

Development and Validation of the Social Reward Questionnaire–Early Childhood

Kate J. Godfrey¹, Lucy Foulkes^{2, 3}, Carly McMorris⁴, Ashley D. Harris¹, and Signe Bray¹

¹ Department of Radiology, Cumming School of Medicine, University of Calgary

² Anna Freud National Centre for Children and Families

³ Department of Clinical, Educational and Health Psychology, University College London

⁴ Department of Psychology, University of Calgary

Social interactions like group inclusion, receiving praise, or treating others kindly can be motivating and enjoyable. Social reward sensitivity, including motivation and enjoyment, varies between individuals. In early childhood, this variation may relate to differences in social experience and development. Social reward questionnaires have been developed to measure individual differences in social enjoyment for adolescents and adults, but no early childhood measure currently exists. Here, we describe the development and validation of the parent/caregiver report Social Reward Questionnaire–Early Childhood (SRQ-EC) for children aged 3–7 years. The SRQ-EC was developed to quantify both wanting (motivation) and liking (enjoyment) of social rewards, which were considered in separate factor models. For wanting and liking models, exploratory ($N = 126$) and confirmatory ($N = 344$) factor analyses identified that three subscales best represented early childhood social reward sensitivity, which were: Sociability (large groups), Admiration (praise and positive attention), and Prosocial Interactions and Compliance (kindness and rule following). SRQ-EC subscales were internally consistent ($\omega = 0.76$ – 0.91 , $\alpha = 0.75$ – 0.88 , mean interitem correlations = 0.38 – 0.60) with high test–retest reliability over 2-weeks ($r = 0.66$ – 0.85 , all $p < .001$). Subscales differentially associated with other social behavior and personality measures, suggesting construct validity. SRQ-EC subscale scores further showed differential and significant associations with autistic-like traits in nonautistic children. These results suggest that SRQ-EC subscale scores are reliable for assessing social reward sensitivity during early childhood, which could offer key developmental insight regarding interindividual variation in early social behavior.

Public Significance Statement

This study developed a new measure for parents to report on young children’s motivation for and enjoyment of social situations, including participating in large groups, being praised, and being prosocial and following rules. This measure could help researchers better understand typical early social development and how social reward sensitivity might relate to other features in young children.

Keywords: factor analysis, paediatric assessment, reliability, social reward, validity

Supplemental materials: <https://doi.org/10.1037/pas0001196.supp>

This article was published Online First December 19, 2022.

Kate J. Godfrey  <https://orcid.org/0000-0002-2578-2382>

Lucy Foulkes  <https://orcid.org/0000-0002-8122-4270>

Carly McMorris  <https://orcid.org/0000-0002-5164-6210>

Ashley D. Harris  <https://orcid.org/0000-0003-4731-7075>

Signe Bray  <https://orcid.org/0000-0002-7626-2600>

Ashley D. Harris and Signe Bray contributed equally to this work.

Kate J. Godfrey received funding from an ACHRI Graduate Scholarship from the Alberta Children’s Hospital Research Institute. Signe Bray and Ashley D. Harris received funding from the Pilot Research Fund Program (PFUN) from the Hotchkiss Brain Institute, University of Calgary. Kate J. Godfrey received funding from a Harley N. Hotchkiss Doctoral Scholarship in Neuroscience from the Hotchkiss Brain Institute, University of Calgary.

The Social Reward Questionnaire–Early Childhood is available in the [Supplemental Materials](#). The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

This study was approved by the University of Calgary Conjoint Health Research Ethics Board (REB19-0737). Written informed consent in accordance with the Declaration of Helsinki was obtained from all interview

participants. A modified consent procedure was used for all online participants. Online participants were presented with the informed consent form, after which they were given the option to continue to the research study. Choice to continue to the online research study was taken as an indication of implied consent. This study was not preregistered.

Kate J. Godfrey played lead role in data curation, formal analysis, investigation, visualization and writing of original draft and an equal role in conceptualization, methodology and writing of review and editing. Lucy Foulkes played an equal role in conceptualization, methodology and writing of review and editing. Carly McMorris played an equal role in conceptualization and writing of review and editing. Ashley D. Harris played an equal role in conceptualization, funding acquisition, methodology, supervision and writing of review and editing. Signe Bray played equal role in conceptualization, funding acquisition, methodology, supervision and writing of review and editing.

Correspondence concerning this article should be addressed to Kate J. Godfrey, Department of Radiology, Cumming School of Medicine, University of Calgary, 2500 University Drive NW, Calgary, AB T2N 4N1, Canada. Email: kate.godfrey1@ucalgary.ca

Early social experiences play a key role in multiple areas of development including future peer relationships (Schneider et al., 2001) and externalizing problems (Hay & Pawlby, 2003). While social engagement is influenced by external factors like peer acceptance (Vaughn et al., 2016), frequency of social interactions has also been associated with internal factors including sensitivity to social rewards (Kawamichi et al., 2016). Indeed, social stimuli like laughter are reported as subjectively enjoyable (Sumiya et al., 2017) and pictures of smiling faces motivate behavior in reward-related tasks (Rademacher et al., 2010). Assessing individual differences in children's motivation and enjoyment of social rewards may provide insight into variation of early social behavior and related cognitive traits. While laboratory-based behavioral assessments of social motivation have been developed, the validity of modeling real-life social interactions with stimuli like photographs of smiling faces has been questioned, for review, see (Holleman et al., 2020). Alternatively, questionnaire-based data collection could capture motivation (wanting) and enjoyment (liking) reward components for a broad range of naturally occurring and rewarding social contexts. Parent-report questionnaires may be especially useful to characterize social reward sensitivity in early childhood, when completion of laboratory-based paradigms may be more challenging.

Foulkes and colleagues developed the first self-report questionnaire to assess enjoyment of distinctly rewarding social contexts (Foulkes et al., 2014). The Social Reward Questionnaire (SRQ) was developed for use in adults, where items were created based on a review of theoretical and empirical literature regarding social reward and related concepts like social goals, for details, see (Foulkes et al., 2014). The SRQ assesses enjoyment of sociability (large groups), admiration (praise and positive attention), prosocial interactions (kind and reciprocal relationships), passivity (giving others control and allowing them to make decisions), negative social potency (cruel or antagonistic behavior), and sexual relationships (frequent sexual experiences). Validity evidence for SRQ subscale scores was examined by assessing associations with personality traits, where increased sociability strongly associated with extraversion, increased prosocial interactions strongly associated with agreeableness (kindness or altruism), and admiration moderately associated with extraversion (Foulkes et al., 2014).

Social reward sensitivity is also important to consider in the context of developmental stage. As such, the Social Reward Questionnaire–Adolescent Version (SRQ-A; Foulkes et al., 2017) was developed. The SRQ-A was developed in a sample of youth aged 11–16 years to assess the same types of social reward as the adult version (excluding sexual relationships). Scores on the SRQ-A showed relations with personality traits that were both shared and unique to those observed in adults. For example, in adults and adolescents, conscientiousness positively associated with enjoyment of prosocial interactions (Foulkes et al., 2014, 2017). In only adolescents, an additional positive association between conscientiousness and enjoyment of admiration was reported (Foulkes et al., 2017), which may be due to increased reward value of social approval during adolescence (Foulkes & Blakemore, 2016) and an observed relation between positive peer feedback and increased adolescent prosocial behavior (van Hoorn et al., 2016). The presence of shared and distinct associations between age groups highlights the utility of social reward questionnaires that can assess different developmental stages. However,

comparisons between developmental stages cannot include early childhood until a measure is developed and evidence for validity is examined for young children.

Social reward questionnaires developed to date have exclusively assessed social enjoyment in adolescents (Foulkes et al., 2017) and adults (Foulkes et al., 2014). However, the incentive salience model (Berridge & Robinson, 1998) states that reward sensitivity can be conceptualized as including a “wanting” component whereby a reward is identified as desirable, and a “liking” component which describes the pleasure experienced when a reward is received. Indeed, social stimuli uniquely activate distinct wanting and liking brain regions (Rademacher et al., 2010). Further, behavioral studies have suggested that self-reported liking of social rewards can be disentangled from wanting, quantified as motivational value, in late childhood (8–11 years; Demurie et al., 2012). While wanting and liking are typically coordinated, such that individuals are motivated to obtain rewards which are enjoyed, these reward components can also be decoupled, for example, as seen in heavy alcohol consumption (Hobbs et al., 2005), anorexia nervosa and bulimia (Jiang et al., 2019), and chronic pain (Elvemo et al., 2015). A lack of harmony between wanting and liking can be extended to disorders which manifest in early childhood, like autism (Clements et al., 2018), further highlighting the utility of examining wanting and liking distinctly in young children.

Adapting the SRQ-A for use in early childhood (3–7 years) could have utility for investigating relations between early social reward sensitivity and additional traits like personality in this key developmental stage. An early childhood measure could be used alongside the SRQ and SRQ-A to investigate how relations between social reward sensitivity and other traits differ between developmental stages. Therefore, we aimed to develop a novel early childhood parent-report assessment, the Social Reward Questionnaire–Early Childhood (SRQ-EC). Further, recognizing the potential to assess the distinct wanting and liking components of reward, we expanded on earlier versions of the SRQ which only assessed liking to evaluate both wanting and liking of social rewards in parallel.

