAS-activity elicits impulsivity, approach behavior and positive affectivity  
8 (PA). BIS-activity elicits inhibition, avoidance behavior and negative affectivity (NA), fear and anxiety.  
9 Stable individual differences in BIS/BAS-activity are referred to as Punishment Sensitivity (PS, for BIS)  
10 and Reward Sensitivity (RS, for BAS). Consistent with this, BIS relates positively to the personality  
11 dimensions Neuroticism and negatively to Impulsivity/Extraversion, while BAS relates positively to  
12 Impulsivity/Extraversion and negatively to Neuroticism (Franken, Muris, & Rassin, 2005; Muris,  
13 Meesters, De Kanter, & Timmerman, 2005). Extreme manifestations of PS and RS are considered risk  
14 factors for, respectively, internalizing and externalizing problems in both adults (Bijttebier, Beck, Claes,  
15 & Vandereycken, 2009; Harnett, Loxton, & Jackson, 2013) and children (Quay, 1988; Vervoort, 2010;  
16 Vervoort et al., 2010). Several adaptations made to the original model (Corr, 2001, 2002; Gray &  
17 McNaughton, 2000)<sup>i</sup> converged in the formulation of a revised version of the theory (rRST). However, the  
18 core assumptions on the role of PS and RS in personality and psychopathology formulated in oRST still  
19 hold to date.

20 Despite the widespread use of RST, there is no agreement on the instrument to assess its concepts.  
21 Several questionnaires have been used to assess PS and RS in child and adolescent samples (Vervoort,  
22 2010). One of the most popular RST-instruments is Carver and White's BIS/BAS-scales (1994)<sup>ii</sup>. It's child  
23 self-report version (Muris et al., 2005) is used extensively and its psychometric characteristics are well  
24 documented: self-reported BIS/BAS-scores are meaningfully associated with personality dimensions

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1 (Bjornebekk, 2009; Muris et al., 2005) and psychopathology. Self-reported BIS is associated with  
2 internalizing problems, like anxiety (Sportel, Nauta, de Hullu, & de Jong, 2013; Sportel, Nauta, de Hullu,  
3 de Jong, & Hartman, 2011; Vervoort et al., 2010), while self-reported BAS is associated with  
4 externalizing problems, like hyperactivity and conduct problems (Muris et al., 2005). Less is known on  
5 reliability and validity of a RST parent-report instrument (Blair, 2003). In a small sample (n=42) of  
6 children aged 3-5, parent-reported BIS correlated significantly positively with CBQ\_Fear (Rothbarth's  
7 Child Behavior Checklist, 1989), and significantly negatively with CBQ\_Anger/Frustration (Blair, 2003).  
8 In a study with a larger sample (n=170) of the same age group, BIS correlated significantly positively with  
9 CBQ\_Fear and both BIS and BAS correlated significantly negatively with CBQ\_Anger/Frustration and  
10 CBQ\_Approach (Blair, Peters, & Granger, 2004). These early studies concluded that a BIS/BAS-scales  
11 parent-version might be a valid index of PS/RS in children, but, given the inconsistent results on BAS and  
12 CBQ\_Approach, suggested nevertheless that more research is needed.

13 Brain development studies reveal lower activity in inhibition regions and higher activity in reward  
14 regions during adolescence compared to younger and older age, suggesting age related differences PS/RS  
15 (Galvan, 2013). However, developmental effects in BIS/BAS-scales are understudied. The few studies  
16 that report age differences concern diverse age groups and results are equivocal and inconsistent with  
17 brain research (Blair, 2003; Blair et al., 2004; Urosevic, Collins, Muetzel, Lim, & Luciana, 2012;  
18 Vervoort et al., 2010). Further, although PS/RS related brain circuits differ between girls and boys (Guyer,  
19 McClure-Tone, Shiffrin, Pine, & Nelson, 2009), gender differences on BIS/BAS-scales are seldom  
20 investigated and even more indistinct. Some studies report lower BAS-scores and higher BIS-scores in  
21 girls than in boys, but others report no differences (Blair, 2003; Matton, Goossens, Braet, & Vervaeat,  
22 2013; Verbeken, Braet, Lammertyn, Goossens, & Moens, 2012). Insight in developmental and gender  
23 differences in PS/RS is critical to understand their role in determining behavior.

