Socio-Dramatic Affective-Relational Intervention for Adolescents with Asperger Syndrome & High Functioning Autism: Pilot Study

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ABSTRACT This study examined the effectiveness of a novel intervention called 'socio-dramatic affective-relational intervention' (SDARI), intended to improve social skills among adolescents with Asperger syndrome and high functioning autism diagnoses. SDARI adapts dramatic training activities to focus on in vivo practice of areas of social skill deficit among this population. SDARI was administered as a six-week summer program in a community human service agency. Nine SDARI participants and eight age- and diagnosis-group matched adolescents not receiving SDARI were compared on child- and parent-report of social functioning at three week intervals beginning six weeks prior to intervention and ending six weeks post-intervention. Hierarchical Linear Modeling (HLM) was used to estimate growth trends between groups to assess treatment outcomes and post-treatment maintenance. Results indicated significant improvement and post-treatment maintenance among SDARI participants on several measures of child social functioning. Implications for practice and research are discussed.

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Children with Asperger syndrome (AS) have average to above average intelligence, but display atypical social development (American Psychiatric Association [DSM-IV-TR], 2000). These children are deficient in domains including social skills, reciprocal interaction, and non-verbal cue recognition.

Keywords: Asperger syndrome, high functioning autism, social skills, hierarchical linear modeling, treatment effectiveness evaluation
These deficits lead to impairment in functioning that can diminish quality of life, and may encourage comorbid conditions such as anxiety and depression (Attwood, 2007). Depression in particular may be directly related to social impairment in this population (Sterling, Dawson, Estes, & Greenson, 2008). As they move into adolescence, youth with AS develop increased interest in social interaction without a concurrent increase in skills, leading some individuals to become more aware of the difficulties they encounter when interacting with peers (Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007). As such, effective evidence-based social skills interventions for adolescents with AS are needed.

Limitations of Existing Social Skills Intervention Research

In recent years, many studies have assessed the effectiveness of social skills interventions for children and adolescents with AS and High Functioning Autism (HFA), with few studies reporting large significant effects, suggesting a continuing need for empirically supported treatment approaches (e.g., Barry et al., 2003; Lopata, Thomeer, Volker, Nida, & Lee, 2008). Recent reviews of this literature have outlined some important limitations (Koenig, De Los Reyes, Cicchetti, Scahill, & Klin, 2009; Matson, Matson, & Rivet, 2007; Rao, Beidel, & Murray, 2008; White, Keonig, & Scahill, 2007). First, there is little consensus on appropriate measurement of social skills among youth with AS and HFA, and studies often lack sensitive multi-informant, multi-method, outcome measures. Both White et al. (2007) and Rao et al. (2008) note several studies that use a single outcome measure, while Koenig et al. (2009) argue that complex social skills may only be captured via a multi-dimensional approach. Second, the majority of studies have included ten or fewer participants (see Matson et al., 2007; Rao et al., 2008). Further, Rao et al. (2008) cite only two studies that included a control or comparison condition.

Finally, context generalization and post-treatment skill maintenance have been little studied and rarely found (Rao et al., 2008; White et al., 2007). Though several investigators have observed in-session gains, they have reported limited skill generalization (e.g., Barnhill, Cook, Tebbenkamp, & Myles, 2002; Barry et al., 2003), with no substantial generalization found for generalization-focused (Rao et al., 2008), peer-mediated, or modeling & reinforcement-based approaches (Matson et al., 2007). Rao et al. (2008) identified just one study that reported post-treatment maintenance of skills (Barry et al., 2003), which were constrained to domains of limited validity. Though recent developments in this field have been considerable, there remains a need for interventions that address the aforementioned limitations in the literature.
**Socio-Dramatic Affective-Relational Intervention**

We report on an intervention called Socio-Dramatic Affective-Relational Intervention (SDARI), formerly Drama-based Social Pragmatic Intervention (Lerner & Levine, 2007). SDARI is a group-based manualized intervention with three core components: (1) a unique performance-based social skills curriculum employing affectively engaging improvisation games and dramatic training adapted for this population, (2) a focus on child-child and child-staff relationship building to reinforce social interactions, and (3) use of other age-appropriate motivators such as video games and non-competitive physical activity. The game-based instructional method is theorized to help participants develop and practice social skills in a fun environment. The unique social reinforcements are included to increase participants’ motivation to continue to use the learned skills; such motivation may encourage generalization of skilled behavior to other settings.

The SDARI model builds upon existing social skills training for adolescents with AS while including unique components theorized to increase intervention effectiveness. In White et al.’s (2007) review, several recommendations are put forth for interventions to increase social motivation and skill generalization. Where these techniques are consistent with the positive social reinforcement component (errorless teaching; developing a nurturing, fun environment; clear social rules; reinforcing positive behaviors; multiple trainers to practise skills), the age-appropriate motivators component (age-appropriate initiation strategies), or both (natural social reinforcers; orchestrating peer involvement), they are included in SDARI. Others are not included because they are thought to conflict with the SDARI curriculum (role-play to teach skills), the curriculum and positive social reinforcement component (social ‘scripts’ for common situations; group review of socially appropriate and inappropriate behaviors), or the positive social reinforcement and age-appropriate motivators components (behavior charts; social skills homework).

