

AN INVESTIGATION OF SOCIAL SKILL AND SOCIAL COGNITION  
IN ADOLESCENTS AT GENETIC RISK FOR PSYCHOSIS

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Psychology (Clinical Psychology).

Chapel Hill  
2009

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## ABSTRACT

CLARE E. MARKS: An Investigation of Social Skill and Social Cognition  
in Adolescents at Genetic Risk for Psychosis  
(Under the direction of David Penn, PhD)

Adolescents at genetic high risk (GHR) for schizophrenia have shown social skill impairments and there is some evidence to suggest they have Theory of Mind (ToM) deficits; however no research has used a standardized behavioral measure to assess social functioning in this population nor evaluated ToM with a well-validated measure. The present study used a speech performance based task and a theoretically derived coding scheme to assess social functioning and the Eyes Test to assess ToM in 23 GHR adolescents and 31 non-psychiatric controls (NPCs). The GHR adolescents showed social skills impairments, but did not demonstrate ToM deficits. The results suggest that social skills may be a vulnerability marker for schizophrenia in GHR populations.

## DEDICATION

For my mother, Patricia Keane Marks.

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## AN INVESTIGATION OF SOCIAL SKILL AND SOCIAL COGNITION IN ADOLESCENTS AT GENETIC RISK FOR PSYCHOSIS

Adolescents with a first-degree relative with schizophrenia have shown social impairments and these social skill deficits are related to increased vulnerability for later disease onset (Tarbox & Pogue-Geile, 2008). Specifically, relative to non-psychiatric controls (NPCs), adolescents at genetic high risk (GHR) for schizophrenia have poorer peer relationships (Glatt, Stone, Farone, Seidman & Tsuang, 2006), fewer hobbies and interests (Dworkin, Lewis, Cornblatt & Erlenmeyer-Kimling, 1994), increased social isolation and withdrawal (Hodges, Byrne, Grant & Johnstone, 1999), and lower social adjustment (Glatt et al., 2006; Hans, Auerbach, Asarnow, Styr & Marcus, 2000). These findings indicate that impaired social functioning in GHR adolescents is a marker of disease vulnerability (Stone, Farone, Seidman, Olson & Tsuang, 2005).

Our current understanding of social functioning in GHR adolescents is based primarily on clinical interviews or participant self-reports (e.g., Dworkin et al., 1994; Hans et al., 2000). These measures are problematic in that responses to the questions may be confounded by social desirability. In addition, GHR adolescents may lack insight into their own subtle social skills deficits (Mueser & Bellack, 1998). Because of such concerns, Hans et al. (2000) argue for the need for objective measures of social behavior. Objective behavioral measures, such as speech performance tasks (e.g., giving an impromptu speech) have been shown to validly



measure social skills in adolescents with anxiety disorders (Inderbitzen-Nolan, Anderson & Johnson, 2007).

Indeed, objective performance-based measures have been used to examine social skills deficits in individuals with schizophrenia (for a review, see Mueser & Bellack, 1998), as well as those at clinical high risk for this disorder (i.e., those with prodromal symptoms; Pinkham, Penn, Perkins, Graham & Siegel, 2007). Performance-based measures have also been used to study social functioning retrospectively in children who later developed schizophrenia (Litter & Walker, 1993; Walker, Grimes, Davis & Smith, 1993) and prospectively in GHR adolescents, albeit sparingly (Schiffman et al., 2004b). Schiffman et al. (2004b) videotaped participants while they were eating lunch with another study participant. The results showed that children who later developed schizophrenia (all in the GHR group) were rated as less sociable (i.e., fewer smiles, less laughter, less frequent initiation of conversation, and fewer responses to the other participant) than children not at risk for schizophrenia.

Although promising, the findings from Schiffman et al. (2004b) are limited in two important ways. First, they examined a limited range of behavior. That is, Schiffman et al. only examined four aspects of social behavior and did not assess other behaviors found in the high-risk literature (e.g., social anxiety; Calkins, Curtis, Grove & Iacono, 2004). Second, the interaction was not standardized, therefore making it difficult to compare social behavior across participants. This suggests that a psychometrically sound means of assessing social behavior in GHR adolescents is still lacking in this field. The present study addressed these limitations and used a standardized assessment of social behavior, as well as a coding system that is theoretically grounded in behaviors thought to be associated with at-risk behavior (e.g., as manifest in individuals with schizotypal personality characteristics).

An additional way of understanding social functioning in GHR adolescents is to examine social cognition. Social cognition is of great interest in schizophrenia due to its consistent association with social functioning (Couture, Penn & Roberts, 2006). One component of social cognition, Theory of Mind (ToM), is the ability to infer another person's mental state and is critical to effective social functioning (Roncone et al., 2002). ToM guides behavior so that one can appropriately respond to how others are thinking or feeling. Thus, ToM facilitates social interactions and ToM deficits may lead to social withdrawal (Corcoran, 2001).

ToM impairments are well documented in individuals with schizophrenia (for reviews, see Brune, 2005 & Sprong, Schothorst, Vos, Hox & Van Engeland, 2007), but this area of research has received less attention in at-risk samples, particularly GHR adolescents (Sprong et al., 2007). The few studies that have been conducted using *adult* populations show conflicting results. Some have found no difference in ToM between GHR adults and controls (e.g., Irani et al., 2006; Kelemen, Keri, Must, Benedek & Janka, 2004), while others have found GHR adults are impaired relative to NPCs (e.g., Janssen, Krabbendam, Jolles & van Os, 2003; Marjoram et al., 2006; Wykes, Hamid & Wagstaff, 2001). Interestingly, although Irani et al. did not find group differences in ToM, they did find significant differences when analyzing a subgroup of relatives who scored high on the social-interpersonal factor of the Schizotypal Personality Questionnaire (SPQ). This is consistent with the literature documenting ToM deficits in adults high in schizotypal traits (e.g., Langdon & Coltheart, 2004; Meyer & Shean, 2006). Therefore, a failure to evaluate sub-groups of relatives (e.g., those who score high in schizotypy) may obscure the role of ToM as a vulnerability marker for schizophrenia.

In the only study that investigated ToM in GHR adolescents, Schiffman et al. (2004a) had pre-adolescents and young adolescents (ages eleven to thirteen) at GHR for schizophrenia complete the Feffer's Role-Taking Task (RTT), a measure of perspective taking. Those who later developed schizophrenia spectrum disorders performed worse on the FTT than those who did not later develop a schizophrenia spectrum disorder. This provides preliminary support for ToM as a vulnerability marker for schizophrenia, although the RTT is not a well-validated measure of ToM (particularly for psychotic disorders).

The primary purpose of the present study was to examine social skills and ToM in adolescents at GHR for schizophrenia. The present study adapted a videotaped speech challenge task similar to those implemented in the anxiety literature (e.g., Gramer & Saria, 2007; Inderbitzen-Nolan et al., 2007; Mauss, Wilhelm & Gross, 2003) to evaluate social functioning in GHR adolescents. The speech challenge task is appropriate for a GHR group in light of research showing that high-risk individuals report greater social anxiety than healthy controls (Calkins et al., 2004). Also, a speech performance task obviates the need for a research confederate who might have a differential impact on social behavior as a function of participant age. In addition, the Coding of Social Behavior Rating Manual was derived from the at-risk literature and created to extensively assess social behaviors in GHR adolescents. Since there is currently no theoretically informed rating manual of social behavior in adolescents at GHR, such a rating system may have good utility to the field.