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1 The present study examines the validity of a parent-version of Carver and White (1994) BIS/BAS-  
2 scales in a large sample of children and adolescents, following theoretical RST-based expectations  
3 (Bijttebier et al., 2009; Gray, 1982) and empirical evidence of validity studies using self-report  
4 (Bjornebekk, 2009; Muris et al., 2005; Vervoort et al., 2010). BIS and BAS-scores are expected to  
5 correlate positively with PS and RS, respectively. Following the theoretical and empirically validated  
6 associations between BIS/BAS and personality, BIS-scores are expected to correlate positively with  
7 neuroticism and NA, BAS-scores with extraversion and PA. BIS-scores are expected to correlate  
8 positively with inhibition and negatively with approach, while for BAS-scores the reverse is expected.  
9 Since extreme levels of BIS and BAS are considered risk factors for psychopathology, BIS-scores and  
10 BAS-scores are expected to correlate significantly positively with internalizing and externalizing problems  
11 respectively. Reliability is evaluated and gender and age differences in BIS/BAS-scores explored.

12 **METHOD**

13 *1.1. Participants and procedure*

14 Mothers of 546 children (62% girls, age  $M=11.63$ ,  $SD=3.95$ , range 2-18 years) were recruited in  
15 *region, country* by Psychology students at *institution city* as partial fulfillment of course credits. Children  
16 of participating mothers were divided in three age groups: preschool (2-5 years,  $n=80$ ), primary school (6-  
17 11 years,  $n=138$ ) and secondary school (12-18 years,  $n=326$ ). Children's gender was not distributed  
18 equally over age groups,  $\chi^2(2)=26.24$ ,  $p<.001$ , with 44% girls in the preschool group, 51% girls in the  
19 primary school group and 70% girls in the secondary school group. All procedures were approved by the  
20 Institutional Ethical Committee. Parents signed informed consent and completed child age-appropriate  
21 questionnaires.

22 *1.2. Questionnaires*

23 *1.2.1. Instruments measuring Punishment and Reward Sensitivity*

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1        **BIS/BAS-scales.** SP and SR were indexed by a Dutch parent-version of the Carver and White (1994)  
2 BIS/BAS-scales. The parent-version was developed by our research group and based on a Dutch validated  
3 age-downward adaptation of the original scales (Muris et al., 2005) (not Blair, 2003). For this parent-  
4 version, self-report items were rephrased to refer to the parent's child<sup>1</sup>. Twenty items are scored on a 4-  
5 point scale (1=not at all true, 2=somewhat not true, 3=somewhat true, 4=all true). Seven items are PS/BIS-  
6 related and include statements as "My child is very fearful compared to his/her friends". Thirteen items  
7 are RS/BAS-related and include statements as "My child craves for excitement and new sensations". Five  
8 RS-related items make up the BAS\_RewardResponsiveness (BAS\_RR) subscale, four the BAS\_Drive  
9 subscale (BAS\_D) and 4 the BAS\_FunSeeking subscale (BS\_FS). BAS\_Total is computed by summing  
10 all 20 BAS-items. Validity of the child self-report BIS/BAS-scales is well established (Bjornebekk, 2009;  
11 Muris et al., 2005; Vervoort et al., 2010).

12        **SPSRQ.** The Sensitivity to Punishment and Sensitivity to Reward Questionnaire is a parent-report  
13 measure indexing PS and RS (Colder & O'Connor, 2004). Thirty-three items are scored on a 5-point scale  
14 (1=never, 2=seldom, 3=sometimes, 4=often, 5=always). Fifteen items are related to PS and include  
15 statements as "Your child is a shy person". Eighteen items are related to RS and include statements as  
16 "Your child sometimes does things for quick reward". Validity of the SPSRQ is well established (Becker  
17 et al., 2013; Colder & O'Connor, 2004; Slobodskaya & Kuznetsova, 2013). Internal consistency in the  
18 present sample is good (SP: Cronbach's  $\alpha=0.81$ , SR:  $\alpha=0.84$ ).