The affectively-driven, relational techniques used in SDARI are similar to those present in other interventions for children with autism spectrum disorders (ASDs), which prioritize social engagement over behavioral accuracy (e.g., Greenspan & Wieder, 1998; Gutstein & Sheely, 2002). While such interventions are theoretically consistent with SDARI, a key difference is SDARI’s group-based design, in which young people/adolescents experience multiple repeated opportunities for reinforcing social interaction with peers.

The SDARI curriculum involves activities based loosely on variations of dramatic improvisation-based games (see, for example, Guli, Wilkinson, & Semrud-Clikeman, 2008). Consistent with the suggestions of Attwood (2007), such activities are thought to provide opportunities for participants
to use their individual interests pro-socially, which both motivates participation and replicates the complexities of ‘real’ social interaction without being overwhelming. These activities train participants to attend to specific non-verbal reciprocal interaction cues, to which adolescents with ASDs may fail to attend and consequently misunderstand (Paul, Orlovski, Marcinko, & Volkmar, 2009). For instance, an activity entitled ‘Gibberish’ trains participants in interpretation of body language, perspective-taking, and flexible social cognition (see Figure 1). In this activity, one participant speaks in nonsense sounds instead of words while ‘describing’ how to perform an everyday task (for example, bake a cake). Another participant must watch and translate the ‘gibberish’ into words for the other youth. Critically, participants are encouraged to integrate humor into the activities, which can facilitate social connection (Attwood, 2007) and shift the focus from rote practice (as in a role-play) to interpretation of the subtle non-verbal information being conveyed. We are not aware of other interventions for social skills that similarly combine affective engagement (e.g. via humor), in-vivo skill building, and activities calibrated to promote specific areas of non-verbal deficit. We theorize that the combination of socially simplified and emotionally engaging activities enables participants to experience successful group social participation, leading to improved clinical outcomes. We also theorize that adolescents may be optimally receptive to this approach as opposed to younger children, because their increased social awareness and motivation (Tse et al., 2007) may facilitate active participation in SDARI.

Over the course of a summer intervention, SDARI employs over 100 games repeated across multiple days corresponding to specific goals (see Figure 1). Staff choose games for specific days and groups based on appropriateness for a given skill and group preference. For example, if a given group expresses dislike of Gibberish on Working Together day, it can be replaced with Emotion Ball. The goals are addressed through a manualized daily schedule. This five hour schedule includes daily meetings to present the goals at the beginning and ending of each day, multiple sessions of SDARI games, brief video game time, outdoor games time, a daily self-evaluation period, snack, and lunch. This structure and timeframe were developed through the clinical experience of the authors to maximize skill learning and social engagement.

The SDARI intervention manual is introduced to all staff during training (see Procedures below) and used daily to maintain theoretical and methodological consistency. It includes a sequence, definition, and description of daily goals and corresponding activities (for example, Figure 1). It also presents common behavioral problems and intervention strategies. Finally, the manual includes logistical instructions and materials for staff.
Hypotheses

We first hypothesized that SDARI participants, relative to an age-, sex-, and diagnosis-matched comparison group of young people/adolescents who did not receive the intervention, would display improved parent-reported social functioning at the end of the six-week intervention period. We next hypothesized that SDARI participants, relative to the comparison group, would display decreased errors in receptive non-verbal cue reading in an objective test and, because depression may be related to social competence, decreased self-reported depression at the end of the intervention period. Our third hypothesis was that improvements among the SDARI participants relative to the comparison group would be evident at six weeks after intervention completion, indicating post-treatment maintenance.

Method

Participants

Seventeen youth with AS or HFA, ages 11–17, participated in this study. Young people/adolescents were recruited over five months from two sources. Because this study aimed to ascertain initial effects of SDARI, only parents of youth who had not previously received SDARI and were newly-enrolled in the program administering SDARI (North Shore Arc’s Spotlight Summer Program) were solicited for participation in the intervention condition. There were 24 such newly-enrolled families in the 2007 Spotlight Summer Program (out of 56 total families), nine of whom consented to participate in the study. For the comparison condition, clients who met inclusion criteria at an affiliated clinic in the same geographic area, as well as former SDARI participants who had received SDARI in either past summer programs or after-school programs but who were not enrolled in the 2007

<table>
<thead>
<tr>
<th>Games</th>
<th>Working Together</th>
<th>Body Language</th>
<th>Tone of Voice</th>
<th>Someone Else’s Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibberish</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Emotion Ball</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>One Word Story</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Machine</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1 SDARI sample goals versus games table
Spotlight Summer Program were solicited. Former SDARI participants were considered eligible for this comparison condition because the primary hypotheses of this study specifically address change over the course of the study period and not overall group differences; statistically, inclusion of past participants in the comparison condition would impact the intercept, but not the slope, of measures collected in this study. It is theorized that, if long-term treatment gains were present in past participants, they may have stabilized by this point and would not continue along the same trajectory as the newly-enrolled participants in SDARI. Eight families expressed interest in participating in the comparison condition (four who had participated previously in SDARI, four who had never participated in SDARI), out of approximately twenty who were approached.