Method

Overview of Study Design

The Social Reward Questionnaire–Early Childhood (SRQ-EC) was developed in a 5-step process. First, social liking items from the SRQ-A were adapted from self-report to parent-report format to be relevant for early childhood. Social liking items were further used as a base to develop an additional wanting item, asking about motivation to obtain each social liking item, which produced wanting and liking question pairs. Second, we gathered qualitative feedback on the adapted items by interviewing parents of 3–7-year-old children. Third, the latent structure of the SRQ-EC was assessed with exploratory factor analysis (EFA) and confirmed in an independent sample with confirmatory factor analysis (CFA). The CFA model was additionally used to evaluate the effects of child and parent demographic variables on factor means and variances via moderated nonlinear factor analysis (Bauer & Hussong, 2009), which included an evaluation of item invariance with respect to demographic variables via differential item functioning analysis (Curran et al., 2014). Fourth, using CFA data, we calculated internal consistency coefficients including coefficient omega, Cronbach's α

and mean interitem correlations in addition to test–retest reliability coefficients for subscale scores over a 2-week period in a subset of CFA participants. Fifth, we examined evidence for validity of SRQ-EC subscale score interpretations by examining relations between SRQ-EC subscale scores and measures of social disinterest and personality. Following the development and validation procedure, due to potential utility of the SRQ-EC in clinical research settings, we used the CFA data to preliminarily investigate associations between SRQ-EC subscales and autistic-like traits in a neurotypical sample. Each of these steps is detailed below. This study was approved by the University of Calgary Conjoint Health Research Ethics Board (REB19-0737). This study was not preregistered. The final version of the SRQ-EC is available in the [Supplemental Materials](#).

Item Adaptation

We adapted questions from the Social Reward Questionnaire–Adolescent Version (SRQ-A) from a self-report format (“I enjoy”) to an observer-report format (“They enjoy”), for parents of young children. Further adding to the SRQ-A, the SRQ-EC was designed to assess both social liking and wanting in parallel sets of questions. To this end, each social liking question from the original SRQ-A was used as a base to create a related social wanting question. Social wanting questions were prefaced with “They want” or “They will,” while social liking questions were prefaced with “They enjoy.” For example, the questions “They want to join in or be part of group playtime” and “They enjoy when they are included in group playtime” would assess Sociability Wanting and Sociability Liking, respectively.

Cognitive Interviewing

We then recruited eight parents of 3–7-year-old children from our laboratory’s participant database to participate in in-person cognitive interviews (Boeije & Willis, 2013; Willis, 2005). All parents self-identified as women. Seven were parents of a neurotypical child without a history of health issues including neurological or psychiatric disorders. As developing a parent-report measure of social reward for early childhood could have implications for investigating early social development in clinical conditions, we also interviewed one parent whose child had a clinician diagnosis of autism. All cognitive interviewing participants provided informed consent to participate and were compensated for their time with a \$10 gift card.

Cognitive interview participants completed a paper version of the pilot survey, which included rating confidence in each response on a sliding scale ranging from “no confidence” to “very confident”. In the interview, parents were first asked to describe the difference between wanting and liking, which included providing examples of children’s behaviors they believe demonstrate wanting and liking of a social interaction. They were then asked follow-up questions about the five pilot survey items where they rated the lowest confidence. Specifically, parents were asked whether low confidence was due to lack of clarity, if the question was not developmentally appropriate, or if there was another reason for low confidence. To probe comprehension of the item, parents were also asked to provide example behaviors that they believed the low confidence questions could have been referring to. Last, parents were asked to evaluate eight additional pilot questions, such that

feedback was obtained from at least one parent for all questions. Parents were asked about item clarity and, like the low confidence questions, parents provided example behaviors to determine item comprehension.

Online Research Participants

Participants for the EFA ($N = 126$) and CFA ($N = 344$) analyses were recruited online via Prolific (Oxford, United Kingdom) between March 2020 and August 2021. Prolific reports high data quality and participant reliability, honesty, and diversity (Peer et al., 2017). All surveys presented through Prolific were digitized using the survey software Alchemer (Boulder, Colorado, United States). Inclusion criteria for this study included having a child between 3- and 7-years old and residing in either Canada, the United States of America, or the United Kingdom. Parents were excluded from participation if their child had a psychiatric, neurodevelopmental, or neurological diagnosis including very preterm birth (<32 weeks gestational age).

Online participants were identified by first recruiting parents to complete a screening survey, which included 16 arbitrary questions about children’s screen time and a demographic assessment. The demographic assessment included reports on child sex, child age, parent gender, and highest level of parental education. Highest level of parental education was used as a proxy for socioeconomic status and was rated on a 6-point Likert-type scale ranging from 0 = *did not complete high school* to 6 = *professional school degree for example, Law, Medicine, Ministry*. Participants who indicated they fit inclusion and exclusion criteria on the demographic assessment were invited to participate in the study.

To further promote quality of data obtained from online samples, we used multiple quality checks. First, responses to four instructional manipulation check items (which require a specific response) were evaluated (Oppenheimer et al., 2009) and participants were excluded if they failed to provide the target responses. Second, a reliability check was performed by comparing participant demographic responses between the recruitment and research surveys. Participants were excluded following the reliability check if they provided different responses on the screening and research surveys for demographic variables which are stable over a 1-week period including child birthday, child sex, child ethnicity, and parent/child relationship (e.g., birth, foster, or adoptive parent). Last, a seriousness check (Aust et al., 2013) was performed upon survey completion by asking participants whether they took part in the study seriously, while informing participants that nonserious responders would still be compensated for participation. Any participants who self-identified as nonserious were excluded. All online participants completed a modified consent procedure. Participants were provided with the informed consent form and were required to indicate consent to participate to be redirected to the research study. Online participants were reimbursed £2.64 for each survey completed.

Exploratory Factor Analysis

All analyses, except where specified otherwise, were conducted in MPlus Version 8.6 (Muthén & Muthén, 2017). Exploratory factor analyses (EFA) were conducted which considered social wanting and social liking questions within the same factor model and in separate factor models. All EFAs were conducted on a polychoric

correlation matrix using mean and variance adjusted weighted least squares (WLSMV) estimation and geomin (oblique) rotation, as this approach is suggested for ordered categorical variables such as Likert scale survey items (Holgado-Tello et al., 2010). As suggested by Thompson and Daniel (Thompson & Daniel, 1996), we used multiple criteria to identify the number of factors to extract in the EFA. A maximal number of factors to extract was determined using the Kaiser–Guttman rule, where all extracted factors must have an eigenvalue ≥ 1 (Guttman, 1954; Kaiser, 1961). We provided additional evidence toward the best solution using parallel analysis (Horn, 1965). At time of analysis, MPlus does not offer parallel analysis on polychoric correlations via WLSMV estimation; therefore, we used both the MPlus parallel analysis default (maximum likelihood extraction performed on the Pearson correlation matrix) and an additional parallel analysis on the polychoric correlation matrix using the “fa.parallel” function from the R “psych” package Version 2.1.3. (Revelle, 2020). All R analyses were conducted using R Version 4.0.2 (R Core Team, 2020).

Once a candidate range of factors was determined, the strength of factor solutions was assessed using the χ^2 statistic, comparative fit index (CFI), and root-mean-square error of approximation (RMSEA). We used the traditional cutoff of a CFI ≥ 0.90 and RMSEA ≤ 0.08 to suggest good model fit (West et al., 2012). At this stage, we also optimized the measure by removing uninformative items which poorly represent the latent constructs (i.e., items which loaded < 0.40 on all factors), or which generalize across latent constructs (i.e., items which cross-loaded ≤ 0.40 on multiple factors). After removing uninformative items based on the above criteria, the final set of items were selected based on factor loading strength and alignment with underlying theory.

Confirmatory Factor Analysis

To confirm the structure observed in the EFA, we conducted a confirmatory factor analysis (CFA) in an independent sample. Like in the EFA, factor analysis was performed on the polychoric correlation matrix via WLSMV estimation and geomin rotation as suggested for ordinal data. CFA model fit was assessed using the χ^2 statistic, CFI, and RMSEA. Sample size for the CFA was based on recommendations of Bentler and Chou (Bentler & Chou, 1987) who recommend a 10:1 ratio of participants to parameters. The target sample was determined following the EFA, as the number of parameters to be tested in the CFA step is dependent on the EFA factor model and number of items retained.