The lack of research on ToM in GHR adolescents underscores the need to clarify its role as a marker of risk status. The proposed study used the Reading the Mind in the Eyes Test--Revised Version to assess ToM in GHR adolescents (Baron-Cohen, Wheelwright, Hill, Raste & Plumb, 2001a; Baron-Cohen, Wheelwright, Spong, Scahill & Lawson, 2001b). The

task requires participants to infer mental states based on photographs of the eye regions of faces and has been used in schizophrenia research (e.g., Bora, Sehitoglu, Aslier, Atabay & Veznedaroglu, 2007; Irani et al., 2006; Kelemen et al., 2004; Russell et al., 2000).

The first aim of the present study was to establish the reliability and the preliminary validity of the Coding of Social Behavior Rating Manual. To address this aim, we examined the inter-rater reliability, internal consistency, construct validity and the convergent validity of the rating manual. A second aim was to examine social skill and ToM in GHR adolescents. It was hypothesized that the GHR group would demonstrate impairments in both social skills and ToM compared to the NPC group. Finally, we explored whether participants high in schizotypal traits displayed ToM and social skills deficits relative to those low in schizotypal traits. It was hypothesized that those high in schizotypal traits would have ToM and social skill deficits relative to those low in schizotypal traits (consistent with Irani et al., 2006).

## Methods

### *Participants*

Twenty-three GHR adolescents were recruited from the University of North Carolina at Chapel Hill's (UNC) community referrals, the UNC inpatient unit, flyers in UNC hospitals and from other high risk studies conducted at UNC. Thirty-one NPCs were recruited through flyers in the community and mass emails to the UNC community. The participants were being recruited as part of the Mapping Cortical Circuit Maturation in High Risk Adolescents study at the Conte Center at UNC.

Males and females between the ages of 9 and 18 were eligible to participate. Inclusion criteria for the GHR adolescents included having a first-degree relative with a

psychotic disorder according to DSM-IV-TR criteria (American Psychiatric Association [APA], 2000) using the Family Interview for Genetic Studies (FIGS; Maxwell, 1996). The affected first-degree relatives' diagnoses were confirmed with the Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID-I; First, Gibbon, Spitzer & Williams, 2002). Study exclusion criteria for both the GHR and NPC groups included: Past or current DSM-IV-TR Axis I Psychotic Disorder or Bipolar Affective Disorder, as assessed with the Kiddie Schedule for Affective Disorders and Schizophrenia-Present and Lifetime Version (K-SADS-PL; Kauffman et al., 1997), diagnosis of a major central nervous system disorder (e.g., seizure disorder), impaired intellectual functioning (WAIS-III/WISC-III IQ < 65), current treatment with antipsychotics or a past history of more than 12 weeks lifetime cumulative treatment with an antipsychotic. The NPC group had the additional exclusion criteria of no first-degree relative with a psychotic disorder using DSM-IV-TR diagnostic criteria. Family history of psychosis in the NPC group was also assessed with the FIGS.

### *Measures*

*Social functioning measures.* Social functioning was assessed with a speech-challenge task, namely the “MTV task.” This is a test of social skills under socially anxious conditions. Participants are asked to perform a mock 45-second audition for a new reality show for the television network, MTV, and are instructed to demonstrate why they should be chosen for the show. If participants are not familiar with MTV or reality television, they are told that they can pretend that a local newspaper is writing an article about kids in the area and they have to give a speech as to why the paper should write an article about them. All participants were videotaped facing the camera, were not given a practice speech and were

minimally probed. If they had trouble completing the task, they were encouraged to give their best effort and to continue until 45 seconds had elapsed.

The speech-challenge task was coded with the Coding of Social Behavior Rating Manual (CSB; See Appendix A for the rating items on the CSB). The CSB was derived from the high-risk literature (e.g., Calkins et al., 2004; Docherty, Gordinier, Hall & Dombrowski, 2004; Kendler, McGuire, Gruenberg & Walsh, 1995) and was developed specifically for the MTV task. The manual comprises 16 items rated on a five point Likert scale (higher scores indicating better social skills). These items were constructed to yield four theoretically derived dimensions: Affect, Odd Behavior and Language, Communication, and Social-Interpersonal. There is also a summary item assessing the rater's overall impression of the participant. The theoretically derived factors were explored in the present study via factor analysis.

The CSB was primarily modeled after the Interpersonal Measure of Schizoidia and Schizotypy (IM-SS; Kosson et al., 1999). The IM-SS assesses schizophrenia-spectrum behaviors and was chosen as a referent measure due to the association between at risk status and schizotypal traits (Calkins et al., 2004; Kendler et al., 1995; Miller, 2002). However, the IM-SS was not used in the present study as it was developed for a standardized interaction during a semi-structured interview or a role-play lasting for a significant amount of time. Furthermore, the items on the CSB's Communication factor were not adapted from the IM-SS. These items were derived from the literature documenting communication deficits in GHR adults (e.g., vague and ambiguous speech; Docherty et al., 2004).

The speech-challenge task was videotaped and rated independently by three trained research assistants. The raters were blind to group status and trained to high levels of inter-rater reliability (i.e., ICCs > .80).

Social functioning was also assessed with the Global Assessment of Functioning—Social Functioning Scale (GAF-S; APA, 1994). In order to establish the convergent validity of the CSB, social skills ratings were correlated with ratings on the GAF-S. This scale yields a single global social functioning score between 0 and 10, with higher scores indicating better social functioning. Trained research clinicians determined the GAF-S score.

*Social cognition measure.* ToM was assessed with the Reading the Mind in the Eyes Test-- Revised Version (Eyes Test). A trained research assistant administered both the adult (Baron-Cohen et al., 2001a) and child's (Baron-Cohen et al., 2001b) versions of the Eyes Test. Participants under 16-years-old were administered the child's version, participants older than 16-years-old were administered the adult's version, and 16-year-olds were administered both versions. For those 16-year-olds that received both Eyes Test versions, the child version was administered before the adult version. The adult's version consists of 36 photographs and the child's version consists of 28 photographs. Participants are asked to guess the mental state (i.e., what the person is thinking or feeling) using the four choice words. In the child's version, the research assistant reads the word choices to the child (see Appendix B for stimuli on the child's version). In the adult's version, participants circle their answers (see Appendix C for stimuli on the adult's version). Participants are given a practice item to ensure that they understand the task. Each eye region is presented on a note card with the four choice mental states shown in the four corners of the card (one target word and three foil words). There is no time constraint in choosing the mental states. A glossary of the

mental states was made available for the adult's version, if the participants were unsure of the meaning of a word. Performance is measured by the number of faces correctly discriminated.