Inclusion criteria for all participants included the presence of a DSM-IV-TR (2000) diagnosis of AS or HFA and being 10–17 years of age. Diagnostic and comorbidity status were confirmed via the presentation of any pre-existing diagnostic report, regardless of recency, by a licensed Psychologist, Medical Doctor, Psychiatrist, or Developmental Pediatrician, and/or an Individualized Education Plan (IEP) from the individual’s school district noting the presence of a Pervasive Developmental Disorder (PDD). The accuracy of the diagnosis was supported by baseline Social Responsiveness Scale (SRS, see below; Constantino & Gruber, 2005) scores, the means of which were above recommended cutpoints (65 and 70 for females and males, respectively) for screening for PDD (see Table 1; Constantino & Gruber, 2005). A record of comorbid affective or other pragmatic language disorders was not an exclusion criterion because of the high prevalence of these disorders among AS and HFA populations (Attwood, 2007). Exclusion criteria for all participants included a record of psychotic illness, mental retardation, limited verbal ability, or significant medical or neurological illness that could impair participation in the intervention. Psychotic illness was verified using the psychosis module of the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition With Psychotic Screen (SCID-I/P W/ PSY SCREEN; First, Spitzer, Gibbon, & Williams, November, 2002), which was administered by a trained Licensed Psychologist or psychiatric Nurse Practitioner. All other exclusion criteria were either informally assessed during the SCID-I/P (verbal ability), or via review of diagnostic history and IEP records (comorbid affective or pragmatic language disorders, mental retardation, significant medical or neurological illness). Participants in the intervention and comparison groups did not differ significantly on any demographic variable of age, sex, or diagnosis (see Tables 1 and 2).

Participants were not randomized to intervention or comparison conditions. Consistent with the recommendations of Westen, Novotny, and
Thompson-Brenner (2004), this investigation was considered a study of a psychotherapy using practice as a natural laboratory. The intention, therefore, was that this study would provide an initial investigation into the effectiveness of SDARI as administered in the Spotlight Program. Finally, practical considerations of enrollment and cost of participation to families and their school districts made randomization difficult for this investigation.

**Measures – Parent-Reported – Typical Social Behavior**

All parent-reported measures are used to address hypotheses one (change on parent-reported measures) and three (sustained change post-treatment).

### Table 1  Baseline Scores on Measures between Groups

<table>
<thead>
<tr>
<th>Baseline Score</th>
<th>Mean (SD)</th>
<th>Group Difference t-test (p-value)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comparison (n = 8)</td>
<td>Intervention (SDARI) (n = 9)</td>
</tr>
<tr>
<td>Age</td>
<td>14.32 (1.931)</td>
<td>14.31 (1.328)</td>
</tr>
<tr>
<td>EDI</td>
<td>122.38 (24.407)</td>
<td>117.44 (24.820)</td>
</tr>
<tr>
<td>CBCL – Social Problems</td>
<td>69.75 (8.940)</td>
<td>73.00 (9.487)</td>
</tr>
<tr>
<td>CBCL – Internalizing</td>
<td>69.38 (3.739)</td>
<td>67.89 (8.418)</td>
</tr>
<tr>
<td>CBCL – Externalizing</td>
<td>59.63 (6.368)</td>
<td>56.89 (7.721)</td>
</tr>
<tr>
<td>SRS</td>
<td>81.625 (9.665)</td>
<td>75.444 (14.544)</td>
</tr>
<tr>
<td>SSRS</td>
<td>73.875 (16.208)</td>
<td>80.778 (14.087)</td>
</tr>
<tr>
<td>BDI-Y</td>
<td>47.50 (9.798)</td>
<td>51.89 (9.413)</td>
</tr>
<tr>
<td>DANVA-2-CF</td>
<td>4.88 (2.232)</td>
<td>5.00 (2.330)</td>
</tr>
<tr>
<td>DANVA-2-CP</td>
<td>6.25 (5.064)</td>
<td>6.50 (3.464)</td>
</tr>
<tr>
<td>DANVA-2-AF</td>
<td>6.25 (1.753)</td>
<td>4.88 (2.167)</td>
</tr>
<tr>
<td>DANVA-2-AP</td>
<td>7.00 (2.878)</td>
<td>9.38 (1.685)</td>
</tr>
<tr>
<td>DANVA-2-POS</td>
<td>14.375 (2.200)</td>
<td>14.222 (1.481)</td>
</tr>
<tr>
<td>Satisfaction Survey</td>
<td>3.688 (1.067)</td>
<td>4.111 (1.269)</td>
</tr>
</tbody>
</table>