19        **1.2.2. Instruments measuring related personality traits**

20        **HiPIC.** The 'Hierarchical Personality Inventory for Children' is a parent-report measure for Big Five  
21 Personality in youth (Mervielde & De Fruyt, 2002). 144 items are scored on a 5-point scale (1=hardly  
22 typical, 2=a little typical 3=more or less typical, 4=typical, 5=clearly typical). The HiPIC describes 5  
23 domains: Neuroticism, Extraversion, Imagination, Benevolence and Consciousness. In the present study,  
24 Neuroticism and Extraversion are considered proxies for PS and RS respectively. Validity of the HiPIC is

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<sup>1</sup> the scale is available on request to the first author

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1 well established (Decuyper, De Bolle, De Fruyt, & De Clercq, 2011). Internal consistency in the present  
2 sample is good (Neuroticism: Cronbach's  $\alpha=0.88$ , Extraversion:  $\alpha=0.89$ ).

3 **CBQ.** The 'Child Behavior Questionnaire-short' is a parent-report instrument measuring temperament in  
4 children (Putnam & Rothbart, 2006). 94 items are scored on a 7-point scale (1=extremely untrue,  
5 7=extremely true). The CBQ-short has three broad domains: Surgency/Extraversion (31 items: subscales  
6 ActivityLevel, Extraversion, Shyness, Impulsivity), NegativeAffectivity (35 items: subscales  
7 Anger/Frustration, Discomfort, FallingReactivity/Soothability, Fear, Sadness) and EffortfulControl (28  
8 items: subscales InhibitoryControl, AttentionalFocussing, LowIntensityPleasure, PerceptualSensitivity).  
9 Apart from these domains, there are additional scales: Approach/PositiveAnticipation,  
10 HighIntensityPleasure, SmilingLaughter. In the present study, NegativeAffectivity and  
11 Surgency/Extraversion are considered proxies for PS and RS respectively. Because of their specific  
12 content, Approach/PositiveAnticipation (*'amount of excitement and positive anticipation for expected*  
13 *pleasurable activities'*) and InhibitoryControl (*'the capacity to plan and to suppress inappropriate*  
14 *approach responses under instructions or in novel or uncertain situations'*) will additionally be explored.  
15 Validity of the CBQ is well established (Gartstein, Putnam, & Rothbart, 2012; Putnam & Rothbart, 2006).  
16 Internal consistency in the present sample is acceptable to excellent for InhibitoryControl ( $\alpha=0.70$ ),  
17 NegativeAffectivity ( $\alpha=0.83$ ) and Surgency/Extraversion ( $\alpha=0.91$ ), but questionable for  
18 Approach/PositiveAnticipation ( $\alpha = 0.62$ ).

19 **1.2.3. Instruments measuring psychopathology**

20 **CBCL.** The Child Behavior Checklist (CBCL 1-5 and CBCL6-18) (Achenbach & Rescorla, 2001;  
21 Verhulst & van der Ende, 2000 2001) measures emotional and behavioral problems. The CBCL1-5  
22 consists of 100 items, the CBCL6-18 of 113 items, rated on a 3-point scale (0=not true, 1=somewhat true,  
23 2=very or often true). Item scores are summed up to form two broad-band scales: Internalizing (INT) and  
24 Externalizing Problems (EXT). T-scores, based on Flemish normative scores, are reported. Higher T-  
25 scores represent more problems. Psychometrics are good to excellent (Verhulst & van der Ende, 2000

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1 2001). Internal consistency in the present sample is good (INT: Cronbach's  $\alpha=0.84$  for CBCL1-5,  $\alpha=0.88$   
2 for CBCL6-18; EXT:  $\alpha=0.89$  for CBCL1-5 and CBCL6-18).

3 *1.3. Missing data handling and data inclusion*

4 If one or two items of a questionnaire were missing, the missing was replaced by the scale mean. If  
5 more items were missing, data for that subject on that questionnaire were excluded.

6 To minimize participant burden and accommodate for the fact that personality and psychopathology  
7 symptoms in different age groups are measured with different questionnaires, mothers completed child  
8 age appropriate instruments. All mothers completed the BIS/BAS parent-report.

9 *1.4. Analyses*

10 Reliability is indexed by Cronbach's  $\alpha$ . Gender- and age differences in BIS/BAS-scores are tested  
11 using separate Univariate Analyses of Variance with gender and age group as between-subject factors.  
12 Follow-up analyses are tested with polynomial contrasts. Relationships between BIS/BAS-scales and  
13 other questionnaires are described by Pearson correlations. Because of the significant correlation between  
14 BIS and BAS ( $r=.24$ ,  $p<.001$ ), partial correlations are computed to control for shared variance. Results are  
15 considered significant if  $p<.001$ .