Measurement Invariance

To examine the impact of demographic variables on latent factors, we assessed the effect of child age, child sex, the interaction between child age and sex, and parent gender on latent factor means and variances via moderated nonlinear factor analysis (MNLFA; Bauer & Hussong, 2009). We additionally examined item invariance using the differential item functioning (DIF) analysis procedure described by Curran and colleagues (Curran et al., 2014). In brief, the DIF analysis was conducted by introducing the impact of child age, child sex, the interaction between child age and sex, and parent gender on the intercept and loading of each item. A likelihood ratio test was then conducted to examine if the fit of a model accounting for those covariates was significantly improved compared to the

baseline model. If significant improvement was detected, the influence of demographics on the item loading and intercept would be evaluated. An item would be deemed noninvariant if two criteria were met. There must be a significant impact of any covariates on either the item loading or intercept (significant covariate effect) and the model must be improved by accounting for these effects (significant likelihood ratio test). The DIF analysis procedure involved performing one likelihood ratio test and one regression for each item for a total of 30 statistical tests per model; therefore, to account for α inflation, a more stringent significance threshold of $p \leq .01$ was used in DIF analyses to approximately account for multiple comparisons (Curran et al., 2014). For both MNLFA and DIF analysis, child age was mean centered, child sex effects were estimated by specifying females as the reference group, and parent gender effects were estimated by specifying women as the reference group. The minimum effect detectable at 80% power in DIF analyses was $f^2 = 0.034$.

Internal Consistency and Test–Retest Reliability

CFA data were used to calculate internal consistency coefficients for each subscale, including coefficient omega and Cronbach's coefficient α , alongside mean interitem correlations. Coefficient omega and Cronbach's coefficient α were calculated using the “compRelSEM” function from the R “semTools” package Version 0.5-6 (Jorgensen et al., 2022). A subset of CFA participants ($N = 71$) was invited to complete the SRQ-EC a second time, approximately 2 weeks later, and test–retest reliability coefficients were calculated by Pearson correlating SRQ-EC subscale scores between timepoints.

Construct Validation

The validation procedure involved asking CFA participants to complete established questionnaires assessing social behaviors and personality. Parents completed the Child Social Preference Scale (CSPS; Coplan et al., 2004), an 11-item measure with two subscales assessing Shyness and Unsociability (i.e., social disinterest) in children aged 3–5 years. CSPS Unsociability is assessed with questions like “my child seems content to play alone,” where a higher subscale score indicates that children show more behaviors indicating social disinterest. To support the validity argument of SRQ-EC subscale scores, we aimed to confirm the presence of negative associations with Unsociability, such that children who are less sensitive to social rewards (in all SRQ-EC subscales) show greater CSPS Unsociability scores. Parents additionally completed the Inventory of Children's Individual Differences–Short Version (ICID-S; Deal et al., 2007), a 50-item measure for children and youth aged 2–15 years. The ICID-S assesses personality facets including Extraversion, Agreeableness, and Conscientiousness. To support the validity argument of SRQ-EC subscales, we aimed to confirm similar relations between SRQ-EC subscale scores and personality facets in children as were observed in adults (Foulkes et al., 2014) and adolescents (Foulkes et al., 2017). We hypothesized that SRQ-EC Sociability would have a strong positive association with ICID-S Extraversion; SRQ-EC Prosocial Interactions would have a strong positive association with ICID-S Agreeableness (kindness and altruism) and Conscientiousness (responsibility); SRQ-EC Passivity would negatively associate with ICID-S Conscientiousness; and SRQ-EC Admiration would have a moderate

positive association with ICID-S Extraversion. For the validation procedure and preliminary analyses (described below), associations were determined by calculating Pearson correlation coefficients with 90% confidence intervals calculated by bootstrapping with 1,000 samples. The threshold for statistical significance in construct validation and preliminary analyses were Bonferroni corrected for 30 comparisons ($p \leq .001$).

Preliminary Analysis of Autistic-Like Traits

As the SRQ-EC has potential utility for understanding differences in early social reward sensitivity in various clinical conditions with social features, we performed a preliminary investigation to examine associations between SRQ-EC subscale scores and autistic-like traits in the typically developing CFA sample. Parents completed the Autism Spectrum Quotient: Children's Version (AQ-Child; Auyeung et al., 2008), a 50-item measure for early childhood and beyond (ages 4–11 years) which assesses the presentation of behaviors which are consistent with a diagnosis of autism. A higher total AQ-Child score indicates that children show more behaviors like those seen in autism. We hypothesized that autistic-like traits would negatively associate with Sociability, Admiration, and Prosocial Interactions and positively associate with Passivity similar to findings in adults (Foulkes et al., 2015).

Results

Cognitive Interviewing

In cognitive interviews, parents expressed confidence in distinguishing between social wanting and social liking. When asked about the difference between wanting and liking, parents provided examples like “enjoyment is feelings you have in the moment, while wanting is your desire to have it [a social interaction].” Several parents expressed they observed that children may enjoy social interactions in the moment but were not motivated to seek them out, with examples including attending social activities like sports or swimming lessons. When asked about example behaviors related to whether their child would want a social interaction, parents provided examples like “asking for things” or “initiating without assistance from parents”; while example behaviors that related whether their child is liking a social interaction included “laughing,” or “having more energy.”

Four changes were adopted to the SRQ-EC based on parent feedback. First, questions from the “Negative Social Potency” subscale were dropped due to low confidence that preschool children intentionally perform cruel or manipulative behaviors and that parent observers could objectively rate such behaviors. Second, the Prosocial Interactions subscale (which measures kindness and social reciprocity) underwent further refinement. Parents reported low confidence on several Prosocial Interactions items which they deemed too developmentally advanced for preschool children, including questions assessing enjoyment of fairness (“They enjoy treating others fairly”), sharing feelings without prompting (“They enjoy sharing their feelings and hearing the feelings of others”), and keeping promises (“They enjoy keeping promises”). To address this, new items were developed to ask about sharing (“They enjoy sharing items they like”), helping (“They enjoy helping others”), taking turns (“They enjoy taking turns with others”), and comforting

others (“They enjoy making someone feel better who is sad or sick”).

The third adjustment was that the Likert-type scale response anchors were modified from an agreement scale (strongly agree to strongly disagree) to a frequency scale (always to never), with accompanying qualifiers, for example, “usually (about 90% of the time),” as parents reported more confidence rating frequency of behavioral events rather than determining degree of agreement. Last, based on feedback from the parent of a child with autism, questions were modified to ensure emphasis on social elements in questions where there could be ambiguity. For example, “They enjoy going to social events” became “They enjoy going to social events because they know many people will be there.” Following modifications based on parent cognitive interviews, the SRQ-EC contained 54 items measuring four subscales which were Sociability, Admiration, Prosocial Interactions, and Passivity, with parallel questions for wanting and liking.

Exploratory Factor Analysis

Of the 267 participants who completed the screening survey, 201 met inclusion criteria and were invited to participate, and 188 completed the SRQ-EC. Data from participants who completed the SRQ-EC were then excluded following data quality screening for failing instructional manipulation ($N = 18$), reliability ($N = 35$), or both instructional manipulation and reliability ($N = 8$) checks. No participants failed the seriousness check, but one additional participant was excluded as they indicated they were pursuing an autism diagnosis for their child. After all exclusions ($N = 62$), the final EFA sample included 126 participants.

The 126-participant sample for the EFA was deemed adequate based on two criteria; A Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy ≥ 0.8 , (KMO for *Wanting and Liking Model* = 0.82; KMO for *Wanting Model* = 0.86; KMO for *Liking Model* = 0.85; Kaiser, 1970; Kaiser & Rice, 1974), and Bartlett's Test of Sphericity $p \leq .05$, (Bartlett's Test for *Wanting and Liking Model*: $\chi^2(1,431) = 5295.073$, $p \leq .001$; Bartlett's Test for *Wanting Model*: $\chi^2(351) = 1501.696$, $p \leq .001$; Bartlett's Test for *Liking Model*: $\chi^2(351) = 1619.972$, $p \leq .001$; Bartlett, 1951). KMO and Bartlett's tests were conducted, respectively, using the “KMO” and “cortest.bartlett” functions from the R “psych” package Version 2.1.3. (Revelle, 2020). Demographic information provided by parents included child sex, child age, and child ethnicity in addition to parent gender and highest level of parental education which was used as a proxy of socioeconomic status. Demographic variables are summarized in Table 1.

In the *Wanting and Liking Model*, when all items were considered together, The Kaiser–Guttman rule suggested a maximum of 12 factors, with parallel analysis in MPlus and R suggesting the five-factor solution to be optimal. We therefore explored the relative strengths of 1–12 factor solutions with particular attention to the five-factor solution. In the EFA, the five-factor solution did not reach the a priori cutoff of 0.90 for the CFI (CFI = 0.897). However, the six-factor solution was most parsimonious while showing good fit, $\chi^2(940) = 1598.591$, $p \leq .001$; CFI = 0.913; RMSEA [90% CI] = 0.075 [0.068–0.081]. In the six-factor solution, two factors were eliminated due to either low factor loading strength of all items or most items cross loading ≥ 0.4 on other factors. The remaining four factors were representative of

Table 1
EFA and CFA Participant Demographics

| Demographic variable | EFA sample (<i>N</i> = 126) | CFA sample (<i>N</i> = 344) |
|---|---------------------------------|---------------------------------|
| Child sex (male/female) | (66/60) | (167/177) |
| Child age, <i>M</i> ± <i>SD</i> (range) | 5.15 ± 1.67 (3.35–7.27) | 5.23 ± 1.27 (3.08–7.59) |
| Child ethnicity | | |
| White (%) | 80 | 83 |
| Asian (%) | 6 | 1 |
| Black (%) | 4 | 5 |
| Hispanic or Latinx (%) | 3 | 1 |
| Other (%) ^a | 7 | 10 |
| Parent gender (woman/man/ nonbinary) | (80/46/0) | (243/100/1) |
| Parent education, <i>M</i> + <i>SD</i> (range) | 2.96 ± 1.11 (1–5) | 2.87 ± 1.09 (1–5) |

Note. EFA = exploratory factor analysis; CFA = confirmatory factor analysis; *M* = mean; *SD* = standard deviation.