¹All df = 15

### Table 2  Sample Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Comparison n (% of total)</th>
<th>Intervention (SDARI) n (% of total)</th>
<th>Group Difference p¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male = 6 (75%) Female = 2 (25%)</td>
<td>Male = 8 (89.9%) Female = 1 (11.1%)</td>
<td>.576</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>AS = 6 (75%) Other = 2 (25%)</td>
<td>AS = 5 (55.56%) Other = 4 (44.4%)</td>
<td>.620</td>
</tr>
</tbody>
</table>

AS = Asperger Syndrome primary diagnosis; Other = other Pervasive Developmental Disorder primary diagnosis. ¹Group differences calculated via 2-sided Fisher’s exact test.
Child Behavior Checklist (CBCL; Achenbach, 1991). Parents reported on adolescents’ behavioral problems on the CBCL. The internalizing broadband, externalizing broadband, and social problems subscales were chosen for analyses. The CBCL contains 113 items answered on a 1–3 Likert metric. The CBCL yields T-scores ($M = 50$, $SD = 10$), with higher scores corresponding to more problems. It has extensively demonstrated reliability and validity in community samples and autistic populations (for example, Bölte, Dickhut, & Poustka, 1999).

Social Skills Rating System (SSRS; Gresham & Elliot, 1990). Parents reported on adolescents’ overall social skills on the SSRS. The SSRS contains 52–55 items (sample item: joins group activities without being told to), dependent upon child grade level, answered on a 0–2 Likert scale. The SSRS contains 4 subscales, Cooperation, Assertion, Responsibility, and Self-control. The SSRS yields standard scores ($M = 100$, $SD = 15$), with higher scores corresponding to higher ratings of social skills. While Barry et al. (2003) noted the potential lack of SSRS treatment sensitivity for AS and HFA children, it has nonetheless subsequently become the most extensively used parent-report measure for assessing social skills in adolescents with AS (White et al., 2007), and has demonstrated treatment sensitivity (e.g., Laugeson, Frankel, Mogil, & Dillon, 2009).

Measures – Parent-Reported – ASD-related Behavior

Emory Dysemmia Index (EDI; Love, Nowicki, & Duke, 1994). Parents reported on the adolescents’ nonverbal communication skills on the EDI. The EDI contains 42 items (sample item: ‘misreads the intentions or feelings of others’), answered on a 1–5 Likert metric. It has demonstrated acceptable internal consistency and test-retest reliability in a typical population (Love et al., 1994). Norms are not available for youth on the autism spectrum, though we believe it captures an important construct targeted in the intervention. Cronbach’s $\alpha$ in our sample was .823. Items were summed to form a raw score for which higher values indicate poorer non-verbal communication skills.

Social Responsiveness Scale (SRS; Constantino & Gruber, 2005). Parents reported on social impairments on the SRS. The SRS contains 65 items (sample item: ‘takes things too literally and doesn’t get the real meaning of a conversation’), answered on a four-point Likert scale. Constantino & Gruber (2005) report good internal consistency and validity for this measure with AS populations. The SRS includes five subscales, including Social Awareness (8 items), Social Cognition (12 items), Social Communication (22 items), Social Motivation (11 items), and Autistic Mannerisms (12 items). The SRS yields T-scores, with higher scores corresponding to a higher degree of social impairment. The SRS is thought to be particularly
sensitive to change, and has demonstrated treatment sensitivity in this population (Bass, Duchowny, & Llabre, 2009; White et al., 2007).

**Measures – Parent-Reported Satisfaction**

Satisfaction Survey. All parents rated their satisfaction with their child’s summer experience on a 1–5 Likert Scale in a post-summer survey. The overall satisfaction item (‘how satisfied were you with your child’s experience this summer?’) was used for analyses (see Table 2).

**Measures – Child Nonverbal Cue Reading**

All child-completed measures were used to address hypotheses two (receptive non-verbal cue reading), and three (sustained change post-treatment).

Diagnostic Analysis of Nonverbal Accuracy-2 (DANVA-2; Nowicki, 2004). Youth completed the computer-based DANVA-2 to assess errors in reading non-verbal emotion cues in faces, paralanguage (i.e. tone of voice), and postures. The Adult Faces (AF; Nowicki & Carton, 1993), Child Faces (CF; Nowicki & Carton, 1993), Adult Paralanguage (AP; Baum & Nowicki, 1996), Child Paralanguage (CP; Demertzis & Nowicki, 1998), and Postures (POS; Pitterman & Nowicki, 2004) DANVA-2 subtests have demonstrated acceptable internal consistency and test-retest reliability for this age group. All DANVA-2 tests produce raw scores representing the number of errors an individual has made in identifying emotions. Mean errors (and standard deviations) for typical populations on each of the scales in the given age group are 3.067 (2.267) for CF, 4.8 (3.3) for CP, 4.6 (2.55) for AF, 8.3 (2.8) for AP, and 8.75 (3.05) for POS (Nowicki, 2004). While the Faces and Paralanguage modules of the DANVA-2 have been previously used with youth with ASDs (e.g., Barnhill et al., 2002; Lopata et al., 2008), only the Faces module has previously demonstrated treatment sensitivity in youth with ASDs (Solomon, Goodlin-Jones, & Anders, 2004).

