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Regular Article

Developmental antecedents of social anhedonia: The roles of early temperament and sex

Emma E. Mumper[1], Megan C. Finsaas[1], Brandon L. Goldstein[2], Diane C. Gooding[3] and Daniel N. Klein[1]

[1]Department of Psychology, Stony Brook University, Stony Brook, NY, USA; [2]Department of Psychiatry, University of Connecticut School of Medicine, Farmington, CT, USA and [3]Department of Psychology, University of Wisconsin–Madison, Madison, WI, USA

Abstract

Social anhedonia is well established as a transdiagnostic factor, but little is known about its development. This study examined whether temperament and parenting in early childhood predict social anhedonia in early adolescence. We also explored whether the relationships between early predictors and social anhedonia are moderated by a child's sex. A community sample of children participated in laboratory observations of temperament and parenting practices at age 3 ($n = 275$). The participants returned at age 12 and completed the Anticipatory and Consummatory Interpersonal Pleasure Scale–Child Version (ACIPS-C). Our results indicated that, at age 3, lower observed sociability predicted higher levels of social anhedonia at age 12. These associations were moderated by child sex, such that males with diminished sociability reported greater social anhedonia. These findings indicate that predictors of early adolescent social anhedonia are evident as early as 3 years of age. However, these effects were evident only for males, suggesting that the pathways to social anhedonia in early adolescence differ as a function of sex.

Keywords: parenting, social anhedonia, temperament, youth

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From birth, humans have a propensity for social relationships and a need for interpersonal attachment that shapes development and drives behaviors across the lifespan (Baumeister & Leary, 1995). Feelings of pleasure and satisfaction from human connection reinforce the motivation to develop and maintain relationships and contribute to physical and psychological health (Chu, Saucier, & Hafner, 2010; Thoits, 2011). However, there are individual differences in the experience of social reward, with individuals at the lower end of the spectrum experiencing social anhedonia, or diminished pleasure when interacting with other people (Chapman, Chapman, & Raulin, 1976).

Social anhedonia overlaps with a number of constructs in the literature such as introversion, low sociability, social withdrawal, shyness, and social anxiety (Brown, Silvia, Myin-Germeys, & Kwapil, 2007; Coplan & Armer, 2007; Martin, Cicero, Bailey, Karcher, & Kerns, 2016), but it is uniquely distinguished by diminished pleasure from social contact. Introversion is a much broader concept that encompasses a number of facets including low positive affect, assertiveness, activity, and excitement-seeking as well as diminished sociability (Watson, Stasik, Ellickson-Larew, & Stanton, 2015). Low sociability and social withdrawal are heterogeneous constructs that can include both social anhedonia and shyness/social anxiety (Coplan & Armer, 2007). Shy and socially anxious individuals avoid social interactions, but they actually desire social contact. Their avoidance is driven by negative affect and discomfort rather than a lack of positive affect and enjoyment (Brown et al., 2007).

Although the term "anhedonia" originated with the French psychoanalyst Ribot (1986), the earliest theoretical models of anhedonia can be traced to Rado (1953, 1962) and Meehl (1962, 1989). In these early models, anhedonia was conceptualized as a diminution or reduction in the ability to experience pleasure from typically pleasurable sources and/or stimuli (Meehl, 1962). In contrast, some models of anhedonia (Ho & Sommers, 2013) regard anhedonia as a decrease in hedonic experience from previously pleasurable activities. Typically, depression researchers and those who are more interested in the state-related nature of anhedonia focus on the latter conceptualization.

There are several ways by which to operationally define anhedonia. It may be defined in terms of the hedonic domain that is affected, such as the physical domain (i.e., physical anhedonia) versus the social domain (i.e., social anhedonia), or it may be defined in terms of the chronology of the affective experience (e.g., a deficit in appetitive versus consummatory pleasure). Typically, clinicians and researchers use self-report as the primary means of assessing anhedonia, either through self-report scales or symptom-based interviews (see Fonseca-Pedrero et al., 2014 for a discussion of interview and self-report measures of anhedonia). In addition, functional-magnetic-resonance-imaging reward paradigms have been used to assess anhedonia (see Forbes & Dahl 2012).

Author for Correspondence: Emma E. Mumper, Department of Psychology, Stony Brook University, 100 Nicolls Road, Stony Brook, NY 11794; E-mail: emma.mumper@stonybrook.edu.

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Although anhedonia in general is included in the DSM-5 (APA, 2013) criteria for depression, social anhedonia in particular is important to investigate for several reasons. First, social anhedonia has been observed in many mental health disorders, such as bipolar disorder, autism spectrum disorders, anorexia nervosa, bulimia nervosa, and posttraumatic stress disorder, so it can be regarded as being a transdiagnostic symptom (Barkus & Badcock, 2019; Bedwell et al., 2014). Relatedly, social anhedonia is a risk factor for a variety of later mental health problems. For example, youth at familial risk for depression display blunted neural response to social rewards (Olino et al., 2015), suggesting that social anhedonia may have an etiological role in the development of depression. Moreover, longitudinal studies of birth cohorts (Miettunen et al., 2011), army conscripts (Davidson et al., 1999), and college undergraduates (Gooding et al., 2005, 2007; Kwapil, 1998) have reported that elevated levels of social anhedonia predict the later development of schizophrenia and schizophrenia spectrum disorders. Finally, social anhedonia is associated with increased depression severity and poorer treatment response in clinical samples of depressed youth and adults (Barkus & Badcock, 2019; Hasler et al., 2004; McMakin et al., 2012; Pelizza & Ferrari, 2009) and with lower health-related quality of life in individuals with schizophrenia and/or schizoaffective disorders (Ritsner et al., 2011, 2018).

Prior research has examined individual difference (i.e., temperament; Kiel & Buss, 2011; Sanson, Hemphill, & Smart, 2004) and environmental (i.e., parenting; Coplan, Arbeau, & Armer, 2008; Kiel & Buss, 2011) antecedents of constructs that overlap with social anhedonia (e.g., shyness and social withdrawal). However, little is known about factors that influence the development of social anhedonia itself. Social withdrawal and, more specifically, social disinterest are evident as early as the preschool years (Coplan & Armer, 2007). Similar to adults with social anhedonia, socially disinterested children prefer solitary play but are not averse to peer interactions and do not show high negative emotionality (Coplan & Armer, 2007). Empirical evidence for a distinguishable subgroup of socially withdrawn children who are motivated by low interest in social interactions raises the possibility that there may be early antecedents of social anhedonia. Unfortunately, prior research has not examined early individual differences or antecedents, as social anhedonia has been studied almost exclusively in adults and typically in individuals at risk for psychosis.