16 **2. RESULTS**

17 *2.1. Reliability of BIS/BAS subscales*

18 Regarding the BIS/BAS-subscales (Carver & White, 1994) internal consistency was good for  
19 BAS\_Total ( $\alpha=0.86$ ) and BAS\_Drive ( $\alpha=0.85$ ), acceptable for BIS\_Total ( $\alpha=0.76$ ) and BAS\_RR  
20 ( $\alpha=0.74$ ). Because of its low internal consistency ( $\alpha=0.57$ ), BAS\_FS was excluded from further analyses.

21 *2.2. Descriptives, and gender and age effects*

22 Table 1 displays all descriptive statistics. There were no significant main effects of gender on  
23 BIS/BAS-scale scores. There were significant main effects of age group on BIS\_total (quadratic contrast,



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1 p<.001), BAS\_total (linear contrast, p<.001). The significant main effect of age group on BAS\_RR was  
2 qualified by a marginally significant gender x age group interaction,  $F(2,535)=6.39$ ,  $p=.002$ . In girls,  
3 BAS\_RR decreased linearly with age (2-5 years:  $M=14.44$ ,  $SD=2.57$ , 6-11 years:  $M=14.21$ ,  $SD=2.32$ , 12-  
4 18 years:  $M=13.83$ ,  $SD=2.58$ ), while in boys, BAS\_RR peaked at ages 6-11 (2-5 years:  $M=14.86$ ,  
5  $SD=2.60$ , 6-11 years:  $M=15.69$ ,  $SD=2.44$ , 12-18 years:  $M=13.42$ ,  $SD=2.60$ ). There were no other  
6 significant interactions nor significant effects related to BAS\_D.

7 There were no significant main nor interaction effects of gender and age on other questionnaires.

8 **2.3. Relationships with the SPSRQ**

9 The BIS-subscale correlated significantly positively with the SPSRQ\_SP-scale, but not with the  
10 SPSRQ\_SR-scale. The BAS-subscales correlated significantly positively with the SPSRQ\_SR-scale and  
11 significantly negatively with the SPSRQ\_SP-scale (Table 2).

12 **2.4. Relationships with other personality traits**

13 The BIS-subscale correlated significantly positively with HiPIC\_Neuroticism,  
14 CBQ\_NegativeAffectivity and CBQ\_InhibitoryControl, significantly negatively with HiPIC\_Extraversion  
15 and CBQ\_Surgency/Extraversion, but not with CBQ\_Approach/PositiveAnticipation (Table 2).

16 The BAS-subscales correlated significantly positively with HiPIC\_Extraversion,  
17 CBQ\_Surgency/Extraversion and CBQ\_Approach/PositiveAnticipation, significantly negatively with  
18 HiPIC\_Neuroticism, but not with CBQ\_NegativeAffectivity. BAS\_Total, but not BAS\_RR, correlated  
19 significantly negatively with CBQ\_InhibitoryControl. BAS\_Drive correlated significantly positively with  
20 CBQ\_NegativeAffectivity, CBQ\_Surgency/Extraversion, CBQ\_Approach/PositiveAnticipation,  
21 significantly negatively with CBQ\_InhibitoryControl, but not with HiPIC subscales (Table 2).

22 **2.5. Relationships with psychopathology**

23 The BIS-subscale correlated significantly positively with CBCL\_INT and CBCL\_EXT. The BAS-  
24 subscales correlated significantly positively with CBCL\_EXT, but not with CBCL\_INT (Table 2).

1 **3. CONCLUSION AND DISCUSSION**

2 The present study examined validity and reliability of a parent-version of Carver and White's (1994)  
3 BIS/BAS-scales. Age and gender differences in BIS/BAS-scores were explored.

4 The present study provides evidence for the validity of the BIS/BAS parent-version by describing  
5 favorable relationships with other instruments assessing PS and RS, personality and psychopathology.