**Measures – Child Depression**

Beck Depression Inventory –Youth (BDI-Y; Beck, Beck, & Jolly, 2001). Youth self-reported depressive symptoms on the BDI-Y. The BDI-Y contains twenty depression-related items answered on a 0–3 Likert scale. It has shown good internal consistency and test-retest reliability (Beck et al., 2001). The BDI-Y yields T-scores, where higher scores correspond to greater depression. This is the first known investigation to use the BDI-Y in an ASD population, though others have examined child-reported depression as a change measure in social skills interventions for this population (e.g., Barry et al., 2003; Solomon et al., 2004).
Procedures

Intervention youth participated in the Spotlight Summer Program for five hours/weekday over six weeks during summer 2007. Participants received 145 hours of group treatment over 29 sessions. There were seven groups of five to nine youth and three staff per group. Groups contained one to three study participants. Spotlight staff were unaware of which group members were study participants, so there was no difference in the intervention provided to study and non-study participants.

Staff received one week of training prior to the Spotlight Summer Program. This training consisted of an introduction to the specific intervention activities, an overview of the clinical population, and behavior management strategies. Two clinical researchers familiar with the intervention provided consultation and observation throughout the summer for treatment fidelity. Fidelity was monitored through random live observation of sessions (at least one hour per rater per group per week), daily review of group curricula, and weekly staff discussion and session tape review meetings. Curriculum content was 100 percent consistent across groups, and no observation or meeting yielded evidence of substantial deviation from training materials.

Data collection proceeded in three week intervals over 18 summer weeks for a total of seven time points, with SDARI administered during the middle six weeks. Visits took place at two research centers near Boston, where participants and parents completed all measures on-site in the presence of a research assistant unaware of which participants were assigned to which condition. The intake procedure took place prior to data collection, the EDI, SRS, SSRS, BDI-Y, and DANVA-2 measures were administered at each visit, and the CBCL was administered at every other visit. After study completion, Parent Satisfaction Survey was administered by mail.

Data Analytic Plan

Intervention and comparison groups were first compared on baseline scores on all primary assessment measures using two-tailed independent samples t-tests.

To test Hypotheses 1–3, Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002) of growth curves was used to assess differences in change between groups. While traditional repeated measures ANOVA approaches rely on mean difference scores, HLM describes the trajectory of individual change (Raudenbush & Bryk, 2002), and is considered to be superior in its accurate representation of change over time (Lyon & Moats, 1997). For all variables, three HLM models were specified. First, an unconditional model was specified to account for baseline Level 1 ($\sigma^2$) and
Level 2 (\( \tau \)) variance components. Next, a time only model was specified to examine if the introduction of Time significantly reduced \( \sigma^2 \) and thereby produced a slope effect. Finally, a full model was specified as follows:\(^2\):

Level 1: \[ Y_{ti} = \pi_{0i} + \pi_{1i} (\text{Time}) + \epsilon_{ti} \]

Level 2: \[ \pi_{0i} = \beta_{00} + \beta_{01} (\text{Group}) + r_0 \]
\[ \pi_{1i} = \beta_{10} + \beta_{11} (\text{Group}) + r_1 \]

\( Y_{ti} \) was the outcome variable at a given time point, \( \text{Time} \) was the time point variable (representing assessment time points), \( \pi_{0i} \) and \( \pi_{1i} \) were the intercept and slope of the line, \( \beta_{01} \) and \( \beta_{11} \) were the estimated coefficients, \( \epsilon_{ti} \) was the overall error term, while \( r_0 \) and \( r_1 \) represent the error in slope and intercept. \( \text{Group} \) was dummy coded and centered to represent intervention status and determine if Group significantly reduced \( \sigma^2 \) or \( \tau \) and thereby produced an effect on the trajectory or mean of the derived line (see Tasca & Gallop, 2009). All significant Group (i.e. intervention) effects (\( \alpha = .05 \)) were reported.

Power analysis for linear change in treatment (Raudenbush & Xiao-Feng, 2001) with an \textit{a priori} standardized effect size of .6 (comparable to effect sizes found in previous social skills interventions; White et al., 2007) yielded an estimated power of .21 with 17 participants. Despite the low power, the exploratory nature of this study led us to apply no correction to account for multiple comparisons to detect any potentially significant effects, while recognizing that this introduced an increased possibility of Type I error into our analyses. Because the goal of the study was to analyze a social skills intervention, social skills outcomes were deemed particularly relevant, so all SSRS subscales were analyzed.