Research with young adults has revealed associations between social anhedonia and particular personality dimensions and environmental factors. Examinations of the relationship between the Big Five personality traits and social anhedonia have yielded inverse associations with the higher order traits of extraversion (Gooding, Padrutt, & Pflum, 2017; Ross, Lutz, & Bailley, 2002; Silvia & Kwapil, 2011), agreeableness (Gooding, Padrutt, et al., 2017; Silvia & Kwapil, 2011), conscientiousness (Gooding, Padrutt, et al., 2017), and openness (Gooding, Padrutt, et al., 2017; Ross et al., 2002). Studies of lower order personality traits indicate that social anhedonia is negatively related to positive affectivity, sociability/gregariousness, and activity/excitement seeking (Gooding, Padrutt, et al., 2017; Ross et al., 2002; Silvia & Kwapil, 2011). Links with neuroticism and related lower order personality traits are inconsistent, with some studies finding positive associations (Gooding, Padrutt, et al., 2017; Ross et al., 2002) and others finding no relationship with social anhedonia (Silvia & Kwapil, 2011). Importantly, in several studies, personality correlates of social anhedonia varied as a function of sex (Gooding, Padrutt, et al., 2017; Ross et al., 2002; Silvia & Kwapil, 2011). Although these studies were all cross-sectional and conducted with adult samples, they raised the possibility that early-emerging personality traits (i.e., temperament), particularly those that are related to low extraversion, may be early antecedents of social anhedonia. In addition, they raised the question of whether this association is moderated by sex.

Studies of adults that focus on interpersonal relationships suggest that social anhedonia is associated with lower perceived availability and diminished quality of social support (Horan, Brown, & Blanchard, 2007). Moreover, socially anhedonic individuals perceive their families as being less supportive and helpful as well as having greater conflict than do nonanhedonic individuals (Blanchard et al., 2009). However, the social environment of individuals with social anhedonia has been primarily studied by using cross-sectional designs and self-report measures, which raises questions about reporting biases and the direction of the associations.

Although previous research has focused on adults, a large body of literature suggests the benefits of parental involvement with children in the development of motivation for social relationships (El Nokali, Bachman, & Votruba-Drzal, 2010; Zhou et al., 2002). According to social learning theory, early interactions with a supportive parent teach the child that social exchanges are pleasurable and rewarding while modeling how to engage appropriately with others (O'Connor, Woolgar, Humayun, Briskman, & Scott, 2018). Thus, the child is motivated to seek out social interactions and engage in interpersonal relationships. Additionally, warm and responsive parenting leads to secure attachment, influencing internal working models that guide cognitions, feelings, and behaviors in future relationships (Ainsworth, Blehar, Waters, & Wall, 2015; Cassidy & Shaver, 2002). Children with supportive and responsive caregiving are likely to form positive expectations for future relationships, whereas children with insecure attachment may develop negative expectations, leading to later difficulties in and avoidance of social relationships (Bowlby, 1982). Importantly, children who live in homes with high levels of conflict and aggression or a lack of warmth and nurturance initiate fewer social interactions and report more problematic and less supportive social relationships across their lifespan (see Repetti, Taylor, & Seeman, 2002 for a review). In contrast, warm and sensitive parenting predicts better social outcomes for children (Booth-LaForce & Oxford, 2008; Kochanska, Forman, & Coy, 1999). However, we are not aware of any longitudinal studies that have examined parenting, particularly in childhood, with respect to predicting later social anhedonia.

While research has started to identify correlates of social anhedonia, some limitations are notable. First, most prior studies have measured personality and environmental characteristics and social anhedonia concurrently, precluding the development of an understanding of the temporal relationship between variables. To our knowledge, no studies have examined early antecedents of social anhedonia. Second, prior work that has examined the relationship of personality and environmental variables with social anhedonia has focused on college-aged and adult samples. Early adolescence is an especially important period to examine, given the increasing salience of peer relationships and their role in social and neural development (Albert, Chein, & Steinberg, 2013; Crone & Dahl, 2012). Moreover, as this is just before the risk period for schizophrenia and depression, a more comprehensive understanding of social anhedonia at this time could help elucidate the etiologies of these disorders and provide clues for early intervention (Gooding, Padrutt, et al., 2017).

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To expand on past findings, the present study examined whether temperament and parenting in early childhood (age 3) predicted social anhedonia in early adolescence (age 12). Observational measures were used to assess child temperament and parenting. Consistent with the cross-sectional literature that was summarized above, we hypothesized that social anhedonia in early adolescence would be predicted by low levels of positively valenced traits, such as temperamental exuberance and sociability, and differences in parenting. Due to prior findings of biological sex differences in social anhedonia in adults (Gooding & Pflum, 2014a; Gooding, Pflum, Fonseca-Pedero, & Paino 2016; Gooding, Chan, Zhou, Li, & Cheung, 2017), we hypothesized that males would report greater social anhedonia. In addition, in light of evidence that associations between social anhedonia and personality differ as a function of biological sex (Gooding, Padrutt, et al., 2017; Ross et al., 2002), we examined whether sex moderated the associations with the predictors.

Method

Participants

The participants were part of a larger longitudinal study that recruited parents of age-3 children from a commercial mailing list (Klein & Finsaas, 2017). At the initial assessment, the sample consisted of 559 3-year-old children who had no significant medical or developmental disabilities and lived with at least one English-speaking biological parent.

The sample for this paper consisted of 275 participants (49.8% male) who completed a measure of social anhedonia that was added midway through the data collection at the age-12 wave. From this sample, 234 had full assessments of temperament and parenting at age 3 (see Table 1).

At the initial assessment, the children ranged from 2.93 to 4.18 ($M = 3.5$; $SD = 0.3$) years of age. At the age-12 wave, their ages ranged from 11.50 to 13.92 ($M = 12.5$; $SD = 0.4$) years (Table 1). Of the sample with data on social anhedonia, 16.7% were Hispanic, 85.5% were Caucasian, 10.5% were African American, 2.9% were Asian American, 0.4% were Native American, and 0.7% identified race as "Other." At the age-12 wave, 28.4% of the mothers and 27.3% of the fathers had completed a bachelor's degree, 25.5% and 10.9%, respectively, had completed a master's degree, 1.5% and 3.3%, respectively, had attained a doctoral degree (e.g., PhD, MD, DDS, or JD), and 0.4% and 1.5%, respectively, did not report education. Total household income was reported as less than $20,000 (2.2%), $20,000–$59,000 (12.0%), $60,000–$99,000 (22.9%), and more than $100,000 (55.2%); 7.6% did not report income. Participants who were offered and completed the measure of social anhedonia (94.2%) were slightly but significantly younger at the age-12 wave than those who did not ($M = 12.5$, $SD = 0.44$ and $M = 13.0$, $SD = 0.74$, respectively, $t(16.70) = -3.03$, $p < .01$; $d = 0.90$). A Levene test indicated unequal variance for age at 12, $F = 23.16$, $p < .001$, so degrees of freedom were adjusted.

