BRIEF REPORT

Brief Report: Individual Social-Multi-Modal Intervention for HFASD

Nirit Bauminger

Abstract This research is the first part of a 2-year cognitive-behavioral-ecological (CB-E) social skills training for high-functioning children with autism spectrum disorder (HFASD). Current study examined efficacy of an individual CB-E intervention in facilitating children's dyadic interactions (immediately after treatment and 4 months later) and their social cognition capabilities (e.g., emotion understanding and recognition, social problem solving). Participants were 19 HFASD children aged 7 years and 7 months to 11 years and 6 months. Results demonstrated improvement in children's social cognition and positive dyadic interaction and decrease in children's low-level social interaction behavior. Long-term evaluation revealed maintenance of improvement. Progress in children's cooperation, self-control, and assertiveness was reported by their teachers. Discussion focused on CB-E intervention efficacy in promoting integral social functioning for HF children with ASD.

Keywords High-functioning children with autism · asperger syndrome · social skill intervention · cognitive-behavioral therapy

Introduction

The focus of the social-communication deficit in high-functioning (HF) children with autism spectrum disorder (ASD) comprises the child's lack of intuitive,

N. Bauminger (✉)
School of Education, Bar-Ilan University, Ramat-Gan 52900, Israel
e-mail: bauminn@mail.biu.ac.il

spontaneous learning about the social and emotional world (Howlin, 1998; Klin & Volkmar, 2000; Frith, 2004) that results in major difficulties both in social-emotional knowledge and in effective peer and group social interactions (Krasny, Williams, Provencal, & Ozonoff, 2003). These difficulties attain special significance during adolescence in light of the reported loneliness (a reflection of social motivation) and high rates of affective disorders (65% specified in Attwood, 2004) such as anxiety and depression among HF adolescents with ASD (Klin & Volkmar, 1997; Bauminger & Kasari, 2000; Bauminger, Shulman, & Agam, 2003; Paul, 2003; Attwood, 2004), emphasizing the need for interventions to help them develop theoretical and practical social-emotional knowledge.

Social-Emotional Functioning in HF Children with ASD

Spence (2003) suggested that a multitude of social cognitive processes determine the actual behavior of children in social situations. Social information processing, a core skill in social cognition (Crick & Dodge, 1994), consists of an interplay between social perceptions and social problem-solving skills. Social perceptions include attention to and knowledge of relevant social-emotional cues, correct interpretation of verbal and non-verbal information, the ability to take another's perspective (i.e., theory of mind capability), and so forth. Social problem-solving skills incorporate identifying social tasks, determining social goals, generating ideas for alternative behaviors, predicting consequences, deciding upon the most efficient response, and so on. Each and every stage of social

information processing also involves emotional processes such as emotion recognition and knowledge (Lemerise & Arsenio, 2000). For example, deficits in affective cue detection (in oneself, in others, and/or in the social context) may lead to pursuing social goals that impede the successful continuation of social interaction.

Although social information processing has not been directly evaluated in HF children with ASD, one may expect inefficient social information processing among this population. This expectation derives from these children's documented deficits in several areas: (a) their limited social-emotional knowledge, especially their immature understanding of social norms and constructs and their immature understanding and recognition of emotions, particularly complex emotions (e.g., Travis & Sigman, 1998; Klin & Volkmar, 2000); (b) their difficulties in intuitively inferring about other people's feelings and thoughts (theory of mind), specifically in everyday social situations (e.g., Frith, 2004); and (c) their deficits in executive functions, specifically in cognitive flexibility, planning skills, and problem solving (e.g., Liss et al., 2001). Indeed, research has shown that HF children with ASD fixated on irrelevant stimuli when attempting to comprehend a social situation (Ozonoff, 1998), recounted the factual details of a "real life type" social problem less well than their typical peers (Channon, Charman, Heap, Crawford, & Rios, 2001), and demonstrated inefficient social perception (e.g., encoding) capabilities. In addition, they revealed qualitative impairments in social problem-solving skills; although quantitatively they did offer a similar number of solutions to a social problem as did typical agemates, the suggested solutions were less socially appropriate and evidenced less appreciation of the problem, and these children were also less able to evaluate the practical effectiveness of different social solutions (Channon et al., 2001; Loveland, Pearson, Tunali-Kotoski, Ortegon, & Gobbs, 2001). Thus, HF children with ASD need training on integral social cognitive skills including social perception and social problem-solving processes.