For Hypotheses 1 and 2, this HLM procedure was conducted on data from Time 1 through Time 5 (baseline through SDARI endpoint) on parent-based measures and child-based measures. For Hypothesis 3, the procedure was conducted on data from Time 1 through Time 7 (baseline through six week follow-up) on all measures. For significant results, effect sizes were calculated as the proportion of variance in the individual differences in slopes explained by Group in the final model relative to the time only model. Post-hoc analyses were conducted comparing past SDARI participants to non-SDARI comparison participants on trajectories of significant results, and examining linear trajectories of such results during pre-treatment and post-treatment time periods only for all participants. We conducted these analyses to assess whether effects were unique to current SDARI participants and the intervention time period.
**Results**

**Sample Characteristics**
Table 1 presents age and baseline scores on all measures. There were no significant differences between groups on age, scores on baseline measures, or satisfaction survey scores. Though some of the mean group differences appear large (≥ one SD), low statistical power limited reliable assessment of whether these differences were significant. Eleven of the 17 participants had complete data. Of those with missing data, no more than two of the seven time points were missing (< 5% overall), typically for fewer than two measures, so all participants met minimum data requirements (three points) required for HLM growth curve analyses. Missing values were left as-is for t-tests, while for HLM, imputation using the mean of adjacent values was applied to maximize power in this small sample; we note that all HLM analyses were also conducted without imputation without affecting the pattern of results. This represents a conservative imputation scheme, since it produces no change in derived linear slopes.

**Hypothesis 1 – Parent Measures, Time 1 through Time 5**
Table 3 summarizes the results of Hypothesis 1, that SDARI participants would display improved adjustment as reported by parents on measures from Time 1 to Time 5 relative to comparison group participants. Below we highlight the findings for these dependent measures.

Time produced a significant negative effect on the slope of EDI (ASD-like non-verbal communication skills), CBCL – Internalizing (parent-reported depression, anxiety, and related problems), and a significant positive effect on the slope of SSRS (overall social skills), indicating that all participants on average displayed a pattern of reduction in EDI and CBCL scores, and increase in SSRS scores, between Time 1 and Time 5. Time did not produce a significant effect on CBCL – Social Problems (parent-reported social rejection and teasing), CBCL – Externalizing (parent-reported acting out behavior), or SRS (ASD-like social behaviors), indicating no change across groups over time. Group did not produce a significant effect on the linear intercept or slope of EDI, CBCL measures, SRS, or SSRS indicating no differential trend for intervention participants. Effect sizes were small (all $R^2 < .03$).

SSRS (social skills) subscales were examined, and no significant effects for Group were found on SSRS – Responsibility, SSRS – Cooperation, or SSRS – Self-Control. Effect sizes were medium and small (all $R^2 < .07$). On the SSRS – Assertion subscale, Group produced a large ($R^2 = 0.445$) and significant positive slope effect, indicating that parent-reported social assertion increased among intervention relative to comparison participants.
### Table 3  HLM Models, Time 1–5, Significant Group Findings

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
<th>Parameter</th>
<th>Fixed Effects</th>
<th>σ²</th>
<th>τ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Coefficient</td>
<td>SE</td>
<td>T-ratio</td>
</tr>
<tr>
<td>SSRS – Assertion</td>
<td>7.55</td>
<td>3.57</td>
<td>β₀₀</td>
<td>6.971</td>
<td>0.908</td>
<td>7.677</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>β₀₁</td>
<td>0.322</td>
<td>1.825</td>
<td>0.177</td>
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<td>3.01</td>
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<td>0.729</td>
<td>11.209</td>
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<td>β₀₁</td>
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<td>0.286</td>
<td>−2.212</td>
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α = .05; * = p < .05; ** = p < .01. Note: All df = 15
Hypothesis 2 – Child Measures, Time 1 through Time 5

Table 3 summarizes the results of Hypotheses 2, that SDARI participants would display decreased errors on measures of receptive non-verbal cue reading and self-reported depression from Time 1 to Time 5 relative to the comparison group participants. Below we highlight the findings for these dependent measures.

Time produced a significant negative slope effect on DANVA-2-CF (child faces) and -POS (postures), and no significant slope effect on BDI-Y (depression), DANVA-2-CP (child voices), -AF (adult faces), and -AP (adult voices), indicating that all participants displayed a pattern of reduction in DANVA-2-CF and -POS scores between Time 1 and 5, but not in -CP, -AF, -AP, or BDI-Y scores. Group did not produce a significant intercept or slope effect on BDI-Y or any DANVA-2 subscales except AP (adult voices), indicating no differential trend in scores on these scales for intervention participants. Effect sizes were small (all $R^2 < .021$).

Group produced no significant intercept effect on DANVA-2-AP (adult voices), but produced a very large ($R^2 = 0.335$) and significant negative linear slope effect, indicating that errors in identifying emotions in adult voices decreased among intervention participants relative to comparison participants.

