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Psychometric properties of the Spanish version of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire for Children (SPSRQ-C)

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ABSTRACT

Reinforcement Sensitivity Theory has been applied to childhood psychopathology and the development of different types of personality in recent years. Few studies have reported evidence of the reliability/validity of specific measures based on this theory. The aim of this study was to assess the psychometric properties of the measures obtained through the Spanish version of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire for Children (SPSRQ-C) in a community sample of $N = 478$ children aged 6. Confirmatory Factor Analysis showed that the three-factor model was the best solution with indexes of moderate to good fit. Resulting factors were F1 sensitivity-to-punishment, F2 impulsivity/fun-seeking and drive and F3 reward-responsivity. High correlations were achieved between empirical SPSRQ-C factors and external measures: a) F1 largely correlated with anxiety–depression and internalizing problems, shyness and negative affectivity; b) F2 was strongly related to externalizing problems (attention-aggressive), activity level and surgency; and c) F3 achieved the highest correlations with externalizing problems. These results highlight the validity of the SPSRQ-C measures to be used with young children from the general population. Availability of accurate measures of response to punishment and reward is especially valuable in educational and therapeutic plans that include discipline and incentives as contingencies

1. Introduction

1.1. Formulation of Reinforcement Sensitivity Theory (RST)

Jeffrey A. Gray proposed RST as a reformulation of the Eysenck model of human personality (Gray, 1970, 1981). RST has recently been revised to incorporate findings from different areas in psychology and neuroscience, and it constitutes at present a biologically based personality model that proposes the following three behavioral/neuropsychological systems to explain individual differences in the emotion, learning and motivation domains (Berkman, Lieberman, & Gable, 2009; Corr, 2004): a) a behavioral approach system (BAS, "appetitive system"), identified as an impulsivity trait, responsible for activating behaviors in the presence of reward and non-punishment signals; b) a behavioral inhibition system (BIS, "aversive system"), identified as an anxiety trait, responsible for inhibiting behavior in response to punishment, non-reward and novelty signals; and c) a flight–fight system (FFS, the "threat system"), responsible for mediating the subject's responses to aversive stimuli, novel stimuli and non-rewards.

1.2. Measurement instruments based on RST for adults

RST has been applied to different areas of adult psychological functioning, and at present a number of questionnaires exist to measure its three main systems (FFS, BIS and BAS). Many RST questionnaires in adulthood are based on the original BIS–BAS model, and were initially assessed through classical measures of anxiety and impulsivity (Corr, 2016). A specific first assessment measure for RST was the Gray–Wilson Personality Questionnaire (GWPG; Wilson, Barrett, & Gray, 1989), which measured six components of rodent-reactions to reinforcement and covered the BAS, BIS and FFS system. This was followed by the General Reward and Punishment Expectancy Scales (GRAPES) (Ball & Zuckerman, 1990), which was centered on the cognitive interpretation of RST instead of responses to reinforcing stimuli. Subsequently, Carver and White (1994) developed the BIS/BAS scales, divided into three factors (impulsivity/fun-seeking, reward responsivity and drive). But the most consistent attempt to develop a specific measurement tool within RST was the global self-report proposed for adults by Torrubia, Ávila, Molto, and Caseras (2001): the Sensitivity to Punishment and

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Sensitivity to Reward Questionnaire (SPSRQ), a self-report with 48 yes–no response items. In the SPSRQ, the Sensitivity to Punishment scale (24-items) was developed to measure processes related to threat of punishment or failure (BIS), while the Sensitivity to Reward scale (24-items) assessed differences in Gray's impulsivity dimension (BAS), with FFS not being considered. But this original two-factor structure did not consistently obtain support in more recent psychometric studies using exploratory and confirmatory factor analyses in calibration and validation samples. The results suggested that it was necessary to delete many items to improve the adjustment to the data, that a solution with more than two factors was preferable and that some items were not sufficiently identified in their corresponding factor. Adapted versions of the SPSRQ in different countries have reported adequate convergent/discriminant validity measures with some regular personality measures, but the empirical studies have also pointed out the need for the structural refinement of the SPSRQ.

1.3. Measurement instruments based on RST for children

Although Gray's RST is of great interest in childhood, few studies have reported evidence of the reliability/validity of measures based on this system in young children. Blair (2003) developed a parent-report version for the assessment of RST in children based on the BIS/BAS psychometric model, and in a sample of 42 children with a mean age of 4 he found that the BIS-scale was positively related to teacher-reported social competence and the BAS-scale was not related to any of the study outcomes (physiological and cognitive self-regulation, temperamental emotionality and social competence).

Colder and O'Connor (2004) adapted items of the BIS/BAS and the SPSRQ to develop a new instrument for caregivers of 9- to 12-year-old children, the SPSRQ-C. Factorial analysis of this new tool in a sample of $n = 63$ children aged 9–12 showed a good fit for a four-factor solution: one dimension of the BIS (sensitivity to punishment) and three dimensions of the BAS (impulsivity/fun-seeking, drive and reward responsivity). The derived factors showed convergent validity with problem behaviors: high levels of impulsivity/fun-seeking (but not drive or reward responsivity) were related to high levels of externalizing scores, and high levels of sensitivity to punishment were related to high levels of internalizing scores. However, methodological issues limited this study's usefulness; sample size was low and no subsequent cross-validation data were available.