^aIncludes those who reported multiple ethnic backgrounds.

the SRQ-A factors of Sociability, Admiration, Prosocial Interactions, and Passivity such that wanting and liking items loaded on the same factor. When this four-factor model was evaluated within a CFA model framework, model fit was acceptable but not ideal as assessed by the χ^2 statistic, $\chi^2(773) = 1524.128$, $p < .0001$, and RMSEA (RMSEA [90% CI] = 0.088 [0.081–0.094]) and did not reach threshold as assessed by the CFI (CFI = 0.883). We next investigated factor structure when wanting and liking items were considered in separate factor models.

For the *Wanting Model* exploratory factor analysis, The Kaiser–Guttman rule suggested a maximum of five factors, with parallel analysis in MPlus and R suggesting the three-factor solution to be optimal. We therefore explored the relative strengths of 1–5 factor solutions, with particular attention for a three-factor solution. In line with our expectations from the parallel analyses, the three-factor solution was the most parsimonious while showing good fit, $\chi^2(228) = 353.263$, $p < .001$; CFI = 0.949; RMSEA [90% CI] = 0.066 [0.052–0.079]. All three factors were well identified, with five items per factor (all factor loadings ≥ 0.44). Examination and interpretation of items determined that for social wanting, two factors were closely aligned with the existing SRQ/SRQ-A subscales of Sociability and Admiration. To reflect this similarity between measures, these names were retained in the SRQ-EC. The third factor consisted of a combination of items from two existing subscales: Prosocial Interactions and Passivity. Prosocial Interactions items which survived factor analysis were related to trying not to hurt others and taking turns, behaviors which align with conceptualizations of early prosocial behavior (Laible & Karahuta, 2014). Passivity items which survived factor analysis were related to following rules and directions, behaviors which align with a trait frequently described in childhood education literature as compliance (Stephenson & Hanley, 2010). We therefore named this third factor “Prosocial Interactions and Compliance” to better capture the content of the subscale.

For the *Liking Model* exploratory factor analysis, like wanting, the Kaiser–Guttman rule suggested a maximum of five factors,

with parallel analysis in MPlus and R suggesting the three-factor solution would optimally fit the data. Therefore, we explored the relative strengths of 1–5 factor solutions, with particular attention to the three-factor solution. In line with our expectations from the parallel analysis, the three-factor solution was the most parsimonious while still showing good data fit, $\chi^2(228) = 359.517$, $p < .001$; CFI = 0.953; RMSEA [90% CI] = 0.068 [0.054–0.081]. All three factors were well identified, with five items per factor (all factor loadings ≥ 0.52). Examination and interpretation of items determined that for social liking, like social wanting, two factors related to Sociability and Admiration while a third factor represented items relating to Prosocial Interactions and Compliance.

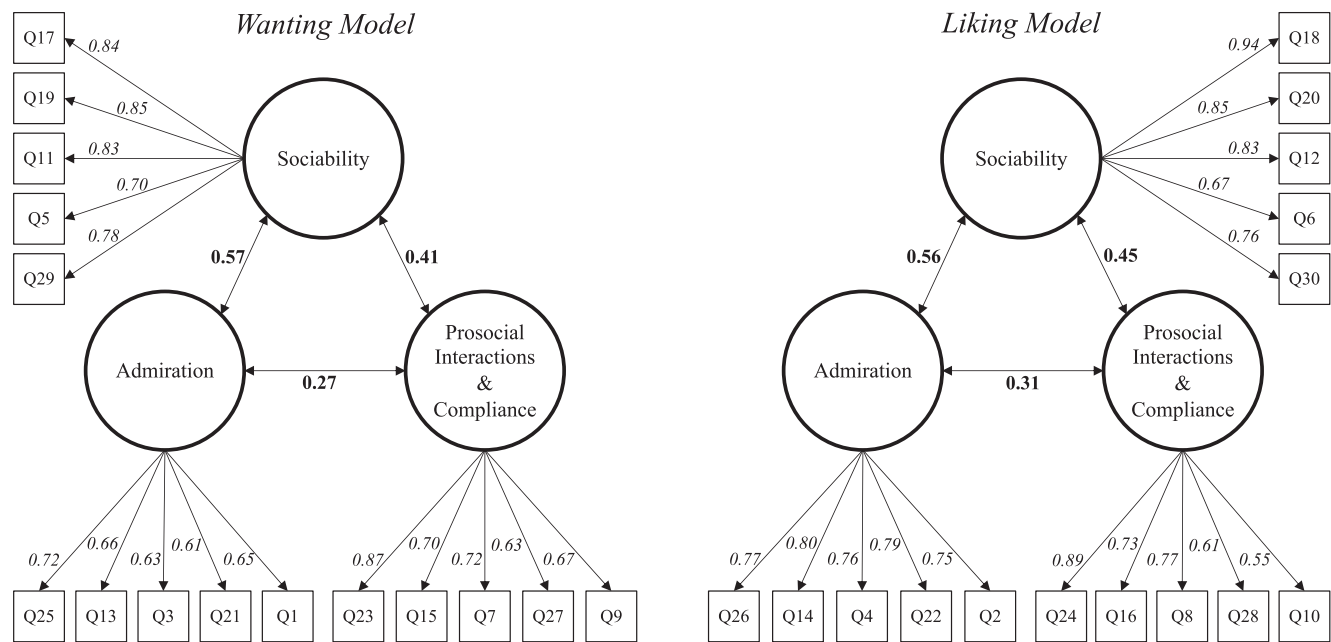
As improved fit was obtained when wanting and liking items were considered within separate models, we considered wanting and liking within independent models for subsequent analyses. At this stage, we also aimed to optimize the questionnaire by removing uninformative items. Items were excluded if they did not strongly load on any factors (all loadings < 0.40), or if they cross-loaded on multiple factors (two or more loadings ≥ 0.40). Items were then evaluated based on factor loading strength, underlying theory, and the objective of retaining both items from wanting and liking dyads. Following item removal and optimization, the final 30-item SRQ-EC contained three wanting and three liking subscales which were each identified with five questions (see [Supplemental Materials](#)).

Confirmatory Factor Analysis

In the CFA, we recruited one sample of participants to evaluate the *Wanting* and *Liking Models* in parallel. Each model has 15 questions and three factors (Sociability, Admiration, Prosocial Interactions and Compliance), for a total of 33 parameters (15 factor loadings, 15 error variances, and 3 factor correlations). To test these models, we aimed to recruit 330 CFA participants based on the recommended 10:1 ratio of participants to parameters (Bentler & Chou, 1987). We anticipated similar data loss as observed in the EFA (47% of screened participants provided useable data), therefore, we screened 701 participants for the CFA. 550 screened participants met inclusion criteria and were invited to participate, of which 469 participants completed the study. No participants failed the seriousness check, but participants were excluded for failing instructional manipulation ($N = 54$), reliability ($N = 57$), or multiple ($N = 14$) data quality checks. After quality checking, the final sample included 344 participants which are summarized in [Table 1](#).

For the *Wanting Model*, the three-factor structure identified in the EFA step provided good data fit in the confirmatory sample, $\chi^2(87) = 199.617$, $p < .0001$; CFI = 0.974; RMSEA [90% CI] = 0.061 [0.050–0.073]. For the *Liking Model*, the three-factor structure identified in the EFA step provided good data fit in the confirmatory sample as assessed by the χ^2 statistic, $\chi^2(87) = 299.078$, $p < .0001$, and CFI (CFI = 0.963), but only acceptable fit as assessed by the RMSEA (RMSEA [90% CI] = 0.084 [0.074–0.095]). Pearson correlations between wanting and liking for the same social reward type were high (Sociability: $B = 0.923$, $p < .001$; Admiration: $r = 0.780$, $p < .001$, Prosocial Interactions and Compliance: $r = 0.864$, $p < .001$). Factor models for both *Wanting* and *Liking* are presented in [Figure 1](#).

Figure 1
Factor Structure of the Social Reward Questionnaire–Early Childhood (SRQ-EC)



Note. Correlation coefficients between subscales are shown in bold, all $p < .001$. Standardized factor loadings are italicized.