Hypothesis 3 – All Measures, Time 1 through Time 7

Table 4 summarizes the significant results for Hypotheses 3, that SDARI participants would maintain improvements on measures analyzed in Hypothesis 1 and 2 from Time 1 through Time 7 (follow-up assessment) relative to comparison participants. The pattern of results at follow-up was largely similar to that obtained from Time 1 to Time 5. No differences between intervention and comparison groups were found on the EDI (ASD-like non-verbal communication skills), CBCL – Internalizing (parent-reported depression, anxiety, and related problems) and Externalizing (parent-reported acting-out behaviors), SRS (ASD-like social behaviors), SSRS broadband (overall social skills), BDI-Y (depression), and DANVA-2-CF (child faces), -CP (child voices), -AF (adult faces), or -POS (postures). Effect sizes were medium and small (all $R^2 < .067$). Significant differences continued to be found on SSRS- Assertion and DANVA-AP with large effect sizes ($R^2 = 0.222$ and 0.515 respectively), indicating sustained increases in parent-reported social assertion and decreases in errors identifying emotions in adult voices among intervention relative to comparison participants.

In addition, there was also a large ($R^2 = 0.705$) and significant emergent negative slope effect for Group on CBCL – Social Problems, indicating that parent-reported teasing and social rejection decreased among intervention relative to comparison participants.
Table 4  HLM Models, Time 1–7, Significant Group Findings

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mean</th>
<th>SD</th>
<th>Parameter</th>
<th>Fixed Effects</th>
<th>$\sigma^2$</th>
<th>$\tau$</th>
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<td>CBCL – Social Problems</td>
<td>68.59</td>
<td>8.732</td>
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<td>$72.765$ 2.111 34.465 0.000**</td>
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<tr>
<td>Group (slope effect)</td>
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<td>SSRS – Assertion</td>
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<td>$7.067$ 0.870 8.120 0.000**</td>
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<tr>
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<td>DANVA-2 – AP</td>
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<td>$8.420$ 0.673 12.506 0.000**</td>
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</table>

$\alpha = .05; * = p < .05; ** = p < .01$. Note: All df = 15
Post-hoc Analyses
Post-hoc analyses of significant results were conducted analyzing the effect of Group on the slope of Time 1 through Time 3 and Time 6 through Time 7 to confirm that any significant change took place during the intervention time points\(^3\). These analyses produced no significant results, supporting the hypothesis that observed significant changes associated with intervention status took place during the intervention and were sustained through posttest time points (as illustrated in Figure 2). Additional post-hoc probing of significant results was conducted comparing the slopes of the past SDARI participant subset of the comparison group (\(n = 4\)) to the subset of comparison participants that had never participated in SDARI (\(n = 4\)) and the intervention group participants (\(n = 9\)). No statistically significant differences were found between the trajectory of the two comparison subsets, suggesting that it may have been appropriate to combine them in the primary analyses. However, given the small sample size for these analyses, this finding should be interpreted with caution.

**Figure 2** Mean SSRS – Assertion scores and standard error bars at each time point separated by SDARI and comparison conditions. Dotted vertical reference lines delineate intervention time period. Graph demonstrates that significant change among SDARI participants occurred uniquely during the intervention.

Discussion
We found that youth participating in SDARI for the first time, as administered in a six-week summer treatment program, displayed gains in social
assertion and the ability to accurately detect emotions in adult voices from baseline to the end of the program relative to an age-, sex-, and diagnosis-matched cohort of youth who did not participate in SDARI during the same period. The intervention group did not demonstrate gains relative to the comparison group on other measures of social skills, internalizing and externalizing symptoms, or non-verbal cue reading ability. Treatment group youth continued to show maintenance in gains relative to the comparison group when data were considered from baseline to six weeks post-treatment in social assertion and the ability to detect emotions in adult voices. Post-hoc analyses indicated that this observed maintenance was associated with change that took place during the intervention period, and that no significant regression occurred post-treatment. In addition, at post-treatment the intervention group also demonstrated superiority in reduced social problems, but not in the other assessed domains.

Results of this study suggest that SDARI may be an effective intervention for addressing some areas of social skills development as part of a continuum of care for young people/adolescents with ASDs. Notably, parents of SDARI and comparison participants expressed equal satisfaction about their child’s summer experience, which lessens the likelihood that any differences in their ratings of their children’s adjustment are driven by a difference in overall satisfaction. That some of these results emerge from the DANVA-2 measure is relevant, as it is the only non-questionnaire based measure used in this study, and results may be considered more objective. This is the second study to find significant change associated with an intervention on a DANVA-2 measure (Solomon et al., 2004), and the first to find such change on a DANVA-2 paralanguage instrument (Nowicki, personal communication, March 2nd, 2008). Significant findings in the intervention group also emerged at post-treatment for decreased social problems, potentially indicating sustained post-treatment maintenance of intervention effects and corollary benefits associated with participation in SDARI.