6 First, the BIS/BAS parent-version relates meaningfully to the SPSRQ (Colder & O'Connor, 2004).  
7 BIS\_total correlated significantly positively with SPSRQ\_SP, and not with SPSRQ\_SR. BAS\_total,  
8 BAS\_RR and BAS\_Drive correlated significantly positively with SPSRQ\_SR and significantly negatively  
9 with SPSRQ\_SP. Since the SPSRQ is considered a validated parent measure for RST-concepts, these  
10 relations support the usability of the BIS/BAS parent-version to assess PS and RS as well. Given its  
11 shorter length, the BIS/BAS parent-version might be preferred over the SPSRQ, especially when the  
12 PS/RS-measurement is embedded in an extensive assessment procedure.

13 Second, the associations between BIS/BAS parent-version and personality questionnaires (HiPIC and  
14 CBQ) are generally consistent with RST-assumptions, and with studies investigating this with other  
15 instruments (Bjørnebekk, 2009; Muris et al., 2005). Higher levels of parent-reported PS were related to  
16 higher levels of HiPIC\_Neuroticism, CBQ\_NegativeAffectivity and CBQ\_InhibitoryControl and to lower  
17 levels of HiPIC\_Extraversion and CBQ\_Surgency/Extraversion. The positive associations of the PS-  
18 subscales with CBQ\_InhibitoryControl and the absence of significant associations with CBQ\_Approach  
19 are consistent with the interpretation of BIS as an inhibition/avoidance system. Higher levels of parent-  
20 reported RS were related to higher levels of of HiPIC\_Extraversion and CBQ\_Surgency/Extraversion. It is  
21 unclear, however, why BAS\_Drive is associated with CBQ\_scales, but not with HiPIC\_scales. The  
22 positive associations of the RS-subcales with CBQ\_Approach and their negative associations with  
23 CBQ\_InhibitoryControl are consistent with the interpretation of BAS as an impulsivity/approach system.  
24 However, the relationship with BAS\_RR and CBQ\_InhibitoryControl failed to reach significance.

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1 Presumably, this is because BAS\_RR can be better conceptualized in terms of Reward Sensitivity than in  
2 terms of Impulsiveness (Franken & Muris, 2006).

3 Third, consistent with RST stating that extreme PS or RS levels are predictive of psychopathology  
4 (Bijttebier et al., 2009; Gray, 1982; Harnett et al., 2013; Vervoort, 2010), BIS correlated significantly  
5 positively with CBCL Internalizing and Externalizing Problems. BAS correlated significantly positively  
6 with Externalizing Problems. The association of BIS with both internalizing and externalizing problems is  
7 consistent with the idea that temperamental emotionality or Negative Affectivity (which is strongly related  
8 to BIS) is involved in all domains of psychopathology (Muris et al., 2005; Rothbart & Bates, 2006).

9 The exploratory analyses of age effects suggest developmental changes in PS and RS. However, these  
10 changes are only partly consistent with expectations based on developmental brain research suggesting  
11 age-related decreases in PS and age-related increases in RS (Galvan, 2013). BIS\_total-scores indeed  
12 decreased from school age to adolescent age, but only after an initial increase from preschool to school  
13 age. BAS\_D-scores were relatively stable across different ages. The age-related decreases in BAS\_total-  
14 scores and (after an initial increase) in BAS\_RR-scores are at odds with brain research studies showing  
15 increased RS in adolescence. The BIS/BAS parent-version seems to tap developmental differences in PS  
16 and RS, other than those described in brain research. Despite differential activity in PS and RS-related  
17 brain areas between boys and girls (Guyer et al., 2009), BIS/BAS-scores did not differ between genders. It  
18 seems difficult to capture the overt behavioral gender differences in PS and RS related to differences in  
19 brain activity between girls and boys with the BIS/BAS parent-version.

20 The present study supports the validity of the BIS/BAS parent-version. However, there are some  
21 considerations that need to be taken into account when interpreting the results.

22 Carver and White's BIS/BAS-scales were originally developed as indices of BIS and BAS as  
23 conceptualized by the original version of RST. As such, the present parent-version also considers PS and  
24 RS from the original viewpoint. It is essential that future research also adopts the new perspective from

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1 the revised versions, and that more instruments based on rRST, and suitable for use in youth samples, are  
2 developed.

3 The large sample size and broad age range of the present study sample makes it tempting to use data of  
4 this sample to derive normative scores. However, the non-random selection of this sample precludes this.  
5 In particular, the unbalanced distribution of gender is problematic. Although no information on ethnicity  
6 or income was collected, we assume that the majority of parents participating in this study were Caucasian  
7 and from a higher socio-economic background. Future work is required to determine the generalizability  
8 of the findings to a more diverse population.