Procedure

At the initial (age 3) assessment, the child completed an observational measure of temperament and, together with one parent, an observational measure of parenting. At age 12, the participants completed another wave of assessments. Approximately midway through this wave, a measure of social anhedonia was added to the battery. The parents provided written informed consent and the children provided verbal assent. All of the study procedures were approved by the Stony Brook University Institutional Review Board. The families were financially compensated for their participation at each assessment.

Measures

Child Temperament

At age 3, child temperament-relevant emotional expressions and behavior were assessed by using the Laboratory Temperament Assessment Battery (Lab-TAB; Gagne, Van Hulle, Aksan, Essex, & Goldsmith, 2011; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995). Each child participated in a 2-hr observational assessment that included 12 standardized episodes that were selected to elicit a range of emotional responses and behaviors. A detailed description of each episode and the procedure is presented in Dyson et al. (2012). Each episode was video recorded and coded at a later date.

Every display of facial, bodily, and vocal affect (positive affect, fear, sadness, anger) in each episode was rated by using a 3-point scale (low, moderate, high) and summed separately for each channel (facial, bodily, and vocal) prior to being standardized and summed across channels to calculate total scores for each domain. All of the other variables, with the exception of behavioral inhibition and inhibitory control, were rated on a 4-, 5-, or 10-point scale once per episode and summed across episodes.

Three episodes were used to assess behavioral inhibition at age 3 (*Risk Room*, *Stranger Approach*, and *Exploring New Objects)*. The coders rated specific behaviors, such as latency to touch objects, tentative play, gaze aversion, latency to vocalize, and approach and avoidance in response to strangers on a 3- or 4-point scale for each 20- to 30-s epoch within an episode. A maximum intensity rating of facial, bodily, and vocal fear was also coded within each epoch. Behavioral inhibition was computed as the average of standardized ratings within epochs across the three episodes.

The coding system for inhibitory control was adapted from Carlson (2005) and involved tallying the number of times that a child failed to wait their turn during two episodes: *Tower of Patience* and *Snack Delay*. To calculate inhibitory control, the standardized scores were added across the two episodes. The Lab-TAB scales had adequate consistency and interrater reliability (see Dyson et al., 2015, for coefficient alphas and interrater ICCs).

To reduce the number of temperament variables, a principal component analysis was conducted. Prior to inclusion in the principal component analysis, variables with significant skew and kurtosis were transformed. The results for the principal component analysis were previously reported (see Dougherty et al., 2011), and five components were extracted at age 3 from an inspection of the scree plots and the eigenvalue > 1.0 rule. Regression-weighted scores were derived for each child to yield five scales: Sociability, Exuberance, Dysphoria, Fear, and Disinhibition.

Parenting Behavior

At the age-3 assessment, interactions between the child and one biological parent (93.2% mothers) were assessed by using a modified version of the Teaching Tasks Battery (Egeland et al., 1995). The battery included six standardized tasks that were designed to elicit parenting behaviors including hostility (parent's expression of anger, annoyance, frustration, or rejection of the child), intrusiveness (parent's failure to respect the child as an individual or

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Table 1. Participant characteristics by sex

		Full Sample	Males	Females
	n	% (*n*) or Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Sex (Male)	275	49.8% (137)	–	–
Race/Ethnicity (Caucasian/Non-Hispanic)	275	72.7% (200)	–	–
Age-3 Wave				
Age	239	3.47 (0.25)	3.45 (0.24)	3.50 (0.26)
Sociability	237	−0.03 (0.98)	−0.13 (1.01)	0.07 (0.95)
Dysphoria	237	−0.09 (0.81)	−0.11 (0.82)	−0.08 (0.81)
Fear	237	−0.09(1.04)	−0.20 (1.09)	0.02 (0.98)
Exuberance	237	−0.17 (1.01)	−0.22 (1.02)	−0.13 (1.01)
Disinhibition	237	1.78 (0.89)	2.04 (0.95)	1.52 (0.76)
Adaptive Parenting	236	0.00 (2.56)	−0.06 (2.66)	0.06 (2.46)
Maladaptive Parenting	236	0.00 (1.64)	0.21 (1.77)	−0.20 (1.48)
Age-12 Wave				
Age	275	12.47 (0.44)	12.46 (0.43)	12.47 (0.44)
Social Anhedonia	275	24.33 (7.40)	26.65 (8.57)	22.03 (5.10)

interference with the child's needs, interests, or behaviors), support (parent's expression of positive regard or emotional support), confidence (degree to which the parent believes he or she can successfully work with the child), and quality of instruction (parent's ability to structure the situation so that the child can understand and successfully complete the task). Trained coders rated videotapes of each episode on a 5-point scale with the exception of confidence, which was rated on a 3-point scale. The ratings of parenting behaviors had adequate internal consistency and interrater reliability (see Kujawa, Proudfit, Laptook, & Klein, 2015, for interrater intraclass coefficients). An adaptive parenting composite score was completed by combining the standardized scores on support, confidence, and quality of instruction ($\alpha = .82$), and a maladaptive parenting composite score was completed by combining the standardized scores on hostility and intrusiveness ($\alpha = .53$).