Measurement Invariance

As only one parent self-identified as nonbinary, there was insufficient power to consider a third level of the parent gender variable. As this participant could not be collapsed into either the man or woman group, measurement invariance analyses were conducted with this participant excluded ($N = 343$). Moderated nonlinear factor analysis results for factor means are summarized in Table 2. Child age was significantly related to the factor mean of Prosocial Interactions and Compliance Wanting ($B = 0.242, p < .001$); however, an age effect was not observed for the factor mean of Prosocial Interactions and Compliance Liking ($B = 0.085, p = .143$). There was additionally a trend-level interaction between child age and sex related to the factor mean of Admiration Wanting ($B = -0.182, p = .054$), while an interaction was not observed for the factor mean of Admiration Liking ($B = -0.043, p = .630$). All other child and parent demographic effects on factor means were not significant.

Moderated nonlinear factor analysis results for factor variances are summarized in Table 3. Child age and sex had a significant interaction for factor variance of Sociability Wanting ($B = -0.189, p = .038$), while the interaction was not significant when considering Sociability Liking ($B = 0.001, p = .334$). All other child and parent demographic effects on factor variances were not significant.

DIF analysis of the *Wanting Model* identified a single Sociability Wanting item (“They want to go to social events because they know many people will be there”) where the likelihood ratio test indicated that model fit was significantly improved by including covariate effects, $\chi^2(8) = 22.160, p = .005$. However, at the stringent α threshold ($\alpha = 0.01$), there were no significant covariate effects on the item loading (child age: $B = -0.145, p = .375$; child sex: $B = 0.596, p = .047$; Child Age \times Sex: $B = 0.424, p = .066$; parent

gender: $B = 0.361, p = .273$) or intercept (child age: $B = 0.226, p = .060$; child sex: $B = -0.086, p = .740$; Child Age \times Sex: $B = 0.183, p = .369$; parent gender: $B = -0.581, p = .048$). Due to lack of significant covariate effects on the loading or intercept, the item was deemed invariant. Due to lack of significant likelihood ratio tests, all other *Wanting Model* items were also deemed invariant to child and parent demographic variables.

DIF analysis of the *Liking Model* identified a single Sociability Liking item (“They enjoy participating in activities that have many people involved”) where the likelihood ratio test indicated that model fit was significantly improved by including covariate effects, $\chi^2(8) = 21.111, p = .007$. When covariate effects on the item loading and intercept were examined, the effect of parent gender on the item intercept was significant ($B = 0.980, p = .001$). Due to significance of the likelihood ratio test, and the identification of a significant covariate effect, this item was deemed noninvariant to parent gender. Exclusion of this noninvariant item for the *Liking Model* resulted in unacceptable fit, $\chi^2(74) = 278.741, p < .001$; CFI = 0.955; RMSEA [90% CI] = 0.090 [0.079–0.101], thus this item was retained in the final model. Due to lack of significant likelihood ratio tests, all other *Liking Model* items were deemed invariant to child and parent demographic variables.

Internal Consistency and Test–Retest Reliability

Internal consistency coefficients for SRQ-EC subscales were calculated using data from all CFA participants ($N = 344$). A subset of CFA participants ($N = 85$) was invited to complete the SRQ-EC a second time, approximately 2 weeks later, and test–retest reliability coefficients were calculated using data from participants who passed quality checks at both timepoints ($N = 71$). Omega coefficients for all

Table 2*Moderated Nonlinear Factor Analysis on Factor Means*

| Effect | <i>B</i> | <i>SE</i> | <i>p</i> | Effect | <i>B</i> | <i>SE</i> | <i>p</i> |
|---|-------------|-------------|-----------------|--|----------|-----------|----------|
| Sociability Wanting | | | | Sociability Liking | | | |
| Child age | .015 | .056 | .793 | Child age | .055 | .056 | .329 |
| Child sex | -.022 | .116 | .850 | Child sex | .011 | .117 | .928 |
| Child Age × Sex | -.036 | .087 | .681 | Child Age × Sex | -.029 | .095 | .757 |
| Parent gender | .091 | .133 | .497 | Parent gender | .118 | .131 | .369 |
| Admiration Wanting | | | | Admiration Liking | | | |
| Child age | .026 | .060 | .660 | Child age | .024 | .058 | .680 |
| Child sex | .214 | .125 | .086 | Child sex | .032 | .121 | .793 |
| Child Age × Sex | -.182 | .094 | .054 | Child Age × Sex | -.043 | .088 | .630 |
| Parent gender | -.240 | .152 | .113 | Parent gender | -.183 | .134 | .172 |
| Prosocial Interactions and Compliance Wanting | | | | Prosocial Interactions and Compliance Liking | | | |
| Child age | .242 | .065 | <.001 | Child age | .085 | .058 | .143 |
| Child sex | .084 | .122 | .494 | Child sex | .057 | .115 | .619 |
| Child Age × Sex | -.136 | .097 | .159 | Child Age × Sex | -.152 | .090 | .093 |
| Parent gender | .188 | .142 | .185 | Parent gender | .184 | .133 | .166 |

Note. SRQ-EC = Social Reward Questionnaire–Early Childhood. Moderated nonlinear factor analysis estimating the effects of biological covariates on factor means of SRQ-EC subscales. Effect of child sex was estimated by specifying females as the reference group, effect of parent gender was estimated by specifying women as the reference group. *B* = estimate; *SE* = standard error of the estimate; bold: covariate effects significant at $p \leq .05$.

subscales suggest good internal consistency between items ($M = 0.848$, $SD = 0.055$, range = 0.763–0.909) as did Cronbach's α coefficients ($M = 0.820$, $SD = 0.053$, range = 0.753–0.882). Mean interitem correlations between items were moderate ($M = 0.493$, $SD = 0.090$, range = 0.380–0.601), suggesting items contained on the same subscale showed consistency without being so strongly associated to suggest item redundancy. Pearson correlations for all subscales across timepoints were strong ($M = 0.768$, $SD = 0.079$, range = 0.662–0.845) and significant (all $p < .001$), suggesting stability of SRQ-EC subscale scores over 2 weeks. Internal consistency and test–retest reliability coefficients are summarized in Table 4.

Construct Validation

Sociability Wanting and Liking had strong positive associations with ICID-S Extraversion, strong negative associations with CSPA Unsociability, and moderate positive associations with ICID-S

Agreeableness and Conscientiousness. Admiration Wanting and Liking had moderate positive associations with ICID-S Extraversion, and moderate negative associations with CSPA Unsociability. Prosocial Interactions and Compliance Wanting and Liking had strong positive associations with ICID-S Agreeableness and Conscientiousness, and moderate negative associations with CSPA Unsociability. Pearson correlations between SRQ-EC subscales and additional assessments are summarized in Table 5.

Preliminary Analysis of Autistic-Like Traits

AQ-Child scores negatively associated with all SRQ-EC subscales (Table 5), where children who showed more autistic-like behaviors had lower wanting and liking across social reward types. A strong negative association was observed for autistic-like traits and Sociability Wanting and Liking, while the negative association between other subscale scores and autistic-like traits were moderate.

Table 3*Moderated Nonlinear Factor Analysis on Factor Variances*

| Effect | <i>B</i> | <i>SE</i> | <i>p</i> | Effect | <i>B</i> | <i>SE</i> | <i>p</i> |
|---|--------------|-------------|-------------|--|----------|-----------|----------|
| Sociability Wanting | | | | Sociability Liking | | | |
| Child age | .044 | .048 | .360 | Child age | .040 | .049 | .408 |
| Child sex | .024 | .105 | .821 | Child sex | .110 | .114 | .334 |
| Child Age × Sex | -.189 | .091 | .038 | Child Age × Sex | .001 | .083 | .986 |
| Parent gender | -.093 | .125 | .458 | Parent gender | -.095 | .133 | .477 |
| Admiration Wanting | | | | Admiration Liking | | | |
| Child age | .128 | .077 | .096 | Child age | .084 | .092 | .357 |
| Child sex | -.042 | .134 | .756 | Child sex | -.067 | .155 | .667 |
| Child Age × Sex | -.085 | .102 | .402 | Child Age × Sex | -.115 | .132 | .385 |
| Parent gender | .024 | .157 | .878 | Parent gender | -.089 | .172 | .605 |
| Prosocial Interactions and Compliance Wanting | | | | Prosocial Interactions and Compliance Liking | | | |
| Child age | .028 | .127 | .826 | Child age | .021 | .087 | .809 |
| Child sex | .121 | .175 | .490 | Child sex | .060 | .154 | .695 |
| Child Age × Sex | -.013 | .150 | .931 | Child Age × Sex | .038 | .122 | .754 |
| Parent gender | -.050 | .191 | .793 | Parent gender | -.072 | .175 | .680 |

Note. SRQ-EC = Social Reward Questionnaire–Early Childhood. Moderated nonlinear factor analysis estimating the effects of biological covariates on factor variances of SRQ-EC subscales. Effect of child sex was estimated by specifying females as the reference group, effect of parent gender was estimated by specifying women as the reference group. *B* = estimate; *SE* = standard error of the estimate; bold = covariate effects significant at $p \leq .05$.