*Clinical measure.* The Structured Interview for Prodromal Syndromes (SIPS; McGlashan et al., 2003) was administered by research clinicians not blind to relative status. The SIPS is a semi-structured interview measuring the following: positive symptoms (four items), negative symptoms (six items), disorganized symptoms (four items), and general symptoms (four items). The severity of the symptoms are rated using the Scale of Prodromal Symptoms (SOPS). Each item is rated from 0 (*absent*) to 6 (*extreme/psychotic*), with higher scores indicating more prodromal symptoms. Many of the symptoms measured on the SIPS tap into schizotypal symptoms (e.g., unusual thought content, withdrawal, flat affect). Therefore, those items on the SIPS that overlap with the DSM-IV-TR schizotypal personality disorder criteria were used to assess schizotypic features in the present study. This is consistent with research that has used schizotypal traits to classify prodromal individuals (e.g., Yung, Phillips, Yuen & McGorry, 2004) and others who argue that schizotypal personality disorder is related to the schizophrenia prodrome (e.g., Seeber & Cadenhead, 2005).

### *Procedure*

Participants complete the clinical measures, Eyes Test and the speech challenge task. Testing was completed in a single session and lasted less than one hour (for the ToM and speech task). All measures were administered by trained clinicians and research assistants not blind to group status. The assessments were administered in the same sequence for all participants.



### *Data analytic plan*

Data analyses were performed using SPSS version 16.0 for Windows and SAS version 9.0. Statistical significance was defined as  $p < .05$  and all tests were two-tailed. Chi-square tests and a multivariate analysis of variance (MANOVA) were used to examine group differences on demographic variables. Any variable that was significantly different between the groups was included as a covariate in a MANCOVA.

To evaluate the reliability and the preliminary validity of the Coding for Social Behavior (CSB) rating manual, a series of psychometric analyses were performed using the entire sample ( $N=54$ ). Ratings were summed across participants on each of the factors and averaged between the two raters, where higher scores reflect better social functioning. First, inter-rater reliability was evaluated, where reliability was considered acceptable at Intraclass Correlations (ICCs) greater than .80. Inter-rater agreement was examined with an average, two-way random effects ICC on the 28 cases rated by raters 1 and 2 (pair 1) and the 22 cases rated by raters 1 and 3 (pair 2). The internal consistency was also examined, where internal consistency was considered adequate at Cronbach's alphas greater than .80.

The construct validity of the CSB rating manual was evaluated via factor analysis. An exploratory factor analysis was conducted to examine whether the CSB loaded on the four proposed factors (i.e., Odd Behavior and Language, Affect, Communication, and Social-Interpersonal). A generalized least squares estimation (GLS) and direct oblimin rotation on the factors was employed because the item distributions did not conform to a normal distribution. The factor structure was determined by a preliminary examination of a scree plot and further investigated with a chi-square test and model fit indices.

Using the entire sample ( $N=54$ ), the convergent validity was evaluated by correlating the CSB factors with the GAF-S ratings and performance on the Eyes Test. In addition, CSB ratings were correlated with the SOPS subscales (Positive, Negative, Disorganized, and General symptom subscales) and the SOPS items that tap into schizotypal symptoms (SOPS Schizotypy). The SOPS Schizotypy score was calculated by summing across seven of the SOPS items that map onto the DSM-IV-TR criteria for schizotypal personality disorder namely, unusual thought content, suspiciousness, perceptual abnormalities, social anhedonia, expression of emotion, odd behavior-appearance, and bizarre thinking.

Pearson two-tailed correlations were used for all correlation analyses. The only exception was with the GAF-S, where a maximum likelihood estimator of the polyserial correlation was implemented because it was non-normally distributed.

ANOVAs were conducted to examine the hypothesis that GHR adolescents would show social skill impairments compared to the NPC group. Effect sizes (Cohen's  $d$ ) were calculated to determine the magnitude of differences between the groups on the CSB factors. An event trial logistic model was then employed to examine the hypothesis that the GHR adolescents would show Theory of Mind (ToM) deficits. An event trial logistic model was used because it accounts for the difference in the proportion of Eyes Test stimuli across subjects (i.e., the adult and child's versions of the Eyes Test differ in the number of stimuli presented). For those six participants that received both versions of the Eyes Test (i.e., the 16 year-olds), only the child's version was used in the analyses. This version was chosen to diminish the possibility of practice effects as it was administered first in the Eyes Test sequence.

Next, ANOVAs were employed to examine the main effect of schizotypal traits and the interaction of schizotypal traits and group (GHR versus NPC) on social skill. In addition, an event trial logistic model was implemented to examine the main effect of schizotypal traits and the interaction of schizotypal traits and group on ToM.

Lastly, an exploratory analysis was conducted to examine the effect of development on social skill performance. Tanner staging, which is the stage of pubertal development rated from 1 (prepubescent) to 5 (fully developed), was dichotomized into two groups: prepubescent (stages one and two) and pubescent/post-pubescent (stages three through five). This dichotomization was chosen based on clinical judgment (i.e., conferring with a psychiatrist familiar with tanner staging) and past methods of grouping tanner staging for data analysis (Rapkin, Tsao, Turk, Anderson, & Zeltzer, 2006). The tanner staging was included in ANOVAs to examine the main effects and the interaction of puberty and group (GHR versus NPC) on social skills.

## Results

### *Group comparisons on clinical and demographic factors*

There were no significant differences between the GHR and the NPC groups on gender ( $\chi^2=.260$ , *ns*), ethnicity ( $\chi^2=1.802$ , *ns*), age [ $F(1,52)=1.605$ , *ns*], years of education [ $F(1,52)=1.026$ , *ns*], or SOPS Positive symptoms [ $F(1,52)=3.18$ , *ns*]. The GHR group did, however, have significantly lower GAF-S scores [ $F(1,52)=13.70$ ,  $p=.001$ ] and more SOPS Negative [ $F(1,52)=17.060$ ,  $p=.000$ ], disorganized [ $F(1,52)=5.62$ ,  $p=.021$ ], and General symptoms [ $F(1,52)=10.67$ ,  $p=.002$ ]. There was a trend level difference on the SOPS Schizotypy symptoms with the GHR group having slightly more schizotypy symptoms [ $F(1,52)=2.86$ ,  $p=.097$ ]. There was a significant difference in highest level of maternal

education ( $\chi^2 = 18.24, p = .020$ ) between the groups with the GHR group having fewer years of maternal education. Finally, there was a trend level difference in highest level of paternal education ( $\chi^2 = 12.76, p = .078$ ) with the GHR group having slightly fewer years of paternal education. See Table 1 for group means and standard deviations of group clinical and demographic variables.

#### *Psychopathology of first-degree relatives*

The FIGS was used to ascertain the diagnoses of the affected first-degree relatives. The diagnoses of the first-degree relatives included: 39% schizoaffective disorder; 36% schizophrenia spectrum disorder (i.e., a *specific* schizophrenia spectrum disorder was unclear); 15% schizoaffective versus schizophrenia (i.e., neither diagnosis had been ruled out); and 10% schizophrenia.

#### *Psychometric properties of the CSB*

The 15 items were reduced to three factors, explaining 74% of the variance in CSB ratings. A three factor model fit well ( $\chi^2 = 18.24, p = .020$ ). There was a consensus between the scree plot and the model fit for the selection of a three factor model (see Figure 1 of scree plot of factor loadings). Table 2 displays the factor loadings based on a generalized least squares estimation (GLS) and direct oblimin rotation on the three factors. The rater's impression item was not included in the factor analysis as it is a summary item.