Social Anhedonia

At age 12, the children completed the Anticipatory and Consummatory Interpersonal Pleasure Scale–Child Version (ACIPS-C), a self-report measure for children and younger adolescents that was adapted from the ACIPS (Gooding & Pflum, 2014a, 2014b) and older adolescents (Gooding et al., 2016; Gooding, Chan, et al., 2017). The ACIPS-C contains 17 items for assessing individual differences in one's ability to enjoy social interactions. Examinations of the ACIPS-C factor structure by prior studies did not reveal clear distinctions between the anticipatory and consummatory items on the scale (Gooding & Pflum, 2014b). Therefore, all of the items were considered together. The content of the items includes enjoyment of social activities ("I enjoy talking with my friends and schoolmates"), close social ties ("When something happens to me, there are people I am close to who I can tell"), social cognitions ("I like it when I think of fun things for me and my friends to do together"), anticipatory excitement regarding peer contact ("I look forward to doing fun things with my friends"), and hypothetical questions regarding interest in social activities ("If I heard of a group or club where other kids had similar interests as me, I would be interested in joining it"). Each item was scored by using a 4-point Likert-type scale ranging from 1 (*totally false for me*) to 4 (*totally true for me*). The items were reverse scored such that total scores ranged from 17 to 61, with higher scores indicating greater levels of social anhedonia. In the present sample, the mean score was 24.3 ($SD = 7.40$). Gooding and Pflum (2014a) demonstrated convergent validity of the ACIPS-C with several other measures of anhedonia including the Chapman Revised Social Anhedonia Scale (Eckblad et al., 1982) and the Temporal Experience of Pleasure Scale (Gard et al., 2006), and they found divergent validity with measures of dissimilar constructs including the Magical Ideation Scale and Perceptual Aberration Scale (Eckblad & Chapman, 1983; Chapman et al., 1978, respectively). The coefficient alpha (.92) and coefficient omega, $\omega = .95$, 95% CI [.92, .97], of the ACIPS-C showed high internal consistency. One child who exhibited an inconsistent pattern of responses on the ACIPS-C was removed. Three cases with high values that appeared to be valid based on their patterns of responses and scores on the measures of related constructs were Winsorized to the next highest value on the ACIPS-C to reduce the effect of outliers. An inverse transformation was applied to correct for variable skew and kurtosis, and the responses were multiplied by -100 to bring values above±1 and to correct the distribution direction to be consistent with the original scale.

Data Analysis

Bivariate correlations between child biological sex, race/ethnicity, income, temperament, parenting, and social anhedonia were computed. Point-biserial correlations were used to assess the associations between the dichotomized and continuous variables. Temperament (sociability, exuberance, dysphoria, fear, and disinhibition) and parenting (adaptive and maladaptive composites) were further analyzed by using hierarchical linear regression

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Table 2. Correlations for temperament, parenting, social anhedonia, and demographic variables

Variables	1	2	3	4	5	6	7	8	9	10
1. Social Anhedonia										
2. Sex	0.34**									
3. Race/Ethnicity	0.02	0.08								
4. Income	−0.13*	−0.00	−0.23**							
5. Sociability	−0.14*	−0.10	0.04	−0.01						
6. Dysphoria	0.02	−0.02	0.06	−0.07	0.06					
7. Fear	0.02	−0.10	0.03	−0.04	−0.30**	0.21**				
8. Exuberance	−0.08	−0.05	−0.08	−0.02	0.43**	−0.08	−0.18**			
9. Disinhibition	0.07	0.29**	0.10	−0.02	0.03	0.38**	0.01	−0.09		
10. Adaptive Parenting	−0.06	−0.02	−0.08	0.03	0.05	−0.14*	−0.06	0.11	−0.18**	
11. Maladaptive Parenting	−0.00	0.13	0.09	−0.03	−0.01	0.07	0.07	0.04	0.29**	−0.55**

Note: *p < .05. **p < .01.

models to examine the unique contributions of the variables and explore sex-specific effects. Income was included as a covariate due to a significant association with social anhedonia. The continuous variables were mean centered prior to construction of the interaction terms. The regression models examined temperament and parenting separately to elucidate domain-specific main and interaction effects with biological sex. Child sex and the temperament and parenting variables were entered with income in Step 1, and interactions of child sex with temperament and parenting were entered in Step 2. Significant interactions were probed by examining the simple slopes for males and females (Aiken, West, & Reno, 1991). The assumptions for ordinary least squares regression (multivariate normality, multicollinearity, and homoscedasticity) were satisfied.

Multiple Imputation Procedures

Multiple imputation and subsequent analyses were performed in MPlus (version 8.0) to handle missing data on the predictor variables by using Bayesian methods (Rubin, 1987; Schafer, 1997). The data were imputed for children who had completed the measure of social anhedonia (n = 275). The rates for the imputed values ranged from 14.2% for the measures of parenting to 13.8% for the observations of temperament. At least one variable was imputed for 21.5% (n = 59) of cases.

Auxiliary variables were included in the imputation process to recapture information in the variables for which values were imputed and thereby reduce the risk of bias (Enders, 2010). Race, ethnicity, and age at the initial measurement point (age 3) and adolescent wave (age 12) were included as auxiliary variables. Missing data were imputed for 50 datasets (Enders, Baraldi, & Cham, 2014). The imputation was performed within subgroups that were defined by sex (Enders, 2017). In Mplus, the Gelman–Rubin (Gelman & Rubin, 1992) convergence criterion is used to determine the convergence of the Bayesian estimate. The default value in Mplus is 0.05, but in the current study a stricter value of 0.01 was used.

The continuous variables were mean centered within each imputed dataset and the subgroup data sets were merged. The product term was then calculated by multiplying sex and the imputed predictor value. Hierarchical linear regression models were estimated separately on each imputed dataset, and the parameter estimates were pooled by averaging the parameters from each of these models. Standard errors were computed by using the average of the standard errors and the between-imputation parameter estimate variance (Schafer, 1997).

Results

Descriptive Statistics

The descriptive data and correlations between the variables are presented in Tables 1 and 2. Male sex, income, and lower observed sociability at age 3 predicted greater social anhedonia at age 12. At age 3, males showed more disinhibition than females during observations of temperament (M = 2.03, SD = 0.95 and M = 1.52, SD =0.76, respectively), t (221.55) = -4.61, p < .001, d = 0.60, and males reported greater social anhedonia at age 12 than females did (M = -4.06, SD = 1.01 and M = -4.72, SD = 0.83, respectively), t (262.79) = 5.87, p < .001, d = 0.71. A Levene test indicated unequal variance for disinhibition at age 3, F = 6.11, p = .01, and social anhedonia at age 12, F = 9.00, p = .003, so degrees of freedom were adjusted. There were no significant sex differences for sociability, dysphoria, fear, exuberance, or parenting.