Table 4
Internal Consistency and Test–Retest Reliability Coefficients

| SRQ-EC Subscale | ω | α | MIC | Test–Retest |
|---------------------------------------|----------|----------|-----|-------------|
| Wanting Model | | | | |
| Sociability | .90 | .88 | .60 | .84** |
| Admiration | .76 | .75 | .38 | .69** |
| Prosocial Interactions and Compliance | .82 | .80 | .46 | .85** |
| Liking Model | | | | |
| Sociability | .91 | .88 | .60 | .76** |
| Admiration | .86 | .82 | .49 | .66** |
| Prosocial Interactions and Compliance | .84 | .78 | .43 | .82** |

Note. SRQ-EC = Social Reward Questionnaire–Early Childhood; ω = coefficient omega; α = Cronbach's coefficient alpha; MIC = mean interitem correlation. Test–retest coefficients are Pearson correlation coefficients for SRQ-EC subscale scores between timepoints.

** $p < .001$.

A table summarizing all correlations between major study variables is provided in the [Supplemental Material](#).

Discussion

In this study, we developed and examined the validity of the 30-item SRQ-EC for use as a parent-report measure of early childhood social reward sensitivity. The scale was adapted from the Social Reward Questionnaire for adults (Foulkes et al., 2014) and adolescents (Foulkes et al., 2017). The SRQ-EC evaluates sensitivity for distinctly rewarding social contexts, captured by three subscales: Sociability (large group interactions), Admiration (praise and positive attention), and Prosocial Interactions and Compliance (kindness and rule following). Further, the SRQ-EC expands on previous measures as it contains two sets of items, separately evaluating social wanting and social liking. All SRQ-EC items were invariant to child age and sex, which suggests that the SRQ-EC evaluates social reward sensitivity similarly across ages and between sexes. A single Sociability Liking item was shown to be noninvariant to gender of the reporting parent, such that parents identifying as men reported higher scores, however, parent gender did not have an effect on the latent mean or variance of any SRQ-EC factors. SRQ-EC subscale scores had high internal consistency coefficients, and subscale scores were reliable over 2 weeks. Evidence in support of construct validity was additionally established by observing expected associations between SRQ-EC subscales and assessments of early social behavior and personality. The SRQ-EC may be useful for adapting future measures to investigate atypical early social development, which was explored here by examining relations between SRQ-EC subscale scores and autistic-like traits in typically developing children.

Item adaptation for the SRQ-EC was based on items in the SRQ (Foulkes et al., 2014) and SRQ-A (Foulkes et al., 2017), but the current results suggest that a simpler three-factor model best represents both social wanting and liking in early childhood. In adults, factor analysis indicated a six-factor model of social liking, related to enjoyment of admiration, passivity, prosocial interactions, negative social potency, sexual relationships and sociability (Foulkes et al., 2014). In adolescents (11–16-year-olds), five factors were identified which mirrored those observed in adults without the subscale assessing enjoyment of sexual relationships (Foulkes et al., 2017). In the present study of children aged 3–7, like in adults and adolescents, Sociability (enjoyment of large groups) and Admiration (praise and positive attention) emerged as

distinct factors. Unique to our early childhood assessment, Prosocial Interactions and Passivity did not emerge as distinct factors and were represented together. Items on this third factor were related to trying not to hurt others, taking turns, and following rules which are manifestations of early prosocial behavior (Laible & Karahuta, 2014) and compliance (Stephenson & Hanley, 2010); therefore, this subscale was named Prosocial Interactions and Compliance. One possible reason for the lack of distinction is that passivity items which survived factor analysis were related to following rules. In younger children, following rules could more closely resemble motivation to be prosocial by upholding order or enjoyment of behaving responsibly, rather than desire to be passive. In other words, in early childhood, following rules or directions from others may be a bigger part of demonstrating prosocial behavior than at later ages, and therefore, the two constructs (being prosocial and being passive/compliant) overlap and merge in early childhood. The other difference in SRQ-EC factor structure as compared to previous assessments is lack of Negative Social Potency subscale, and therefore, the SRQ-EC cannot evaluate social reward sensitivity for intentionally cruel or manipulative behaviors. Negative Social Potency items were excluded prior to factor analysis during cognitive interviews because parents reported doubt that preschool children were capable of intentional cruelty or manipulation, or doubt that parents could objectively rate such behaviors in their own children.

Validity arguments that SRQ-EC subscales are assessing social reward sensitivity in children were supported by evaluating associations between subscale scores and additional measures of social disinterest and personality. First, as expected, social disinterest had a negative association with all SRQ-EC subscales, where children with increased social disinterest showed lower social wanting and liking across reward types. Sociability Wanting and Liking had the strongest negative relation with Unsociability, which was expected as unsociable children have a lower preference for peer play and make fewer social relationships (Coplan et al., 2004). SRQ-EC subscale scores were additionally examined for relations with personality. Sociability Wanting and Liking had the strongest association with Extraversion, which describes characteristics like being outgoing, friendly, and strong-willed (Digman, 1990). Prosocial Interactions and Compliance Wanting and Liking showed the strongest relation with Agreeableness, which includes traits like being altruistic and caring (Digman, 1990), aligning with the expectation that these factors evaluate sensitivity for socially kind behavior. Prosocial Interactions and Compliance also strongly associated with Conscientiousness, occasionally termed responsibility (Digman, 1990), which further supports that items intended to assess passivity may be more accurately capturing desire to follow rules or instructions. Similar to adults and adolescents (Foulkes et al., 2014, 2017), Admiration showed only small or moderate relations with additional measures of social behavior and personality.

The current findings indicate that social wanting and liking factors of the SRQ-EC represent at least partly distinct constructs. When considered within the same EFA model, wanting and liking items loaded together on their respective constructs but this model showed relatively poor fit. Due to relatively poor fit, and theoretical and empirical motivation, wanting and liking were then considered in separate factor models which showed acceptable fit across EFA and CFA steps. Across different analyses, we saw some evidence suggesting that the *Wanting and Liking Models* were differentially sensitive to demographic and cognitive variables. Prosocial Interactions and Compliance Wanting, but not Liking, had a highly

Table 5
Construct Validation

| Subscale | Social Reward Questionnaire–Early Childhood | | | |
|--|---|--------------------|---|--|
| | Sociability Wanting | Admiration Wanting | Prosocial Interactions and Compliance Wanting | Prosocial Interactions and Compliance Liking |
| Child Social Preference Scale | | | | |
| Unsociability | -.46 (–.54, –.37)* | –.34 (–.42, –.25)* | –.20 (–.30, –.11)* | –.17 (–.26, –.07)* |
| Inventory of Children's Individual Differences–Short | | | | |
| Extraversion | .50 (.43, .57)* | .33 (.23, .42)* | .13 (.03, .22)* | .18 (.08, .27)* |
| Agreeableness | .25 (.15, .32)* | .13 (.03, .22)* | .59 (.52, .65)* | .59 (.51, .65)* |
| Conscientiousness | .18 (.08, .27)* | .08 (–.03, .17) | .43 (.34, .51)* | .50 (.41, .57)* |
| Autism Spectrum Quotient–Child | | | | |
| Total score | –.50 (–.56, –.43)* | –.28 (–.36, –.18)* | –.31 (–.40, –.21)* | –.31 (–.40, –.21)* |

Note. Pearson correlation coefficients with 90% confidence intervals, calculated via bootstrapping with 1,000 samples. Bold: significant following correction for 30 comparisons ($p < .001$).
* significant at $p < .05$.

significant association with age. The lack of age effect when examining differential item functioning suggests that older children show greater levels of wanting for Prosocial Interactions and Compliance, but not greater liking, which is not driven by bias for individual items. Further, when considering relations with other traits, Admiration Liking had a slightly stronger relation with autistic-like traits as compared to Admiration Wanting while Prosocial Interactions and Compliance Liking had a slightly stronger association with Conscientiousness compared to Prosocial Interactions and Compliance Wanting. However, we note slight overlap in the confidence intervals for the autistic-like traits and Conscientiousness correlations, therefore, these findings should be interpreted with caution. Taken together, these findings provide tentative evidence that the SRQ-EC is differentially sensitive to social reward wanting and liking. We note that a challenge for examining differential sensitivity of the SRQ-EC to wanting and liking is that measures used in the validation procedure were not developed to be sensitive to these different reward components. An alternative approach could be to examine relations between SRQ-EC subscale scores and behavioral or neuroimaging measures which have discriminative validity for wanting and liking. In addition to challenges with evaluating discriminative sensitivity of wanting versus liking subscales, it should also be recognized that wanting and liking items did not emerge as unique when considered within the same EFA. Therefore, while the performed construct validation analyses suggest that both the wanting and liking subscales are assessing children's sensitivity to social rewards, future work employing this measure should be cautious in interpreting results which compare children on wanting and liking until appropriate discriminative validity is further supported with appropriate measures.