9 Although the present findings support the hypothesis that high levels of PS or RS are associated with  
10 psychopathological symptoms, the cross-sectional nature of the study precludes causal conclusions.  
11 Additionally, future research might investigate associations of this parent-report with instruments  
12 assessing specific psychopathology symptoms (e.g. anxiety, ADHD).

13 The present study focused on validity and reliability. Future research should investigate additional  
14 psychometric qualities. A thorough examination of the scales factor structure (both within the original and  
15 revised framework of RST) could advance the field, especially given the inconsistent results of several  
16 earlier factor analytical studies with the BIS/BAS-scales (Franken et al., 2005; Kingsbury, Coplan, Weeks,  
17 & Rose-Krasnor, 2013; Muris et al., 2005; Vervoort et al., 2010).

18 The present study shows that the BIS/BAS parent-version can be used to assess a child's PS and RS,  
19 but other sources of information might provide additional insight. In the present study, only mothers  
20 participated. However, it might be interesting to collect data from fathers or teachers. Consistent with  
21 RST's neuropsychological nature, several performance-based measures are found to be good indicators of  
22 PS and RS as well (Avila & Torrubia, 2008; Colder & O'Connor, 2004; Colder et al., 2011; Vervoort,  
23 2010). Investigating the relationship between such measures and parent-reported PS and RS might  
24 strengthen their support. Furthermore, given the idea that PS and RS are manifestations of reactivity to  
25 environmental stimuli, observations in real life situations might be informative as well. Observational

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- 1 measures of children's temperament or personality do exist (Dyson, Olino, Durbin, Goldsmith, & Klein,
- 2 2012), but they do not focus on PS or RS. Construction of an observational measure to assess reactivity to
- 3 punishing or rewarding stimuli might be a way forward in the study of RST concepts.
- 4 In conclusion, the present study supports the use of BIS/BAS-scales parent-version as a valid and
- 5 reliable index of Punishment and Reward Sensitivity in children of a broad age range

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Table 1  
*Descriptive statistics for all questionnaires.*

	Total sample		Boys		Girls		Gender difference	2-5 years		6-11 years		12-18 years		Age difference
	M	(SD)	M	(SD)	M	(SD)		M	(SD)	M	(SD)	M	(SD)	
BIS/BAS-scales	n=541		n=207		n=334		F(1,535)	n=77		n=138		n=326		F(2,535)
BIS_total	15.96	(3.57)	15.64	(3.66)	16.16	(3.50)	p=.29	14.88	(3.61)	16.76	(3.65)	15.88	(3.45)	p<.001
BAS_total	31.00	(6.44)	31.93	(6.77)	30.43	(6.17)	p=.02	33.00	(6.30)	32.03	(6.48)	30.10	(6.30)	p<.001
BAS_RR	14.16	(2.64)	14.45	(2.73)	13.97	(2.53)	p=.06	14.68	(2.58)	14.93	(2.48)	13.71	(2.59)	p<.001
BAS_D	8.67	(2.88)	8.88	(2.98)	8.53	(2.82)	p=.12	9.27	(2.85)	8.76	(2.96)	8.48	(2.84)	p=.09
SPSRQ	n=94		n=53		n=41		F(1,90)	n=75		n=18				F(1,90)
SP	33.71	(9.12)	32.79	(9.03)	34.88	(9.20)	p=.60	32.79	(8.13)	37.55	(11.93)	na	na	p=.06
SR	52.05	(8.39)	53.13	(7.90)	50.68	(8.88)	p=.99	52.24	(8.60)	51.28	(7.61)	na	na	p=.86
HIPIC	n=153		n=27		n=126		F(1,149)			n=47		n=106		F(1,149)
N	40.73	(9.79)	40.96	(10.44)	40.67	(9.69)	p=.59	na	na	40.83	(9.64)	40.68	(9.77)	p=.43
E	113.69	(14.83)	119.37	(11.50)	112.48	(15.21)	p=.22	na	na	118.09	(13.35)	111.76	(15.09)	p=.70
CBQ	n=95		n=53		n=42		F(1,91)	n=77		n=18				F(1,91)
NA	107.25	(20.56)	107.19	(20.75)	107.33	(20.57)	p=.03	107.53	(20.51)	106.05	(21.35)	na	na	p=.92
S/E	112.19	(19.89)	115.35	(19.72)	108.20	(19.61)	p=.67	113.00	(20.18)	108.69	(18.72)	na	na	p=.51
App	28.39	(4.95)	27.87	(4.81)	29.03	(5.08)	p=.22	28.76	(4.91)	26.83	(4.96)	na	na	p=.16
IC	26.28	(5.92)	25.24	(6.32)	27.56	(5.18)	p=.34	25.63	(5.95)	29.00	(5.13)	na	na	p=.04