Temperament

Next, we conducted a hierarchical multiple regression analysis to examine the unique effects of sex and age-3 temperament on age-12 social anhedonia (Table 3). When sex, income, and temperamental sociability, exuberance, dysphoria, fear, and disinhibition were entered simultaneously in step 1, only the associations of sex and income with social anhedonia were significant. However, this was qualified in step 2 by a significant interaction of sex with sociability (Figure 1). Males with low sociability reported greater social anhedonia in early adolescence, B = -0.26, t (262) = -2.62, p = .009. In contrast, among females sociability was not associated with later social anhedonia,

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Table 3. Regression model with sex and age-3 temperament predicting social anhedonia at age 12

Predictors	R^2	*B*	*SE*	*t*	*p*
Step 1	0.15**				
Sex		0.64	0.12	5.39	<.001**
Income		−0.06	0.03	−2.28	.02*
Sociability		−0.09	0.07	−1.32	.19
Dysphoria		0.03	0.08	0.35	.73
Fear		−0.00	0.06	−0.02	.98
Exuberance		−0.03	0.07	−0.40	.69
Disinhibition		−0.03	0.08	−0.35	.73
Step 2	0.18**				
Sex		0.65	0.12	5.50	<.001**
Income		−0.06	0.03	−2.26	.02*
Sociability		0.07	0.10	0.75	.45
Dysphoria		0.10	0.11	0.86	.39
Fear		−0.04	0.09	−0.51	.61
Exuberance		−0.03	0.09	−0.34	.74
Disinhibition		−0.08	0.12	−0.67	.51
Sociability × Sex		−0.33	0.14	−2.40	.02*
Dysphoria × Sex		-0.14	0.17	−0.84	.40
Fear × Sex		0.05	0.12	0.40	.69
Exuberance × Sex		0.02	0.13	0.15	.88
Disinhibition × Sex		0.09	0.16	0.58	.56

Note: *p < .05. **p < .01.

$B = 0.07$, t (262) = 0.75, $p = .45$. No other interactions with sex were significant.

Parenting

A similar hierarchical multiple regression analysis was computed to examine the unique effects of child sex and parenting on age-12 social anhedonia (Table 4). When child sex, adaptive parenting, and maladaptive parenting were entered simultaneously in step 1, sex and income were significantly associated with social anhedonia. No main effects of parenting or interactions with sex were significant ($p > .05$).

Discussion

Despite ample research that implicates social anhedonia as a transdiagnostic symptom with ties to schizophrenia spectrum disorders and depression (Blanchard, Horan, & Brown, 2001), little is known about its development. Prior studies have almost exclusively used cross-sectional designs, and the participants were typically college-aged or adults. We examined temperament and parenting during early childhood and biological sex as predictors of social anhedonia that was measured in early adolescence. Bivariate analyses revealed that social anhedonia, as measured by the ACIPS-C at age 12, was predicted by lower levels of observed temperamental sociability at age 3. In addition, males reported greater social anhedonia during adolescence than females did. However, observed parenting was not associated with later social anhedonia.

Next, hierarchical regressions were used to examine any unique effects and explore whether the associations for temperament and parenting differed as a function of sex. We found that sex moderated the effects of age-3 sociability on subsequent social anhedonia. Specifically, males that were low in observed sociability at age 3 reported heightened levels of social anhedonia during early adolescence, but there were no effects for females. Additionally, parenting by sex interactions were not significant.

Our finding of a significant inverse relationship between social anhedonia and observed sociability in children is consistent with (and extends) previous findings of significant associations of social anhedonia with self-reported low extraversion in adults (Gooding, Padrutt, et al., 2017). Children with low sociability may engage in fewer exchanges and have fewer positive interpersonal experiences, reducing the desire for future social interactions. Diminished social engagement may also interfere with the development of social skills, decreasing the likelihood of positive social experiences in the future and further reducing motivation to interact with others. Alternatively, given the phenotypic similarities between temperamental sociability and social anhedonia, low sociability during early childhood may represent the early manifestation of social anhedonia. The present study extended previous research by examining personality correlates longitudinally from early childhood, while prior investigators have used cross-sectional designs with adults (Gooding, Padrutt, et al., 2017; Kwapil et al., 2009; Ross et al., 2002; Silvia & Kwapil, 2011). Our study also extends earlier research in that we identified personality antecedents by using observational measures that were independent of self-perception and self-report.

Previous studies suggest that socially anhedonic adults report perceptions of low familial social support (Blanchard et al., 2009; Horan et al., 2007). However, we are not aware of any longitudinal studies that have examined whether parenting, particularly in childhood, predicts later social anhedonia. In the present study, we did not find evidence that lower adaptive or greater maladaptive parenting in early childhood predicted social anhedonia in early adolescence.

Our finding that males report greater social anhedonia during early adolescence replicates similar findings in late adolescence and adulthood (Chan et al., 2012; Gooding et al., 2016; Gooding, Padrutt, et al., 2017) and extends prior work by indicating the emergence of sex differences earlier in development. This finding contrasts with a prior study that suggested that sex differences in anhedonia do not appear until age 16.5 (Bennik, Nederhof, Ormel, & Oldehinkel, 2014). However, Bennik et al. studied anhedonia in general, whereas the present study examined social anhedonia specifically.

Importantly, we observed sex-specific associations of temperament with social anhedonia. These effects may be influenced by developmental differences in the valuation of relationships during early adolescence. Adolescent girls report greater salience of social goals; express a greater desire for close friendships; and worry more about relationship losses, loneliness, and peer evaluation than adolescent males do (Henrich, Blatt, Kuperminc, Zohar, & Leadbeater, 2001; Rose & Rudolph, 2006; Rudolph & Conley, 2005). Concerns about lack of social connection and peer evaluation in early adolescence may override females' socially anhedonic tendencies and prompt social approach behaviors, resulting in rewarding interactions. In contrast, males may continue to exhibit behavior that is consistent with early temperamental propensities.

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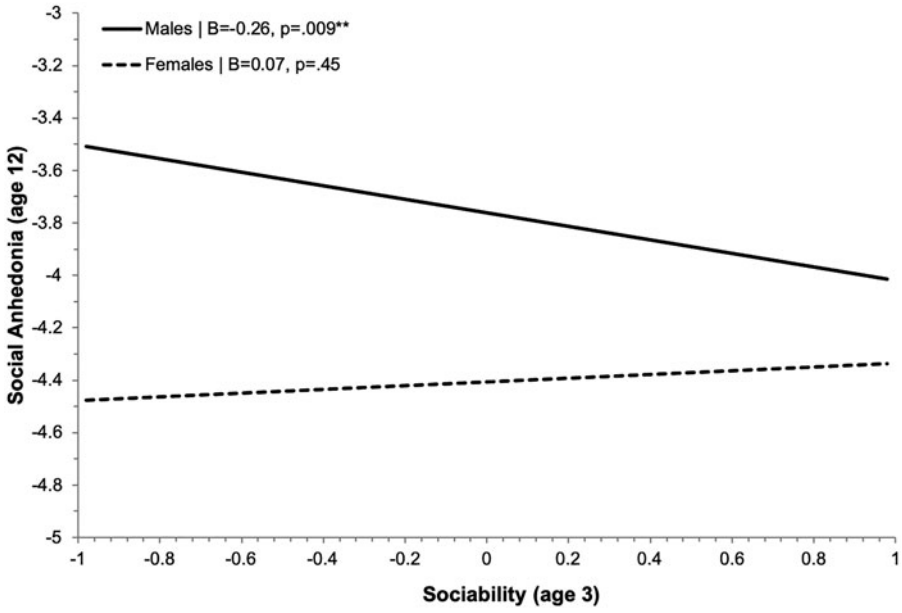

Figure 1. Interaction of age 3 Lab-TAB sociability and sex predicting age 12 social anhedonia (n = 275). Males with low sociability reported greater social anhedonia in early adolescence (B = −0.26, t (262) = −2.62, p = .009). The relationships of sociability with later social anhedonia were not significant for females (B = 0.07, t (262) = 0.75, p = .45). An inverse transformation was applied to the social anhedonia scale and values were multiplied by −100.