The proposed factor structure was not fully supported by the factor analysis. The items loading onto each factor were reviewed for the common domain. As a result, the three factors identified were "Social-Interpersonal" which is composed of four items, "Affect," composed of six items, and "Odd Behavior & Language," made up of five items. See Table 2 for the loadings of the specific items on each of the aforementioned established factors.

The CSB demonstrated very good internal consistency for the total score ( $\alpha=.93$ ), as well as for each of the factors. See Table 2 for the internal consistency of the CSB established factors. Each of the CSB factors was significantly positively correlated with each other, the total score and the rater's impression item (Table 3). The inter-correlations, while statistically significant, suggest overlapping but not redundant variance among the CSB factors. In addition, the raters reached high levels of inter-rater reliability on the established factors (i.e., ICCs  $> .80$  on all factors except the Affect factor for the second pair of raters, where ICC  $> .70$ ; see Table 4 for the CSB inter-rater reliability results). It should also be noted there was a significant difference in the participant profile between the two pairs of raters such that the participants rated by the second pair of raters (raters 1 and 3) were comprised of significantly fewer high risk subjects ( $\chi^2=5.99, p<.05$ ) and had a trend towards lower SOPS General subscale rating scores ([pair 1  $M=1.07, SD=1.54$ , pair 2  $M=.36, SD=.79$ ];  $F(1,48)=3.85, p=.056$ ) than those coded by the first pair of raters (raters 1 and 2).

All three established factors (Affect, OB& L, and Social-Interpersonal), the rater's impression item and the total CSB score (the three factors and rater's impression item combined) were significantly positively correlated with GAF-S, such that higher GAF-S ratings (i.e., better social functioning) were associated with better performance on the CSB (Table 5). The Social-Interpersonal factor was significantly positively correlated with the Eyes Test (i.e., better performance on the Eyes Test was associated with better social-interpersonal skills on the CSB). The CSB total score, the Affect factor and the OB & L factor were significantly negatively correlated with the SOPS Disorganized subscale (i.e., better performance on the CSB, greater expression of affect and less odd behavior were associated with fewer SOPS disorganized symptoms). The summary item had a trend level

negative correlation with the SOPS Disorganized subscale (i.e., better rater's impression scores were associated with fewer SOPS disorganized symptoms).

#### *Social skill: performance on the CSB*

ANOVAs were conducted to examine group differences on the CSB (Table 6). The GHR group had significantly lower (i.e., worse ratings) on the Social-Interpersonal [ $F(1,52)=13.66, p<.05$ ] and Affect [ $F(1,52)=5.04, p<.05$ ] factors, the rater's impression item [ $F(1,52)=4.76, p<.05$ ] and the CSB total score [ $F(1,52)=9.55, p<.05$ ]. There was a trend level difference in the OB & L factor [ $F(1,52)=3.06, p=.086$ ], with the GHR group performing slightly worse (i.e., more odd behavior). The effect sizes ranged from medium to large across the three factors, rater's impression item and total score.

The above analyses were repeated after controlling for the SOPS subscale scores that differed between the groups (i.e., the SOPS Negative, General and Disorganized subscales) using a MANCOVA. When controlling for the SOPS subscales, the results were largely unchanged except for the Affect factor, which was now at a trend level of statistical significance [ $F(1,52)=3.63, p=.063$ ].

#### *Theory of Mind*

An event trial logistic analysis showed no group differences in ToM on the Eyes Test between the GHR and NPC groups (Likelihood ratio  $\chi^2 = .93, \beta = -.11, SE = .11, ns$ ).

#### *Schizotypal traits as it relates to ToM and social skill*

Event trial logistic analyses showed no main effect of schizotypal traits (Likelihood ratio  $\chi^2 = .01, \beta = .003, SE = .02, ns$ ) nor an interaction between schizotypal traits and group (Likelihood ratio  $\chi^2 = 1.51, \beta = .011, SE = .03, ns$ ) on the Eyes Test. Similarly, ANOVAs

revealed no main effects of schizotypal traits nor an interaction between schizotypal traits and group on social skills (Table 7).

*Exploratory analysis: development and social skill*

Finally, the effect of development on social skill performance was explored via ANOVAs. There was no interaction between tanner staging (stage of pubertal development) and group on the CSB factors. There was a main effect for tanner stage, however, on the OB& L factor [ $F(1,52)=4.6, p<.05$ ], such that pubescent adolescents ( $n=37, M=22.04, SD=3.07$ ) had less odd behavior than the prepubescent adolescents ( $n=14, M=19.86, SD=3.97$ ). There were no main effects on the other factors for tanner staging.

### Discussion

The primary aim of this study was to examine the psychometric properties of the Coding for Social Behaviors (CSB) Rating Manual, a theoretically derived manual and procedure that assesses social skills in adolescents at genetic high-risk (GHR) for psychosis. A second aim of the study was to examine the social skills (i.e., performance on the CSB) and theory of mind (ToM) of GHR adolescents as compared to non-psychiatric controls (NPC). In addition, the present study explored whether schizotypal traits have an impact on social skills and ToM.

The findings revealed that the CSB indeed demonstrated acceptable levels of reliability and validity. The hypothesis that GHR adolescents would have worse social skills than the NPC group was supported; however there were no group differences in ToM as measured by the Eyes Test. Lastly, contrary to what was hypothesized, participants high in schizotypal traits did not have worse ToM or social skill performance. These findings add to the present body of literature suggesting social functioning deficits are a vulnerability marker

of schizophrenia (Tarbox & Pogue-Geile, 2008) and lend preliminary evidence for a new, potentially informative behavioral measure of social skills in GHR adolescents.

The results demonstrate that the CSB is a psychometrically reliable and valid instrument. The psychometric analyses fit a three factor model as opposed to the hypothesized four factor model. Specifically, the proposed Odd Behavior & Language (OB&L), Social-Interpersonal and Affect factors remained, while the proposed Communication factor was not supported. The Communication factor did not remain in the factor analysis possibly due to the fact that the proposed factor only contained two items. Thus, this factor may not have been adequately robust and needed a larger range of communication-related items. Communication deficits in both GHR children (Harvey, Weintraub & Neale, 1982) and adults (Docherty et al., 2004) are well documented, so the current rating scheme may not have been sensitive or broad enough to pick up these deficits. Furthermore, communication deficits may have been viewed by the CSB raters as odd or anxious behavior and could have loaded on the OB & L and Social-Interpersonal factors as opposed to the Communication factor.

The CSB displayed preliminary construct validity such that it was significantly correlated with GAF-S scores. One concern with the MTV task is that it may pull for odd behavior and not be an accurate measure of social functioning. However, the significant relationship between the CSB and GAF-S suggests that performance on the behavioral task does indeed generalize to overall social functioning. This strengthens the CSB's potential to identify adolescents who demonstrate social functioning deficits. Overall, the initial psychometric analyses of the CSB indicate that it is a statistically sound and promising measure of social skill for this population.