The SRQ-EC could be used to assess children with neurodevelopmental disabilities, particularly if altered socialization is present in the clinical phenotype as is the case for autism (American Psychiatric Association, 2013). As a preliminary assessment of utility for investigating clinical conditions, we examined SRQ-EC subscale scores for associations with autistic-like traits assessed by the AQ-Child. We observed that greater autistic-like traits associated with lower social reward sensitivity across all domains. This aligns with work in non-autistic adults, where greater autistic-like traits associated with lower social liking for sociability, prosocial interactions, and admiration (Foulkes et al., 2015). In addition, like findings in adults, subscales showed differential relations with autistic-like traits such that a strong association was observed with Sociability and a moderate association was observed with Admiration. However, it is important to note that our sample was composed of children without an autism diagnosis as reported by parents. Researchers are cautioned against generalizing findings from nonautistic samples to autism (Sasson & Bottema-Beutel, 2021). Therefore, conclusions regarding relations between early social reward and autism phenomenology should be reserved until appropriateness of the SRQ-EC for use in clinical populations is examined and investigations are performed in an autistic sample.

Limitations and Constraints on Generality

While overall this study suggests that SRQ-EC subscale scores were able to assesses social wanting and liking during early childhood, a few limitations should be considered. While an assessment of construct validity was examined based on data that was equally representative of male and female children and we report invariance across child sexes, another important source of bias is gender of the reporting parent. During

item adaptation (cognitive interviews), the sample was composed only of woman-identifying parents, therefore, a qualitative assessment of gender-based variations in item interpretation was not conducted. This is important to consider in future work, as studies suggest maternal and paternal differences in other social judgements of children including social competence (Renk & Phares, 2007). Indeed, we observed item noninvariance for one Sociability Liking item where the item intercept was significantly associated with gender of the reporting parent, such that parents who identified as men rated this item more highly than parents who identified as women. Though the influence of parent gender did not ultimately have an influence on estimates of the latent mean and variance of Sociability Liking in children, the identification of noninvariance suggests that parent gender should be considered as a potential confounding variable in future studies using the SRQ-EC. Our sample also had a notable lack of ethnic diversity and was regionally restricted to Canada, the United States, and the United Kingdom; therefore, it is important for construct validity of SRQ-EC subscale scores to be examined in ethnically and regionally diverse populations.

Another limitation of this study is that it relied exclusively on parent-report assessment. While parent-report is an essential method for collecting data from very young children, motivation for and enjoyment of rewarding stimuli is highly internal and could be difficult to objectively rate. While online collection methods were effective for collecting high volumes of data needed for factor analyses, future work could further assess validity of SRQ-EC subscale scores by examining associations with behavioral or neuroimaging measures. Combining questionnaire data with behavioral or neuroimaging tasks has been suggested as a valuable direction for assessing complex behaviors like executive function (Kenworthy et al., 2009); and this could extend to investigations of social reward.

While associations reported here suggest that the SRQ-EC may be provide insight into clinical features seen in autism, we note several limitations which must be considered prior to use of this tool in clinical research. The item adaptation process modified items which were previously used to represent latent social rewards in neurotypical adults and adolescents. In this study, we did not attempt to generate new items to specifically assess how types of socially rewarding contexts may vary across clinical groups including, but not limited to, autism spectrum disorder. Further, during cognitive interviews, we did not sample a broad range of caregivers to children with diverse clinical conditions. Without incorporating feedback from a diverse set of parents to neurodiverse children in the item adaptation phase, the items adapted here were not intended to specifically sensitive to different manifestations of social reward sensitivity across disorders. Further, applying the SRQ-EC to clinical populations would assume that the factor structure of social reward sensitivity is similar between neurotypical and neurodiverse populations. In this study, we did not include a neurodiverse sample in the factor analysis process and could not test whether the factor structure was invariant between diagnostic groups. Therefore, while the SRQ-EC can capture social reward sensitivity in neurotypical children it should not be considered comprehensive, and it is scores reliable or interpretations valid for use in clinical samples, until future work is conducted within those populations of interest.

Conclusions

We developed the SRQ-EC, a questionnaire for assessing social wanting and liking in early childhood (3–7 years). Using factor

analysis, we identified that there are three partly distinct types of social reward in early childhood: Sociability (large group interactions), Admiration (praise and positive attention), and Prosocial Interactions and Compliance (kindness and following rules). Notably, a three-factor structure is simpler than the factor structures reported in adolescents (Foulkes et al., 2017) and adults (Foulkes et al., 2014). We found preliminary evidence that the SRQ-EC is differentially sensitive to wanting and liking aspects of reward, but this requires further validation. Construct validity of SRQ-EC subscale scores was supported by identifying unique associations with measures of social behavior and personality. SRQ-EC subscale scores additionally showed relations to autistic-like features in a nonautistic sample, which highlights potential utility for adapting this measure for use in clinical populations after appropriate validation studies are conducted. In sum, we present evidence which supports that SRQ-EC subscale scores can be used to examine social reward sensitivity in early childhood.

References

- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.).
- Aust, F., Diedenhofen, B., Ullrich, S., & Musch, J. (2013). Seriousness checks are useful to improve data validity in online research. *Behavior Research Methods*, 45, 527–535. <https://doi.org/10.3758/s13428-012-0265-2>
- Auyeung, B., Baron-Cohen, S., Wheelwright, S., & Allison, C. (2008). The autism spectrum quotient: Children's version (AQ-Child). *Journal of Autism and Developmental Disorders*, 38, 1230–1240. <https://doi.org/10.1007/s10803-007-0504-z>
- Bartlett, M. S. (1951). The effect of standardization on a χ^2 approximation in factor analysis. *Biometrika*, 38(3–4), 337–344. <https://doi.org/10.1093/biomet/38.3-4.337>
- Bauer, D. J., & Hussong, A. M. (2009). Psychometric approaches for developing commensurate measures across independent studies: Traditional and new models. *Psychological Methods*, 14(2), 101–125. <https://doi.org/10.1037/a0015583>
- Bentler, P. M., & Chou, C.-P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, 16(1), 78–117. <https://doi.org/10.1177/0049124187016001004>
- Berridge, K. C., & Robinson, T. E. (1998). What is the role of dopamine in reward: Hedonic impact, reward learning, or incentive salience? *Brain Research Reviews*, 28(3), 309–369. [https://doi.org/10.1016/S0165-0173\(98\)00019-8](https://doi.org/10.1016/S0165-0173(98)00019-8)
- Boeije, H., & Willis, G. (2013). The Cognitive Interviewing Reporting Framework (CIRF): Towards the harmonization of cognitive testing reports. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, 9(3), 87–95. <https://doi.org/10.1027/1614-2241/a000075>
- Clements, C. C., Zoltowski, A. R., Yankowitz, L. D., Yerys, B. E., Schultz, R. T., & Herrington, J. D. (2018). Evaluation of the social motivation hypothesis of autism: A systematic review and meta-analysis. *JAMA Psychiatry*, 75(8), 797–808. <https://doi.org/10.1001/jama.psychiatry.2018.1100>
- Coplan, R. J., Prakash, K., O'Neil, K., & Armer, M. (2004). Do you “want” to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Developmental Psychology*, 40(2), 244–258. <https://doi.org/10.1037/0012-1649.40.2.244>
- Curran, P. J., McGinley, J. S., Bauer, D. J., Hussong, A. M., Burns, A., Chassin, L., Sher, K., & Zucker, R. (2014). A moderated nonlinear factor model for the development of commensurate measures in integrative data analysis. *Multivariate Behavioral Research*, 49(3), 214–231. <https://doi.org/10.1080/00273171.2014.889594>