Table 4. Regression model with sex and age-3 parenting predicting social anhedonia at age 12

Predictors	R^2	B	SE	t	p
Step 1	.14**				
Sex		0.68	0.11	6.08	<.001**
Income		−0.06	0.03	−2.34	.02*
Adaptive Parenting		−0.04	0.03	−1.44	.15
Maladaptive Parenting		−0.07	0.04	−1.63	.10
Step 2	.14**				
Sex		0.67	0.11	6.06	<.001**
Income		−0.06	0.03	−2.31	.02*
Adaptive Parenting		−0.02	0.03	−0.69	.49
Maladaptive Parenting		−0.04	0.03	−1.06	.29
Adaptive Parenting × Sex		−0.04	0.03	−1.06	.29
Maladaptive Parenting × Sex		−0.05	0.06	−0.88	.38

Note: *p < .05. **p < .01.

However, future studies regarding sex differences in the trajectory of social anhedonia across adolescence and into adulthood are needed to clarify our findings.

The current study had several methodological strengths, including the use of a large sample and longitudinal design, which allowed us to examine the effects of child temperament and parenting during early childhood on the development of social anhedonia in early adolescence. Furthermore, we used observational measures of temperament and parenting, which are less susceptible to reporting biases and shared method variance than are self- and parent-reported data. Finally, the present study examined social anhedonia during early adolescence, a period of rapid growth in social development that has not received much attention in anhedonia research. This is a significant gap, as vulnerabilities during this period may set the stage for the increase in onsets of later emotional and psychotic disorders.

However, the current findings should be interpreted in the context of some limitations. First our sample is relatively homogeneous, with predominantly White and middle-class families. Although this mirrors the demographic characteristics of the area (see Bufferd, Dougherty, Carlson, & Klein, 2011), early etiological factors for social anhedonia should be examined in more diverse samples. Second, we observed temperament and parenting in a single setting, which precludes an assessment of traits and practices in other contexts or on other occasions. Third, we used a self-report measure of social anhedonia, which could have introduced error if the participants were unable to assess themselves accurately. Fourth, the present analyses contained notable amounts of missing data at age 3, in part because some participants did not enter the study until a subsequent wave. However, multiple imputation was used to minimize the effects of missing data. Fifth, we did not include measures of socially desirable or infrequent responding, so it is possible that some participants with invalid data were included. Finally, the assessment of social anhedonia at a single point in early adolescence cannot address the question of whether associations with temperament precede, follow, or are contemporaneous with changes in social anhedonia. Similarly, we cannot distinguish whether early childhood low sociability plays a causal role in the development of later social anhedonia or reflects continuity in temperamental social disinterest across development. Moreover, as prior research suggests that anhedonia decreases across adolescence before stabilizing (Bennik et al., 2014), further work is needed to determine whether the predictors and moderating effect of sex that we identified continue to be associated with social anhedonia in older adolescents and adults.

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References

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. N. (2015). *Patterns of attachment: A psychological study of the strange situation*. UK: Psychology Press.

Albert, D., Chein, J., & Steinberg, L. (2013). The teenage brain: Peer influences on adolescent decision making. *Current Directions in Psychological Science*, *22*, 114–120.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Barkus, E., & Badcock, J. C. (2019). A transdiagnostic perspective on social anhedonia. *Frontiers in Psychiatry*, *10*, Article 216. Retrieved from https://dx.doi.org/10.3389%2Ffpsyt.2019.00216

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497–529.

Bedwell, J. S., Gooding, D. C., Chan, C. C., and Trachik, B. J. (2014). Anhedonia in the age of RDoC. *Schizophrenia Research*, *160*, 226–227.

Bennik, E. C., Nederhof, E., Ormel, J., & Oldehinkel, A. J. (2014). Anhedonia and depressed mood in adolescence: Course, stability, and reciprocal relation in the TRAILS study. *European Child & Adolescent Psychiatry*, *23*, 579–586.

Blanchard, J. J., Collins, L. M., Aghevli, M., Leung, W. W., & Cohen, A. S. (2009). Social anhedonia and schizotypy in a community sample: The Maryland Longitudinal Study of Schizotypy. *Schizophrenia Bulletin*, *37*, 587–602.

Blanchard, J. L., Horan, W. P., & Brown, S. A. (2001). Diagnostic differences in social anhedonia: A longitudinal study of schizophrenia and major depressive disorder. *Journal of Abnormal Psychology*, *110*, 363–371.

Booth-LaForce, C., & Oxford, M. L. (2008). Trajectories of social withdrawal from grades 1 to 6: Prediction from early parenting, attachment, and temperament. *Developmental Psychology*, *44*, 1298–1313.

Bowlby, J. (1982). Attachment and loss: Retrospect and prospect. *American Journal of Orthopsychiatry*, *52*, 664–678.

Brown, L. H., Silvia, P. J., Myin-Germeys, I., & Kwapil, T. R. (2007). When the need to belong goes wrong: The expression of social anhedonia and social anxiety in daily life. *Psychological Science*, *18*, 778–782.

Bufferd, S. J., Dougherty, L. R., Carlson, G. A., & Klein, D. N. (2011). Parent-reported mental health in preschoolers: Findings using a diagnostic interview. *Comprehensive Psychiatry*, *52*, 359–369.

Carlson, S. M. (2005). Developmentally sensitive measures of executive function in preschool children. *Developmental Neuropsychology*, *28*, 595–616.

Cassidy, J., & Shaver, P. R. (Eds.). (2002). *Handbook of attachment: Theory, research, and clinical applications*. New York: Guilford.

Chan, R. C., Wang, Y., Yan, C., Zhao, Q., McGrath, J., Hsi, X., & Stone, W. S. (2012). A study of trait anhedonia in non-clinical Chinese samples: Evidence from the Chapman scales for physical and social anhedonia. *PLOS ONE*, *7*, e34275.