The factor analysis was conducted using the combined sample because a parallel factor analysis (i.e., factor analysis examining the NPC and GHR groups separately) was prohibited due to the small sample size of each group. Therefore, it is not known whether the factor structure would remain when analyzing the GHR and NPC groups separately. Future work examining the psychometric properties of the CSB should analyze the factor structure in a large, GHR sample to evaluate whether the present three factor structure is stable.

With regards to the second aim of the study, the GHR adolescents did in fact have significantly worse social skill performance on the CSB compared to the NPC group. Specifically, the GHR adolescents performed significantly worse on the Social-Interpersonal and Affect factors, the rater's impression item, and the CSB total score. There was a trend towards worse performance on the Odd Behavior and Language factor for the GHR group, as well. Importantly, the results were generally unchanged after controlling for the SOPs subscales. These findings are consistent with previous research that found social functioning deficits in GHR adolescents using other measurement strategies, such as self-report questionnaires (Hans et al., 2000; Shim et al., 2008) and semi-structured interviews (Dworkin et al., 1994; Glatt et al., 2006).

Although group differences were seen in social skill performance, the hypothesis that GHR adolescents would have greater impairments in ToM was not supported. It is possible that the Eyes Test is a limited ToM measure. Specifically, the Eyes Test measures the ability to mentalize mental states based on visual representations. Some have argued that there is a social cognitive, as well as a distinct social perceptual aspect of ToM (Tager-Flusberg & Sullivan, 2000) and that the Eyes Test measures the social perceptual component where visual cues are used to perceive another's mental state (Sabbagh, 2004). Perhaps measures

that assess the *social cognitive* aspect of ToM, such as those that evaluate first and second-order beliefs would clarify the role of ToM as a vulnerability marker. ToM deficits have been observed in GHR *adults* when a larger battery of ToM instruments, tapping into the social cognitive dimension of ToM was administered (e.g., Marjoram et al., 2006). Thus, future research examining ToM deficits in GHR adolescent samples would benefit from including a breadth of ToM measures to help elucidate its role as a disease marker.

The hypothesis that individuals higher in schizotypal traits would have worse social skill and ToM was not supported. This is not consistent with the literature showing a relationship between schizotypal traits and social functioning (Aguirre et al., 2008), as well as ToM (Irani et al., 2006). One possible reason why the current study did not replicate previous findings is that we created a composite schizotypy score based on the SOPS items that tap into schizotypal traits, instead of using an established schizotypal measure (e.g., Schizotypal Personality Questionnaire). Research examining the relationship between schizotypy and ToM and social skill should use valid measures of schizotypy to help clarify its role in identifying subgroups of GHR adolescents.

Lastly, we conducted exploratory analyses examining the effect of pubertal development on social skill based on other findings that there are social functioning and behavioral differences between older and younger GHR adolescents (Tarbox & Pogue-Geile, 2008). Our findings did not find a similar effect of development on social functioning; however, pubescent adolescents across the two experimental groups (NPC and GHR) demonstrated less odd behavior than the prepubescent participants. One possible explanation is that the pubescent adolescents may have been more conscious of not appearing “odd” or strange, so they were cautious and conservative in their performance on the MTV task.

Although the present findings lend support to social functioning deficits as a possible vulnerability marker in GHR adolescents, a major limitation in the present study is that a formal measure of intellectual functioning was not administered. Therefore, the role of intelligence on social functioning could not be formally evaluated.<sup>1</sup> In addition, we must temper our conclusions about the genetic nature of social functioning, as we cannot discount environmental factors (e.g., living with an affected parent). It was unknown whether the adolescents in the present study resided with their affected first-degree relatives and the influence this may have had on their social skills.

In summary, this is the first known study to evaluate a structured behavioral measure of social skill in GHR adolescents. The findings highlight the role of social functioning as a potential disease marker. High risk research examining vulnerability markers, such as social functioning deficits, can improve identification of GHR adolescents at risk for psychosis and inform early intervention approaches (Salokangas & McGlashan, 2008).

<sup>1</sup>Although a measure of general cognitive functioning was not available, we repeated the primary analyses after excluding nine participants, all from the GHR group, that were receiving special education services for learning disabilities and emotional distress (using special education as a proxy measure of intelligence). When these nine participants were excluded, there was no longer a significant difference between the NPC and GHR groups on the total CSB score [ $F(1, 43) = 3.23, p = .077, \text{Cohen's } d = .52$ ], and the Affect factor [ $F(1, 43) = 2.00, ns, \text{Cohen's } d = .43$ ]. The Social-Interpersonal factor remained significant [ $F(1, 43) = 5.53, p < .05, \text{Cohen's } d = .68$ ].

Table 1. Group comparisons of clinical and demographic variables

Variable	NPC (n=31)	GHR (n=23)
Gender (% female)	45	52
Ethnicity (%)		
African American	23	30
Caucasian	71	70
Asian	6	0
Age (means years $\pm$ SD)	13.23 $\pm$ 2.49	14.09 $\pm$ 2.45
Years of Education (means years $\pm$ SD)	6.87 $\pm$ 2.40	7.57 $\pm$ 2.61
GAF-S (mean rating $\pm$ SD)*	9.16 $\pm$ .58	8.26 $\pm$ 1.18
SOPS-positive (mean score $\pm$ SD)	1.16 $\pm$ 1.71	2.13 $\pm$ 2.28
SOPS-negative (mean score $\pm$ SD)*	0.55 $\pm$ 1.23	3.26 $\pm$ 3.37
SOPS-disorganized (mean score $\pm$ SD)*	0.45 $\pm$ .89	1.21 $\pm$ 1.48
SOPS-general (mean score $\pm$ SD)*	0.32 $\pm$ .70	1.52 $\pm$ 1.88
SOPS-schizotypy (mean score $\pm$ SD)	1.06 $\pm$ 2.03	2.13 $\pm$ 2.60
Maternal education (%)*		
Did not complete high school	0	9
GED HS Diploma	0	17
Some college	19	39
College Degree/ post college education	81	35
Paternal Education (%)		
Unknown	0	13
Did not complete high school	3	13
GED/HS Diploma	13	17.4
Some college	13	26.1
College degree/ post college education	71	30.5

Note. NPC=Non-Psychiatric Control; GHR=Genetic High Risk

\*Denotes statistically significant difference between the groups on that variable,  $p<.05$ .

Table 2. Factor loadings & internal consistency for the established factors ( $N=54$ )

Factor	Cronbach Alpha	Items (item #)	Corrected item-total correlation	Alpha if item Deleted	Factor loading
Social-Inter	0.89	Fluency of speech (10)	0.91	0.81	0.96
		Guardedness (11)	0.69	0.89	0.78
		Social anxiety (13)	0.66	0.90	0.74
		Engagement (14)	0.81	0.85	0.90
Affect	0.91	Facial affect (1)	0.81	0.89	0.88
		Nonverbal affect (2)	0.76	0.89	0.76
		Appropriate affect (3)	0.81	0.89	0.89
		Verbal expression (5)	0.83	0.89	0.88
		Gaze (12)	0.60	0.92	0.66
		Anergia (15)	0.72	0.90	0.77
OB& L	0.85	Speech valence (4)	0.65	0.83	0.73
		Appearance (6)	0.63	0.83	0.66
		Odd speech (7)	0.75	0.80	0.89
		Tangential speech (8)	0.64	0.83	0.73
		Clear communication (9)	0.68	0.82	0.75

*Note.* Social-inter=Social-interpersonal; OB & L=Odd Behavior and Language.