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CBCL	n=526		n=202		n=324		F(1,520)	n=68		n=135		n=323		F(2,520)
INT	50.85	(11.65)	50.68	(11.56)	50.96	(11.72)	p=.92	47.37	(10.10)	51.86	(10.90)	51.17	(12.14)	p=.03
EXT	47.82	(9.58)	48.35	(9.83)	47.48	(9.42)	p=.05	48.03	(8.78)	46.10	(8.62)	48.49	(10.05)	p=.05

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*Notes.* BIS\_total=BIS/BAS-scales total Behavioral Inhibition System Score, BAS\_total=BIS/BAS-scales total Behavioral Activation System Score, BAS\_RR= BIS/BAS-scales Reward Responsiveness subscale, BAS\_DRIVE=BIS/BAS-scales Drive subscale, SP=SPSRQ total Sensitivity to Punishment score, SR=SPSRQ total Sensitivity to Reward score, S/E=Child Behavior Questionnaire Surgency/Extraversion , NA=Child Behavior Questionnaire Negative Affectivity, App=Child Behavior Questionnaire Approach/ Positive Anticipation, IC=Child Behavior Questionnaire Inhibitory Control, INT=CBCL Internalizing Problems T-score, EXT=CBCL Externalizing Problems T-score, na=not applicable

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Table 2  
*Correlations between BIS/BAS-scales scores and other measurements*

	BIS_total	BAS_total	BAS_RR	
BIS/BAS-scales (n=546)				
BAS_total	.24***			
BAS_RR	.35***	.81***		
BAS_D	.15**	.18***	.52***	
	BIS_total <sup>a</sup>	BAS_total <sup>b</sup>	BAS_RR <sup>b</sup>	BAS_D <sup>b</sup>
SPSRQ (n=93)				
SP_M	.57***	-.31**	-.21*	-.33**
SR_M	.12	.61***	.43***	.59***
HIPIC (n=154)				
N	.68***	-.16*	-.25**	-.02
E	-.20*	.28**	.33***	.10
CBQ (n=94)				
NA	.49***	.10	-.07	.21*
S/E	-.41***	.58***	.39***	.58***
App	.03	.61***	.53***	.53***
IC	.29**	-.35**	-.11	-.35***
CBCL (n=526)				
INT	.50***	-.02	-.07	-.02



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EXT	.15**	.32***	.13**	.30***
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*Notes.* <sup>a</sup>=correlations corrected for BAS\_total, <sup>b</sup>=correlations corrected for BIS\_total, \*\*\*=p<.001, \*\*=p<.01, \*=p<.05, BIS\_total=BIS/BAS-scales total Behavioral Inhibition System Score,

BAS\_total=BIS/BAS-scales total Behavioral Activation System Score, BAS\_RR= BIS/BAS-scales Reward Responsiveness subscale, BAS\_DRIVE=BIS/BAS-scales Drive subscale, SP=SPSRQ total

Sensitivity to Punishment score, SR=SPSRQ total Sensitivity to Reward score, INT=CBCL Internalizing Problems T-score, EXT=CBCL Externalizing Problems T-scores

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<sup>i</sup> A detailed discussion of oRTS vs. rRST is beyond the scope of this article, but can be found elsewhere (e.g, Corr, 2008)

<sup>ii</sup> The revisions made to RST are described to have minimal impact on how RST-concepts should be measured (e.g. Smillie, Jackson, & Dalgleish, 2006, for a different view see Dissabandara, Loxton, Dias, Dalglis, & Stadlin, 2012). Most instruments used to measure RST-concepts are based on the oRST. Only recently, implications of rRST for assessment are considered (Harnett, et al., 2013; Colder et al., 2011). To the best of our knowledge, there exist no rRST measures for use with children and adolescents. We therefore focus on the original conceptualizations of RST.