Chapman, L. J., Chapman, J. P., & Raulin, M. L. (1976). Scales for physical and social anhedonia. *Journal of Abnormal Psychology*, *85*, 374–382.

Chapman, L. J., Chapman, J. P., Raulin, M. L. (1978). Body image aberration in schizophrenia. *Journal of Abnormal Psychology*, *87*, 399–407.

Chu, P. S., Saucier, D. A., & Hafner, E. (2010). Meta-analysis of the relationships between social support and well-being in children and adolescents. *Journal of Social and Clinical Psychology*, *29*, 624–645.

Coplan, R. J., Arbeau, K. A., & Armer, M. (2008). Don't fret, be supportive! Maternal characteristics linking child shyness to psychosocial and school adjustment in kindergarten. *Journal of Abnormal Child Psychology*, *36*, 359–371.

Coplan, R. J., & Armer, M. (2007). A "multitude" of solitude: A closer look at social withdrawal and nonsocial play in early childhood. *Child Development Perspectives*, *1*, 26–32.

Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social–affective engagement and goal flexibility. *Nature Reviews Neuroscience*, *13*, 636–650.

Davidson, M., Reichenberg, A., Rabinowitz, J., Weiser, M., Kaplan, Z., & Mark, M. (1999). Behavioral and intellectual markers for schizophrenia in apparently healthy male adolescents. *American Journal of Psychiatry*, *156*, 1328–1335.

Dougherty, L. R., Bufferd, S. J., Carlson, G. A., Dyson, M., Olino, T. M., Durbin, C. E., & Klein, D. N. (2011). Preschoolers' observed temperament and psychiatric disorders assessed with a parent diagnostic interview. *Journal of Clinical Child & Adolescent Psychology*, *40*, 295–306.

Dyson, M. W., Olino, T. M., Durbin, C. E., Goldsmith, H. H., Bufferd, S. J., Miller, A. R., & Klein, D. N. (2015). The structural and rank-order stability of temperament in young children based on a laboratory-observational measure. *Psychological Assessment*, *27*, 1388–1401.

Dyson, M.W., Olino, T. M., Durbin, C. E., Goldsmith, H. H., & Klein, D. N. (2012). The structure of temperament in preschoolers: A two-stage factor analytic approach. *Emotion*, *12*, 44–57.

Eckblad, M., & Chapman, L. J. (1983). Magical ideation as an indicator of schizotypy. *Journal of Consulting and Clinical Psychology*, *51*(2), 215–225.

Eckblad, M. L., Chapman, L. J., Chapman, J. P., & Mishlove, M. (1982). *The Revised Social Anhedonia Scale*. Unpublished manuscript, University of Wisconsin–Madison.

Egeland, B., Weinfield, N., Hiester, M., Lawrence, C., Pierce, S., Chippendale, K., & Powell, J. (1995). *Teaching tasks administration and scoring manual*. Unpublished manuscript, University of Minnesota.

El Nokali, N. E., Bachman, H. J., & Votruba-Drzal, E. (2010). Parent involvement and children's academic and social development in elementary school. *Child Development*, *81*, 988–1005.

Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford.

Enders, C. K. (2017). Multiple imputation as a flexible tool for missing data handling in clinical research. *Behaviour Research and Therapy*, *98*, 4–18.

Enders, C. K., Baraldi, A. N., & Cham, H. (2014). Estimating interaction effects with incomplete predictor variables. *Psychological Methods*, *19*, 39–55.

Fonseca-Pedrero, E., Gooding, D. C., Paino, M., Lemos-Giráldez, S., & Muñiz, J. (2014). Measuring anhedonia in schizophrenia-spectrum disorders: A selective update. In M. Ritsner (Ed.), *Anhedonia: A comprehensive handbook Volume II* (pp. 19–54). Dordrecht, The Netherlands: Springer.

Forbes, E. E., & Dahl, R. E. (2012). Research review: Altered reward function in adolescent depression: What, when and how? *Journal of Child Psychology and Psychiatry*, *53*, 3–15.

Gagne, J. R., Van Hulle, C. A., Aksan, N., Essex, M. J., & Goldsmith, H. H. (2011). Deriving childhood temperament measures from emotion-eliciting behavioral episodes: Scale construction and initial validation. *Psychological Assessment*, *23*, 337–353.

Gard, D. E., Gard, M. G., Kring, A. M., & John, O. P. (2006). Anticipatory and consummatory components of the experience of pleasure: A scale development study. *Journal of Research in Personality*, *40*, 1086–1102.

Gelman, A., & Rubin, D. B. (1992). Inference from iterative simulation using multiple sequences. *Statistical Science*, *7*, 457–472.

Goldsmith, H. H., Reilly, J., Lemery, K. S., Longley, S., & Prescott, A. (1995). Laboratory temperament assessment battery: Preschool version. Unpublished manuscript, University of Texas Arlington, Department of Psychology.

Gooding, D. C., Chan, R. C., Zhou, H. Y., Li, Z., & Cheung, E. F. (2017). The indirect assessment of social anhedonia in Chinese adolescents: Preliminary findings. *Psychiatry Research*, *257*, 418–423.

Gooding, D. C., Padrutt, E. R., & Pflum, M. J. (2017). The predictive value of the NEO-FFI items: Parsing the nature of social anhedonia using the Revised Social Anhedonia Scale and the ACIPS. *Frontiers in Psychology*, *8*, Article 147. Retrieved from https://www.frontiersin.org/articles/10.3389/fpsyg.2017.00147/full

Gooding, D. C., & Pflum, M. J. (2014a). Further validation of the ACIPS as a measure of social hedonic response. *Psychiatry Research*, *215*, 771–777.

Gooding, D. C., & Pflum, M. J. (2014b). The assessment of interpersonal pleasure: Introduction of the Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS) and preliminary findings. *Psychiatry Research*, *215*, 237–243.

Gooding, D. C., Pflum, M. J., Fonseca-Pedero, E., & Paino, M. (2016). Assessing social anhedonia in adolescence: The ACIPS-A in a community sample. *European Psychiatry*, *37*, 49–55.

Gooding, D. C., Tallent, K. A., & Matts, C. W. (2005). Clinical status of at-risk individuals 5 years later: Further validation of the psychometric high-risk strategy. *Journal of Abnormal Psychology*, *114*, 170–175.

Gooding, D. C., Tallent, K. A., & Matts, C. W. (2007). Rates of avoidant, schizotypal, schizoid and paranoid personality disorders in psychometric high-risk groups at five year follow-up. *Schizophrenia Research*, *94*, 373–374.