- Deal, J. E., Halverson, C. F., Jr., Martin, R. P., Victor, J., & Baker, S. (2007). The Inventory of Children's Individual Differences: Development and validation of a short version. *Journal of Personality Assessment*, 89(2), 162–166. <https://doi.org/10.1080/00223890701468550>
- Demurie, E., Roeyers, H., Baeyens, D., & Sonuga-Barke, E. (2012). The effects of monetary and social rewards on task performance in children and adolescents: Liking is not enough. *International Journal of Methods in Psychiatric Research*, 21(4), 301–310. <https://doi.org/10.1002/mpr.1370>
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41(1), 417–440. <https://doi.org/10.1146/annurev.ps.41.020190.002221>
- Elvemo, N. A., Landrø, N. I., Borchgrevink, P. C., & Håberg, A. K. (2015). Reward responsiveness in patients with chronic pain. *European Journal of Pain*, 19(10), 1537–1543. <https://doi.org/10.1002/ejp.687>
- Foulkes, L., Bird, G., Gökçen, E., McCrory, E., & Viding, E. (2015). Common and distinct impacts of autistic traits and alexithymia on social reward. *PLOS ONE*, 10(4), Article e0121018. <https://doi.org/10.1371/journal.pone.0121018>
- Foulkes, L., & Blakemore, S.-J. (2016). Is there heightened sensitivity to social reward in adolescence? *Current Opinion in Neurobiology*, 40, 81–85. <https://doi.org/10.1016/j.conb.2016.06.016>
- Foulkes, L., Neumann, C. S., Roberts, R., McCrory, E., & Viding, E. (2017). Social Reward Questionnaire-Adolescent Version and its association with callous-unemotional traits. *Royal Society Open Science*, 4, Article 160991. <https://doi.org/10.1098/rsos.160991>
- Foulkes, L., Viding, E., McCrory, E., & Neumann, C. S. (2014). Social Reward Questionnaire (SRQ): Development and validation. *Frontiers in Psychology*, 5, Article 201. <https://doi.org/10.3389/fpsyg.2014.00201>
- Guttman, L. (1954). Some necessary conditions for common-factor analysis. *Psychometrika*, 19(2), 149–161. <https://doi.org/10.1007/BF02289162>
- Hay, D. F., & Pawlby, S. (2003). Prosocial development in relation to children's and mothers' psychological problems. *Child Development*, 74(5), 1314–1327. <https://doi.org/10.1111/1467-8624.00609>
- Hobbs, M., Remington, B., & Glautier, S. (2005). Dissociation of wanting and liking for alcohol in humans: A test of the incentive-sensitisation theory. *Psychopharmacology*, 178, 493–499. <https://doi.org/10.1007/s00213-004-2026-0>
- Holgado-Tello, F. P., Chacón-Moscoso, S., Barbero-García, I., & Vila-Abad, E. (2010). Polychoric versus Pearson correlations in exploratory and confirmatory factor analysis of ordinal variables. *Quality & Quantity: International Journal of Methodology*, 44(1), 153–166. <https://doi.org/10.1007/s11335-008-9190-y>
- Holleman, G. A., Hooge, I. T. C., Kemner, C., & Hessels, R. S. (2020). The 'real-world approach' and its problems: A critique of the term ecological validity. *Frontiers in Psychology*, 11, Article 721. <https://doi.org/10.3389/fpsyg.2020.00721>
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179–185. <https://doi.org/10.1007/BF02289447>
- Jiang, T., Soussignan, R., Carrier, E., & Royet, J.-P. (2019). Dysfunction of the mesolimbic circuit to food odors in women with anorexia and bulimia nervosa: A fMRI study. *Frontiers in Human Neuroscience*, 13, Article 117. <https://doi.org/10.3389/fnhum.2019.00117>
- Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., & Rosseel, Y. (2022). *semTools: Useful tools for structural equation modeling*. R package version 0.5-6. <https://CRAN.R-project.org/package=semTools>
- Kaiser, H. F. (1961). A note on Guttman's lower bound for the number of common factors. *British Journal of Statistical Psychology*, 14(1), 1–2. <https://doi.org/10.1111/j.2044-8317.1961.tb00061.x>
- Kaiser, H. F. (1970). A second generation Little Jiffy. *Psychometrika*, 35(4), 401–415. <https://doi.org/10.1007/BF02291817>
- Kaiser, H. F., & Rice, J. (1974). Little Jiffy, Mark IV. *Educational and Psychological Measurement*, 34(1), 111–117. <https://doi.org/10.1177/001316447403400115>
- Kawamichi, H., Sugawara, S. K., Hamano, Y. H., Makita, K., Kochiyama, T., & Sadato, N. (2016). Increased frequency of social interaction is associated with enjoyment enhancement and reward system activation. *Scientific Reports*, 6(1), Article 24561. <https://doi.org/10.1038/srep24561>
- Kenworthy, L., Black, D. O., Harrison, B., della Rosa, A., & Wallace, G. L. (2009). Are executive control functions related to autism symptoms in high-functioning children? *Child Neuropsychology*, 15(5), 425–440. <https://doi.org/10.1080/09297040802646983>
- Laible, D., & Karahuta, E. (2014). Chapter: Prosocial behaviors in early childhood: Helping others, responding to the distress of others, and working with others. In L. M. Padilla-Walker & G. Carlo (Eds.), *Prosocial development: A multidimensional approach* (pp. 350–373). Oxford University Press. <https://doi.org/10.1093/acprof:so/9780199964772.003.00170>
- Muthén, L. K., & Muthén, B. O. (2017). *MPlus user's guide* (8th ed.).
- Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, 45(4), 867–872. <https://doi.org/10.1016/j.jesp.2009.03.009>
- Peer, E., Brandimarte, L., Samat, S., & Acquisti, A. (2017). Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. *Journal of Experimental Social Psychology*, 70, 153–163. <https://doi.org/10.1016/j.jesp.2017.01.006>
- R Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.
- Rademacher, L., Krach, S., Kohls, G., Irmak, A., Gründer, G., & Spreckelmeyer, K. N. (2010). Dissociation of neural networks for anticipation and consumption of monetary and social rewards. *NeuroImage*, 49(4), 3276–3285. <https://doi.org/10.1016/j.neuroimage.2009.10.089>
- Renk, K., & Phares, V. (2007). Maternal and paternal perceptions of social competence in children and adolescents. *Journal of Child and Family Studies*, 16(1), 98–112. <https://doi.org/10.1007/s10826-006-9071-8>
- Revelle, W. (2020). *psych: Procedures for personality and psychological research (2.1.3)*. <https://cran.r-project.org/package=psych>
- Sasson, N. J., & Bottema-Beutel, K. (2021). Studies of autistic traits in the general population are not studies of autism. *Autism*, 26(4), 1007–1008. <https://doi.org/10.1177/13623613211058515>
- Schneider, B. H., Atkinson, L., & Tardif, C. (2001). Child-parent attachment and children's peer relations: A quantitative review. *Developmental Psychology*, 37(1), 86–100. <https://doi.org/10.1037/0012-1649.37.1.86>
- Stephenson, K. M., & Hanley, G. P. (2010). Preschoolers' compliance with simple instructions: A descriptive and experimental evaluation. *Journal of Applied Behavior Analysis*, 43(2), 229–247. <https://doi.org/10.1901/jaba.2010.43-229>
- Sumiya, M., Koike, T., Okazaki, S., Kitada, R., & Sadato, N. (2017). Brain networks of social action-outcome contingency: The role of the ventral striatum in integrating signals from the sensory cortex and medial prefrontal cortex. *Neuroscience Research*, 123, 43–54. <https://doi.org/10.1016/j.neures.2017.04.015>
- Thompson, B., & Daniel, L. G. (1996). Factor analytic evidence for the construct validity of scores: A historical overview and some guidelines. *Educational and Psychological Measurement*, 56(2), 197–208. <https://doi.org/10.1177/0013164496056002001>
- van Hoorn, J., van Dijk, E., Meuwese, R., Rieffe, C., & Crone, E. A. (2016). Peer influence on prosocial behavior in adolescence. *Journal of Research on Adolescence*, 26(1), 90–100. <https://doi.org/10.1111/jora.12173>

- Vaughn, B. E., Santos, A. J., Monteiro, L., Shin, N., Daniel, J. R., Krzysik, L., & Pinto, A. (2016). Social engagement and adaptive functioning during early childhood: Identifying and distinguishing among subgroups differing with regard to social engagement. *Developmental Psychology*, 52(9), 1422–1434. <https://doi.org/10.1037/dev0000142>
- West, S. G., Taylor, A. B., & Wu, W. (2012). Model fit and model selection in structural equation modeling. In R. H. Hoyle (Ed.), *Handbook of structural equation modeling* (pp. 209–231). The Guilford Press.
- Willis, G. B. (2005). Planning and conducting cognitive interviews. In L. C. Shaw, J. Parnell, & D. Breti (Eds.), *Cognitive interviewing* (pp. 136–150). Sage Publications. <https://doi.org/10.4135/9781412983655.n10>

Received May 13, 2022

Revision received August 29, 2022

Accepted October 6, 2022 ■

Members of Underrepresented Groups: Reviewers for Journal Manuscripts Wanted

If you are interested in reviewing manuscripts for APA journals, the APA Publications and Communications Board would like to invite your participation. Manuscript reviewers are vital to the publications process. As a reviewer, you would gain valuable experience in publishing. The P&C Board is particularly interested in encouraging members of underrepresented groups to participate more in this process.

If you are interested in reviewing manuscripts, please write APA Journals at Reviewers@apa.org. Please note the following important points:

- To be selected as a reviewer, you must have published articles in peer-reviewed journals. The experience of publishing provides a reviewer with the basis for preparing a thorough, objective review.
- To be selected, it is critical to be a regular reader of the five to six empirical journals that are most central to the area or journal for which you would like to review. Current knowledge of recently published research provides a reviewer with the knowledge base to evaluate a new submission within the context of existing research.
- To select the appropriate reviewers for each manuscript, the editor needs detailed information. Please include with your letter your vita. In the letter, please identify which APA journal(s) you are interested in, and describe your area of expertise. Be as specific as possible. For example, “social psychology” is not sufficient—you would need to specify “social cognition” or “attitude change” as well.
- Reviewing a manuscript takes time (1–4 hours per manuscript reviewed). If you are selected to review a manuscript, be prepared to invest the necessary time to evaluate the manuscript thoroughly.

APA now has an online video course that provides guidance in reviewing manuscripts. To learn more about the course and to access the video, visit <http://www.apa.org/pubs/journals/resources/review-manuscript-ce-video.aspx>.