Table 3. Intercorrelations between CSB factors and total score

CSB Variable	CSB total	Social-Inter	Affect	OB & L	Rater's impression
CSB total <sup>a</sup>	-	.86**	.84**	.76**	.86**
Social-Inter		-	.55**	.60**	.81**
Affect			-	.40**	.58**
OB & L				-	.70**
Rater's impression					-

*Note.* CSB=Coding for Social Behavior; Social-inter=Social-interpersonal; OB & L=Odd Behavior and Language.

<sup>a</sup>Total score for all items, including the summary item.

\*\* $p < .001$  (two tailed)

Table 4. CSB inter-rater reliability of the established factors for both pairs of raters

Variable	Pair 1: Raters 1 & 2 ( <i>n</i> =28)				Pair 2: Raters 1 & 3 ( <i>n</i> =22)			
			Rater 1	Rater 2			Rater 1	Rater 3
	ICC	95 CI	<i>Mean (SD)</i>	<i>Mean (SD)</i>	ICC	95 CI	<i>Mean (SD)</i>	<i>Mean (SD)</i>
Affect	.92	.83-.96	19.57 (4.90)	18.54 (5.78)	.71	.29-.88	25.73 (3.10)	25.64 (3.70)
Social-Inter	.88	.75-.95	12.89 (4.29)	13.18 (4.45)	.80	.51-.92	16.05 (2.40)	15.05 (3.97)
OB & L	.91	.81-.96	20.79 (3.71)	19.79 (4.25)	.87	.68-.95	22.45 (2.82)	22.45 (2.94)
Rater's impression	.82	.61-.92	3.00 (1.16)	3.14 (1.33)	.87	.68-.95	3.59 (1.05)	3.14 (1.28)
CSB total <sup>a</sup>	.91	.81-.96	56.25 (11.30)	54.64 (13.34)	.81	.56-.92	67.82 (5.69)	66.27 (8.98)

Note. CSB=Coding for social behavior; Social-Inter=Social Interpersonal;  
OB & L=Odd Behavior and Language; ICC=IntraClass Correlation.

<sup>a</sup>Total score for all items, including the summary item.



Table 5. Correlations between the CSB and GAF-S, SOPS, SOPS schizotypy and Eyes Test ( $N=54$ )

Variable	GAF-S	Eyes Test <sup>a</sup>	SOPS Pos	SOPS Neg	SOPS Dis	SOPS Gen	SOPS Sztypy
CSB total	.31*	.17	.14	-.07	-.29*	-.18	.09
Social-Inter	.27*	.30*	.19	.00	-0.09	-.20	.19
Affect	.34 *	.05	.09	-.06	-.27*	-.15	.00
OB & L	.28*	.09	.07	-.08	-.36*	-.11	.06
Rater's impression	.30*	.23	.14	-.17	-.251	-.07	.11

*Note.* CSB total=total scores on the Coding for Social Behavior; Social-Inter=Social-interpersonal; OB & L=Odd Behavior and Language; GAF-S=Global Assessment of Social Functioning; SOPS= Scale of Prodromal Symptoms, Positive, Negative, Disorganized and General symptom subscales; SOPS sztypy=SOPS items that tap into schizotypy symptoms. Higher Scores on the CSB indicate better social behavior; higher SOPS scores indicate more symptoms; higher GAF-S scores indicate better social functioning; higher Eyes Test scores indicate better performance.

<sup>a</sup>correlations with Eyes Test are based on  $N=53$ , data is missing for 1 participant.

\* $p<.05$  (two tailed).

Table 6. Group means, standard deviations, and effect sizes on the CSB

CSB variable	Score range <sup>a</sup>	NPC ( <i>n</i> =31)	GHR ( <i>n</i> =23)	Effect size ( <i>Cohen's d</i> )
		<i>M (SD)</i>	<i>M (SD)</i>	
Social-Inter	4-20	15.87 (2.35) <sub>b</sub>	12.35 (4.56) <sub>c</sub>	1.04
Affect	6-30	23.69 (4.57) <sub>b</sub>	20.43 (6.11) <sub>c</sub>	0.63
OB & L	5-25	22.05 (3.10) <sub>b</sub>	20.41 (3.76) <sub>b</sub>	0.49
Rater's impression	1-5	3.52 (.94) <sub>b</sub>	2.87 (1.24) <sub>c</sub>	0.61
CSB total	16-80	65.13 (7.33) <sub>b</sub>	56.07 (13.97) <sub>c</sub>	0.87

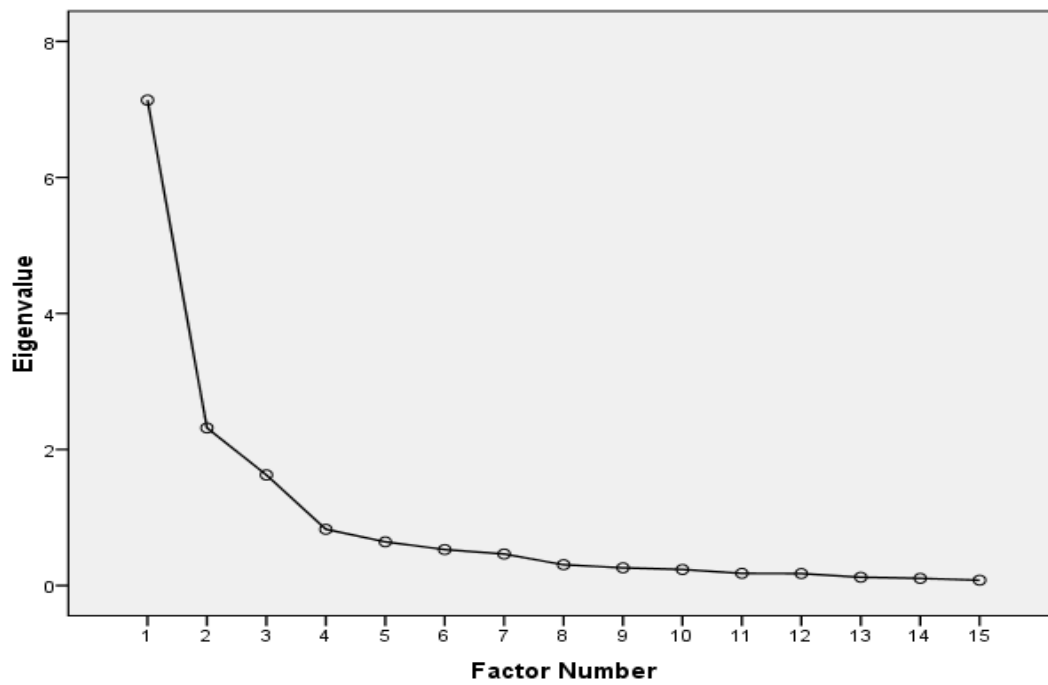
*Note.* Higher scores indicate better performance. CSB=Coding of Social Behavior Rating Manual; Social-Inter=Social-interpersonal;  
OB & L= Odd Behavior & Language Factor; NPC=Non-Psychiatric Control; GHR=Genetic High Risk;  
Means in the same row having different subscripts are significantly different at  $p<.05$ .  
<sup>a</sup>possible range of scores for that factor or item.