Interpretation of these findings should be considered tenuous, given the preliminary nature of this investigation. However, the pattern displayed among SDARI participants – that some measures of skills changed together over the course of the intervention while others did not – suggests that there may be a conceptual relationship between sustained, increased social assertion, ability to detect emotions in voices, and decreased social problems. Though further study is necessary to elaborate on this model, we theorize that the combination of social assertion and ability to more accurately detect emotions may engender increased social confidence and interpretive accuracy, leading to fewer social mistakes and decreased problems in social settings over time. This interpretation is bolstered by the fact that Time 7 occurred one month after participants had returned to their schools,
where generalized gains in social functioning are likely to begin to be more evident due to greater daily peer interaction.

This study has several clinical and methodological strengths. First, this study employs a wide array of largely standardized measures from multiple informants, collected by an examiner unaware of the condition to which participants were assigned, as well as an ‘objective’ measure of functioning. While a subset of measures demonstrated significant change among SDARI participants, given the lack of consensus on appropriate measures of social skills, those scales demonstrating change in this study provide promise for future investigation. Further, this study is among the first to control for confounds such as parent satisfaction.

Aside from very recent studies (e.g., Lopata et al., 2008; Tse et al., 2007), this study contained a relatively large sample for this literature, and is among the first to employ a population-matched simultaneous comparison group. This study is also among the first to find evidence for generalization and post-treatment maintenance of social skills. Finally, this is the first known study in this literature to use advanced statistical modeling that accounts for the time-ordering of assessment (HLM). Effective use of this technique can provide future researchers a valuable tool with which to conduct more valid and highly-powered analyses of interventions in this field. Overall, this study employs all primary and many secondary indicators of quality of group evidence-based practices research in autistic populations (e.g., Reichow, Volkmar, & Cicchetti, 2008).

There are several limitations to this study. First, diagnosis, comorbidity status, language ability, and IQ were not validated by study personnel at the time of study enrollment, and characteristics such as medication status and ethnicity were not recorded; all of these would have been helpful in characterizing the populations being studied. If groups did differ on language ability, comorbidity, medication status, or IQ, these factors could potentially be related to improvements seen in the treatment condition. Moreover, it may be the case that an average level of expressive and receptive language ability is necessary to comprehend and benefit from SDARI as presently described.

Other concerns relate to the sample. Though a comparison group was examined, participants were not randomized to intervention and comparison groups, and the comparison group contained individuals who had previously received the intervention, introducing possible bias into the results. Indeed, the inclusion of such individuals introduces the possibility that long-term intervention effects may have masked potential significant findings in our analyses. The sample size was also roughly one-quarter of what is necessary to detect adequately all statistically significant effects, and not large enough to analyze the potential effect of recorded psychiatric comorbidities.
Related to the measures, though a multi-informant approach was used, there remained a reliance on subjective parent- and self-report measures, and it would be valuable to use more informants (such as teachers or peers) and observation-based measures in the future. The repeated use of the same set of instruments over a relatively short period of time introduces the possibility of inflated self and parent ratings over time and the possibility of a learning effect on a measure such as the DANVA-2. Likewise, the lack of correction for multiple comparisons among these instruments in our analyses introduces an inflated possibility of Type I error. Finally, though the findings from this study are promising, they are relatively modest across all measures and are limited to a few scales.

Further research might employ more well-controlled designs (such as randomized controlled trials) with better diagnostic, treatment fidelity, and screening procedures to assess the validity of the findings from this pilot study. Included in these studies may be investigations of diagnostic and demographic factors that may moderate the effectiveness of the intervention. Medication status would be particularly important to assess in future studies, as both Risperidone (Hanft & Hendren, 2004) and Methylphenidate (Jahromi et al., 2009) have been shown to have positive effects in this population on mood regulation and social communication, respectively. Such investigations may also include longer-term follow-up data to assess the degree, if any, of skill maintenance or subsequent gains beyond six weeks post-treatment, as well as the potential value of booster sessions. Research might also assess whether SDARI or individual components can be effectively delivered in other contexts, including after-school and in-school settings. That is, it will be important to examine what level of intensity of this approach, in time and frequency, is needed in order to achieve positive effects. Finally, investigations into putative unique mechanisms of change might be conducted, attempting to tease out which components of SDARI are most effective for which outcomes, as well as the degree to which the therapeutic techniques, the therapeutic environment, or the combination of the two is most responsible for any change.

Overall, this study presents initial findings regarding the potential effectiveness of a new technique for social skills intervention for adolescents with AS and HFA delivered in a community-based treatment setting, as well as a useful statistical tool (HLM) for assessing change in such interventions. This investigation suggests that increased parent-reported social assertion, observed ability to detect emotions in adult voices and decreased parent-reported social problems, may be encouraged by participating in this intervention. The results of this preliminary report indicate that further study of this intervention may be valuable.
Acknowledgments

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Footnotes

1 Individual scores were also above recommended cutoffs for all but three participants. Analyses excluding these participants were run and did not produce significant changes in findings. As such, they were not excluded from reported results.

2 For more details on these models, contact the primary author.

3 Such analyses could not be conducted on the CBCL scales, as there was not a sufficient number (at least three) of pre- and post-intervention CBCL assessments to do so.

References