Hasler, G., Drevets, W. C., Manji, H. K., & Charney, D. S. (2004). Discovering endophenotypes for major depression. *Neuropsychopharmacology*, *29*, 1765–1781.

Henrich, C. C., Blatt, S. J., Kuperminc, G. P., Zohar, A., & Leadbeater, B. J. (2001). Levels of interpersonal concerns and social functioning in early adolescent boys and girls. *Journal of Personality Assessment*, *76*, 48–67.

Ho, N., & Sommers, M. (2013). Anhedonia: A concept analysis. *Archives of Psychiatric Nursing*, *27*, 121–129.

Horan, W. P., Brown, S. A., & Blanchard, J. J. (2007). Social anhedonia and schizotypy: The contribution of individual differences in affective traits, stress, and coping. *Psychiatry Research*, *149*, 147–156.

Kiel, E. J., & Buss, K. A. (2011). Prospective relations among fearful temperament, protective parenting, and social withdrawal: The role of maternal accuracy in a moderated mediation framework. *Journal of Abnormal Child Psychology*, *39*, 953–966.

Klein, D. N., & Finsaas, M. C. (2017). The Stony Brook Temperament Study: Early antecedents and pathways to emotional disorders. *Child Development Perspectives*, *11*, 257–263.

Kochanska, G., Forman, D. R., & Coy, K. C. (1999). Implications of the mother–child relationship in infancy for socialization in the second year of life. *Infant Behavior and Development*, *22*, 249–265.

Kujawa, A., Proudfit, G. H., Laptook, R., & Klein, D. N. (2015). Early parenting moderates the association between parental depression and neural reactivity to rewards and losses in offspring. *Clinical Psychological Science*, *3*, 503–515.

Kwapil, T. R. (1998). Social anhedonia as a predictor of the development of schizophrenia-spectrum disorders. *Journal of Abnormal Psychology*, *107*, 558–565

Kwapil, T. R., Silvia, P. J., Myin-Germeys, I., Anderson, A. J., Coates, S. A., & Brown, L. H. (2009). The social world of the socially anhedonic: Exploring the daily ecology of asociality. *Journal of Research in Personality*, *43*, 103–106.

Martin, E. A., Cicero, D. C., Bailey, D. H., Karcher, N. R., & Kerns, J. G. (2016). Social anhedonia is not just extreme introversion: Empirical evidence of distinct constructs. *Journal of Personality Disorders*, *30*, 451–468.

McMakin, D. L., Olino, T. M., Porta, G., Dietz, L. J., Emslie, G., Clarke, G., … Shamseddeen, W. (2012). Anhedonia predicts poorer recovery among youth with selective serotonin reuptake inhibitor treatment–resistant depression. *Journal of the American Academy of Child & Adolescent Psychiatry*, *51*, 404–411.

Meehl, P. E. (1962). Schizotaxia, schizotypy, schizophrenia. *American Psychologist*, *17*, 827–838.

Meehl, P. E. (1989). Schizotaxia revisited. *Archives of General Psychiatry*, *46*, 935–944.

Miettunen, J., Veijola, J., Isohanni, M., Paunio, T., Freimer, N., Jääskeläinen, E., … & Joukamaa, M. (2011). Identifying schizophrenia and other psychoses with psychological scales in the general population. *The Journal of Nervous and Mental Disease*, *199*, 230–238.

O'Connor, T. G., Woolgar, M., Humayun, S., Briskman, J. A., & Scott, S. (2018). Early caregiving predicts attachment representations in adolescence: Findings from two longitudinal studies. *Journal of Child Psychology and Psychiatry*, *60*(9), 944–952.

Olino, T. M., Silk, J. S., Osterritter, C., & Forbes, E. E. (2015). Social reward in youth at risk for depression: A preliminary investigation of subjective and neural differences. *Journal of Child and Adolescent Psychopharmacology*, *25*, 711–721.

Pelizza, L., & Ferrari, A. (2009). Anhedonia in schizophrenia and major depression: State or trait? *Annals of General Psychiatry*, *8*, 1–9.

Rado, S. (1953). Dynamics and classification of disordered behavior. *American Journal of Psychiatry*, *110*, 406–416.

Rado, S. (1962). *Psychoanalysis of behavior: The collected papers of Sandor Rado* (Vol. *2*). New York: Grune and Stratton.

Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin*, *128*, 330–366

Ribot, J (1896). *La psychologie des sentiments*. English translation: 1897. London: W. Scott.

Ritsner, M. S., Arbitman, M., & Lisker, A. (2011). Anhedonia is an important factor of health-related quality-of-life deficit in schizophrenia and schizoaffective disorder. *The Journal of Nervous and Mental Disease*, *199*, 845–853.

Ritsner, M. S., Ratner, Y., Mendyk, N., & Gooding, D. C. (2018). The characterization of social anhedonia and its correlates in schizophrenia and schizoaffective patients. *Psychiatry Research*, *270*, 922–928.

Rose, A. J., & Rudolph, K. D. (2006). A review of sex differences in peer relationship processes: Potential trade-offs for the emotional and behavioral development of girls and boys. *Psychological Bulletin*, *132*, 98–131.

Ross, S. R., Lutz, C. J., & Bailley, S. E. (2002). Positive and negative symptoms of schizotypy and the five-factor model: A domain and facet level analysis. *Journal of Personality Assessment*, *79*, 53–72.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: John Wiley & Sons.

Rudolph, K. D., & Conley, C. S. (2005). The socioemotional costs and benefits of social-evaluative concerns: Do girls care too much? *Journal of Personality*, *73*, 115–138.

Sanson, A., Hemphill, S. A., & Smart, D. (2004). Connections between temperament and social development: A review. *Social Development*, *13*, 142–170.

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hall.

Silvia, P. J., & Kwapil, T. R. (2011). Aberrant asociality: How individual differences in social anhedonia illuminate the need to belong. *Journal of Personality*, *79*, 1315–1332.

Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, *52*, 145–161.

Watson, D., Stasik, S. M., Ellickson-Larew, S., & Stanton, K. (2015). Extraversion and psychopathology: A facet-level analysis. *Journal of Abnormal Psychology*, *124*, 432–445.

Zhou, Q., Eisenberg, N., Losoya, S. H., Fabes, R. A., Reiser, M., Guthrie, I. K., … Shepard, S. A. (2002). The relations of parental warmth and positive expressiveness to children's empathy-related responding and social functioning: A longitudinal study. *Child Development*, *73*, 893–915.