Table 7. Schizotypy main effects and Group X Schizotypy interaction on CSB factors

CSB variable	$\beta$	$t$	$SE$	$p$	$\beta$	$t$	$SE$	$p$
Schizotypy Main Effects					Group X Schizotypy			
Social-Inter	.31	1.05	.30	.30	.34	.83	.40	.41
Affect	.01	.02	.48	.99	.27	.41	.65	.68
OB & L	.02	.06	.31	.95	.27	.64	.42	.53
Rater's impression	-.20	-2.58	.10	.80	.20	1.55	.13	.13

*Note.* CSB total=total scores on the Coding for Social Behavior; Social-inter=Social-Interpersonal; OB & L=Odd Behavior and Language.

Figure 1. Screen plot of eigenvalues from Exploratory Factor Analysis



## Appendix A:

### Coding of Social Behavior Rating Manual Items

1. *Facial affect*—the extent to which a participant has constricted facial affect (i.e. lacks facial expression during the video); examples include: no blinking, presenting with a dull, blank facial expression, and/or not smiling. Note that this refers specifically *to facial affect*.

1	2	3	4	5
Constricted facial affect; Blank facial expression; No affect displayed.		varies somewhat (smiles, blinks occasionally)		Not constricted; participant is expressive (e.g. smiles, blinks, frowns).

2. *Non-verbal expression*-- the extent that the participant uses gestures to communicate meaning. Lack of expression is demonstrated by not using hand gestures, frozen body posture, lack of head movement. Note that this item refers to *body expression*, while excluding *facial affect*.

1	2	3	4	5
No expression is displayed regardless of topic.		moderate amount of expression is displayed; some gesture variation.		expressive; gestures are expressed freely.

3. *Appropriate affect*—inappropriate affect refers to when a participant's facial and/or verbal expressions do not match the content of their speech (i.e. flat facial affect when discussing positive topics), affect repeatedly changes throughout the video and/or modes of expression are not consistent (i.e. sad facial expression, and laughing at the same time).

1	2	3	4	5
Inappropriate affect-- Affect and speech content contradict throughout the video (e.g. laughing when discussing a sad topic) such that it interferes with the effectiveness of the participant's speech.		somewhat appropriate-- occasionally content and affect do not match. (e.g.. extreme anger about something only <i>slightly</i> upsetting).		Appropriate affect such that meaning and understanding the participant is enhanced.

4. *Speech content affect*—participant’s speech is positive such that they provide examples of positive self-attributes (i.e. “I am nice”) and/or discuss activities/interests/hobbies/school subjects they excel in, enjoy and/or identify with, alternately, speech is negative to the extent that the participant provides examples of negative self-attributes (i.e. “I am not smart”), discusses activities/interests/hobbies/school subjects that they are unable to perform and/or do not enjoy. Speech is also considered positive if peer and familial relationships are discussed and/or the participant receives pleasure from these relationships, and speech is negative if lack of peer and familial relationships is discussed and/or the participant does not receive pleasure from these relationships.

1	2	3	4	5
Negative content; Participant discusses activities they are not good at (e.g. “I am not good a anything”) and/or does not provide positive comments (e.g. “I am a good student).		somewhat positive; speech <i>occasionally</i> contains positive content, but makes negative self-remarks and/or no positive comments		Positive content; participant provides a variety of positive attributes in support of why they should be on an MTV show or have an article written about them/discusses having many friends.

5. *Verbal expression*—participant uses voice tone, language and inflects voice to enhance meaning; alternately, participant does not use dramatic/expressive language and/or gives short, one word answers.

1	2	3	4	5
Lack of verbal expression; Participant does not elaborate on speech content and is not animated.		somewhat expressive; participant displays some animation and occasionally inflects voice to elaborate on speech content.		Expressive; participant is fully animated and inflects voice so that the participant’s speech is enhanced.

6. *Appearance: Unusual or odd behavior*—participant’s actions and/or appearance during the video is unusual, such that they make unusual gestures with their hands or face, excessively gesture with hands/body, wear sunglasses throughout the video, etc.

1	2	3	4	5
Extremely odd behavior, e.g. stands and walks around while talking in front of the video, wearing clothes inside-out or clapping hands without an apparent purpose, etc.		somewhat normal behavior/appearance; occasionally makes inappropriate or strange gestures with his/her hands, face.		No odd/unusual behavior/appearance; acts and dresses appropriately, e.g. sits in front of the camera without making strange facial or bodily gestures.

7. *Content: Unusual or Odd Speech*—content that is not relevant to the study activity; speech that does not appropriately address the study task assignment; misuse or overuse of phrases/words/idioms; participant refers to self in the third person.

1	2	3	4	5
Extremely unusual/odd speech (bizarre). Discusses topics unrelated to the activity; repeatedly talks about himself/herself in the third person; misuses or overuses idioms, phrases (e.g. “I am a big fish”).		Somewhat normal speech; participant occasionally has odd speech or speech does not address study activity.		No odd/ unusual speech; Participant discusses topics related to the study activity such that the meaning of the speech is enhanced.

8. *Tangential speech*—participant jumps from topic to topic; they may begin discussing a different topic in the middle of the sentence of another topic, or begin to explain another topic without having completed discussion of the previous topic.

1	2	3	4	5
Extremely tangential, such that it is difficult to understand the participant (e.g.. discussing school and then discussing the weather without having fully completed the discussion of school).		some tangential speech, but does not impact understanding the participant.		Clear train of thoughts without tangential speech.

9. *Clear Communication*—the extent to which the participant’s language is clear and unambiguous. Some examples of unclear communication include: missing proper nouns or names (i.e. stating “he” without clarifying who “he” is or “I hate *that* restaurant” without the listener having prior knowledge of what restaurant is being referred to); not enough context to decipher a word’s meaning (i.e. a word/phrase that could have many meanings, but the exact meaning is not clear from the context---such as the word “bank,” which can be a slope by a stream or a financial institution); poor grammar, which makes it difficult to process the participant’s speech (i.e. “I did not do nothing today”); and/or generally ambiguous/unclear language.

1	2	3	4	5
Unclear speech; ambiguous words; missing proper names, which affects and interrupts understanding the participant’s speech.		Somewhat clear speech, but periodic language ambiguity which slightly affects understanding the participant’s speech.		Clear speech; no ambiguity, such that meaning and understanding are enhanced.

10. *Fluency of speech*—extent to which the participant’s speech flows. Speech that is not fluent is evidenced by long pauses, stuttering, and excessive use of speech fillers (i.e. “umm”).

1	2	3	4	5
Not Fluent; Speech does not flow; many long pauses, stuttering.		somewhat fluent; presence of occasional pauses and stuttering.		Fluent speech, such that meaning is enhanced.