Most recently, Colder et al. (2011) reported the psychometric results of the parents' version of the SPSRQ-C in a sample of $N = 387$ children aged 10–13, and concluded good reliability and validity for the seven-factor solution: fear/shyness, anxiety, conflict avoidance, sensory reward, drive, responsiveness to social approval and impulsivity/fun-seeking. The BIS and BAS scales showed cross-convergence and discriminant validity with other measures of the BIS–BAS dimensions, but while the BAS scales were related to physiological correlates, the BIS scales did not yield links to these outcomes. These results were also methodologically questionable, since two factors consisted of only two items (conflict avoidance and drive) and three factors obtained poor to moderate reliability (Cronbach's alpha of .45 for conflict avoidance, .52 for sensory reward and .65 for anxiety).

Luman, van Meel, Oosterlaan, and Geurts (2012), in a large community sample of $N = 1234$ children aged 6 to 13 and based on the SPSRQ-C parents' reports, concluded that the best fit was provided by a four-factor solution: punishment sensitivity, reward responsivity and impulsivity with fun-seeking and drive. In this study, convergent-discriminant reliability for the SPSRQ-C dimensions was obtained in the following clinical sub-samples of children with disruptive problem behaviors: only-ADHD, $n = 34$; ADHD with oppositional defiant disorder -ODD-, $n = 22$; and ADHD with autism spectrum disorder -ASD-, $n = 22$; and a control sample of typically developing children ($n = 75$). The results showed that: a) all ADHD groups were characterized by high scores in reward responsivity and sensitivity to punishment; b) ADHD-only and ADHD + ODD scored high on impulsivity fun-seeking and drive; and c) ADHD + ASD scored high on punishment sensitivity.

1.4. Justification of the study, objectives and hypotheses

In short, early childhood is a malleable developmental period in which the detection of strengths and difficulties in sensitivity to punishment and reward has an enormous potential not only to re-shape these traits but also to detect endophenotypes or vulnerability factors of psychological disorders that could then be prevented. Dysfunctions in sensitivity to punishment and reward have been reported in several frequent disorders in childhood, such as ADHD, ODD, conduct disorder (CD) or anxiety disorders. However, methodological issues compromise the usefulness of many psychometric results, and more evidence of the structure and validity of RST measures is therefore needed at early ages.

This study aims to assess the psychometric properties of the SPSRQ-C in a large community sample of 6-year-old Spanish children. The specific objectives are: a) to validate the structure of the instrument through factor analysis; and b) to measure the association between the derived empirical SPSRQ-C factors and external dimensional and categorical measures of the children's temperament and psychological state. Based on the theoretical background, we hypothesize that: a) the internal structure of the Spanish version of the SPSRQ-C will be similar to the previous versions developed for childhood (the three- or four-factor solutions are the most final models); and b) the resulting derived factors will provide evidence for Gray's RST: factors measuring sensitivity to punishment will be more strongly related to internalizing psychological measures (especially with anxiety), while factors measuring impulsivity and reward responsivity will obtain the strongest associations with externalizing measures.

2. Methods

2.1. Participants

The sample derives from a longitudinal project on behavioral disorders in childhood designed in a two-phase sampling procedure (Ezpeleta, de la Osa, & Doménech, 2014). A total of 2283 families, obtained from the census of all 3-year-old preschoolers in the Barcelona region ($N = 13{,}578$), were invited to participate, with 1341 accepting the invitation. Sixty-three preschoolers were excluded due to language issues (children who were of foreign origin and they or their families did not speak Spanish fluently) or serious developmental problems (ASD, intellectual disability), and the remaining 1278 were screened using the behavioral problems scale of the Strengths and Difficulties Questionnaire for parents of 3- to 4-year-olds (SDQ^{3-4}; Goodman, 1997), plus four ODD symptoms (deliberately annoys people, blames others, is touchy, angry and resentful) from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; APA, 2000) not present in the questionnaire. With the aim of including children at high-risk of behavior problems, such as ODD, in the follow-up, screening was considered positive for raw scores ≥4 on the SDQ^{3-4} conduct problems scale (which corresponds to percentile 90 in this scale), or a response option of 2 ('certainly true') for any of the 8 DSM-IV-TR ODD symptoms listed.

All preschoolers with a positive screening score were invited to participate ($N = 522$ cases, 42.9%), as well as a random 30% of the $N = 756$ children with a negative screening score. The final sample at the end of the screening phase included 622 preschoolers (417 with a positive screening score and 205 with a negative one). This study included data from assessments at ages 3 and 6. The sample of $N = 622$ participants at age 3 included 311 boys (50%). Socioeconomic status (SES; Hollingshead, 1975) was distributed as follows: 205 (33.0%) high-