11. *Guardedness*—participant is reluctant to provide information; seems to be inhibited and does not want to reveal personal details or corresponding emotions.

1	2	3	4	5
Guarded; Appears hesitant to discuss personal information such that little is learned about the participant.		somewhat guarded; the participant presents some personal information, but still appears reluctant to discuss personal information.		Open to discussing personal information; personal details are revealed so that the viewer learns more about the participant.



12. *Gaze*—amount, frequency and duration of eye contact (Note: eye contact can be either with the camera or the RA behind the camera); for example, poor eye contact or lack of eye contact is noted if the participant is looking down at his/her feet during the duration of the video or looking around the room.

1	2	3	4	5
Lack of/inappropriate eye contact (e.g. participant looks down at feet) during the whole video.		Eye contact is minimal; participant <i>occasionally</i> avoids eye contact.		appropriate eye contact; very natural and for a good duration-- (e.g. majority of the video).

13. *Social Anxiety* – the amount of anxiety displayed by the participant during the activity; evidenced by shaking, voice wavering, sweating, stuttering, squirming, fidgeting with hands, etc.

1	2	3	4	5
Very Anxious		Some anxiety, but does not affect speech and video presentation.		Calm, at ease, appears comfortable.

14. *Engagement*-- refers to the general level of interest in the task. A participant who is not engaged in the study task may lose focus during the video (i.e. forget what s/he was saying or is supposed to say) and/or might have a hard time completing the task). Not being able to complete the task is defined as the need to be probed to finish by the research assistants filming the video, and/or the participant stating “I have nothing else to say.” In order to rate this, you will need to consider both verbal (i.e. asking “What am I supposed to be discussing?” or “Am I done, yet?”) and non-verbal behavior (losing focus during the activity, looking away from the camera and/or repeatedly checking one’s watch or a clock during the video).

1	2	3	4	5
Low engagement; Participant repeatedly loses train of thought; cannot complete the task; checks his/her watch repeatedly.		Somewhat engaged; participant is unable to complete the task, but is focused for the first portion of the video; or, does complete the task but occasionally checks watch.		Extremely engaged; Completes the study task successfully while staying focused and not losing train of thought.

15. Physical Anergia—the extent to which the participant appears lethargic and lacking energy such that they are slumped over in the chair, do not move much during the video, speaks slowly, etc.

1	2	3	4	5
Lacking energy; participant appears to be lethargic, tired; speaks slowly.		Moderate amount of energy; occasionally appears lethargic (i.e. slumps in chair).		Energetic; participant seems rested and speaks at moderate rate.

16. How well did the participant perform in this tape (i.e. would you chose them for an MTV show or to have an article written about them)? Take into account all of your previous ratings, and use this as a “summary” score.

1	2	3	4	5
Poor performance; would not chose participant to be on an MTV show/have article written about them.		Moderate performance; may chose participant to be on an MTV show/ have article written about them with slight reservation.		Excellent Performance; would definitely chose participant to be on an MTV show/have article written about them.

## Appendix B:

### Eyes Test--Child's version

<b>Sex of stimulus</b>	<b>Target word</b>	<b>Foil 1</b>	<b>Foil 2</b>	<b>Foil 3</b>
M (practice item)	Scared	Jealous	Relaxed	Hate
F	Kind	Hate	Surprised	Cross
F	Sad	Unkind	Cross	Surprised
M	Friendly	Sad	Surprised	Worried
M	Upset	Relaxed	Surprised	Excited
M	Making somebody do something	Feeling sorry	Joking	Relaxed
M	Worried	Hate	Unkind	Bored
M	Interested	Feeling sorry	Bored	Joking
M	Remembering	Happy	Friendly	Angry
F	Thinking about something	Annoyed	Hate	Surprised
M	Not believing	Kind	Shy	Sad
M	Hoping	Bossy	Angry	Disgusted
M	Serious	Confused	Joking	Sad
F	Thinking about something	Upset	Excited	Happy
M	Thinking about something	Happy	Excited	Kind
F	Not believing	Friendly	Wanting to play	Relaxed
F	Made up her mind	Joking	Surprised	Bored
F	A bit worried	Angry	Friendly	Unkind
M	Thinking about something sad	Angry	Bossy	Friendly
F	Interested	Angry	Daydreaming	Sad
M	Not pleased	Kind	Surprise	Excited
F	Interested	Joking	Relaxed	Happy
F	Thinking about something	Playful	Kind	Surprised
F	Sure about something	Surprised	Joking	Happy
M	Serious	Ashamed	Confused	Surprised
M	Worried	Shy	Guilty	Daydreaming
F	Nervous	Joking	Relaxed	Sorry
M	Not believing	Ashamed	Excited	Pleased
M	Happy	Disgust	Hate	Bored

Note: M=male, F=female

## Appendix C:

### Eyes Test--Adult's version

<b>Sex of stimulus</b>	<b>Target word</b>	<b>Foil 1</b>	<b>Foil 2</b>	<b>Foil 3</b>
M	Panicked	Jealous	Arrogant	Hateful
M	Playful	Comforting	Irritated	Bored
M	Upset	Terrified	Arrogant	Annoyed
F	Desire	Joking	Flustered	Convinced
M	Insisting	Joking	Amused	Relaxed
M	Worried	Irritated	Sarcastic	friendly
F	Fantasizing	Aghast	Impatient	Alarmed
M	Uneasy	Apologetic	Friendly	Dispirited
M	Despondent	Relieved	Shy	Excited
F	Preoccupied	Annoyed	Hostile	Horrificed
M	Cautious	Insisting	Bored	Aghast
M	Regretful	Terrified	Amused	Flirtatious
M	Skeptical	Indifferent	Embarrassed	Dispirited
M	Anticipating	Decisive	Threatening	Shy
M	Accusing	Irritated	Disappointed	Depressed
F	Contemplative	Flustered	Encouraging	Amused
M	Thoughtful	Irritated	Encouraging	sympathetic
F	Doubtful	Affectionate	Playful	Aghast
F	Decisive	Amused	Aghast	Bored
F	Tentative	Arrogant	Grateful	Sarcastic
M	Friendly	Dominant	Guilty	Horrificed
F	Fantasizing	Embarrassed	Confused	Panicked
F	Preoccupied	Grateful	Insisting	Imploring
M	Defiant	Contented	Apologetic	Curious
M	Pensive	Irritated	Excited	hostile
F	Interested	Panicked	Incredulous	Despondent
M	Hostile	Alarmed	Shy	Anxious
F	Cautious	Joking	Arrogant	Reassuring
F	Interested	Joking	Affectionate	Contented
F	Reflective	Impatient	Aghast	Irritated
F	Flirtatious	Grateful	Hostile	Disappointed
F	Confident	Ashamed	Joking	Dispirited
M	Serious	Ashamed	Bewildered	Alarmed
M	Concerned	Embarrassed	Guilty	Fantasizing
F	Distrustful	Aghast	Baffled	Terrified
F	Nervous	Puzzled	Insisting	Contemplative
M	Suspicious	Ashamed	Nervous	Indecisive

Note: M=male, F=female

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