The two major capabilities that interchangeably predict competent social interaction with peers during middle childhood comprise conversational skills (e.g., how to start, maintain, and end a conversation; how to switch between topics) and cooperative prosocial skills (e.g., mutual planning, sharing, comforting, providing help, empathy) (Hay, Payne, & Chadwick, 2004). In fact, these two capabilities are recognized as major hallmarks of the social deficit in HF children with ASD. Among this population, children's conversational style may be limited to areas of interest for them,

with long-winded, one-sided topic initiations. They experience difficulties in choosing topics appropriate to the setting and conversational partner as well as difficulties in choosing what is relevant and irrelevant during a conversation. They exhibit problems in initiating and maintaining conversations that are sensitive to the social context and to others' interests and previous knowledge. Taking turns within an ongoing conversation or switching between topics to accommodate the conversational partner's perspective also poses difficulty (for extensive information on conversational characteristics of HF children with ASD, see, Landa, 2000; Rubin & Lennon, 2004).

Similarly to their conversational difficulties, these children encounter problems initiating and maintaining an interaction with peers during social activities or games. Maintaining interactions, in particular, requires the performance of complex, cooperative, prosocial behaviors that pose difficulty for these children, such as sharing feelings and experiences, collaborating, and comforting (Stone & Caro-Martinez, 1990; Lord & Magill-Evans, 1995; Bauminger et al., 2003). Group entry (joining into group activities or conversation) constitutes the highest social challenge for them (Lord & Magill-Evans, 1995; Sigman & Ruskin, 1999). Indeed, children with ASD have been found to cooperate with relatively more ease when the social interaction (conversation or cooperation) includes one particular child (most preferably a familiar child) over a group of children (Lord, 1984; Hauck, Fein, Waterhouse, & Feinstein, 1995). Taking into consideration their difficulties in understanding other minds as well as their executive functioning deficiencies, mainly in shifting attention and flexibility (e.g., Liss et al., 2001; Frith, 2004), these children's social demands gradually increase with greater social stimuli, where group situations (compared with one-on-one interactions) comprise their highest social challenge. Thus, intervention programs need to focus on the enhancement of both dyadic and group cooperative as well as conversational skills.

Cognitive Behavioral Therapy in HF Children with ASD

The multifaceted nature of the social-emotion deficit characterizing this disorder calls for interventions to help these children develop multi-dimensional social competence, integrating behavioral (e.g., social interaction), cognitive (e.g., accurate processing of information, perspective taking, problem solving), and affective skills (e.g., emotion knowledge) to adapt flexibly to diverse social contexts and demands

(Bierman & Welsh, 2000). The cognitive-behavioral therapy (CBT) model fits this need well inasmuch as its conceptual basis assumes reciprocity between the ways in which an individual thinks, feels, and behaves in social situations (Hart & Morgan, 1993). Also, CBT presumes that social perception processes can be taught cognitively and can influence behavior (Hart & Morgan, 1993). CBT's notion of the child as an active ''cognitive constructor'' of his/her social world corresponds with the ''compensation hypothesis'' for HF children with ASD, which suggests that such children make cognitive efforts to learn about their social-emotional life through their relatively higher functioning cognitive channel (Kasari, Chamberlain, & Bauminger, 2001). Furthermore, recent developments in social skills training (SST) programs not specific to ASD have supported the effectiveness of multi-modal SST that utilizes CBT techniques (e.g., affective education, problem solving, cognitive reconstruction) together with behavioral treatments such as modeling (e.g., how to perform a particular social behavior), instruction (e.g., why such a behavior is important), and practice (via role play, behavioral rehearsal, feedback, and reinforcement) over monomodal SST that focuses on only one technique, either social, cognitive or behavioral (e.g., Beelmann, Pfingest, & Losel, 1994; Ronen, 1998; Spence & Donovan, 1998; Bierman & Welsh, 2000; Spence, 2003).

Despite the general acceptance of the potential utility of integrating CBT components into SST programs for HF children with ASD, not many studies have empirically tested the effectiveness of such monomdal or multi-modal SST programs (Ozonoff & Miller, 1995; Hadwin, Baron-Cohen, Howlin, & Hill, 1996; Hare & Paine, 1997; Baron-Cohen & Howlin, 1998; Gray, 1998; Bauminger, 2002; Attwood, 2003, 2004; Reavan & Hepburn, 2003; Solomon, Goodlin-Jones, & Anders, 2004; Sofronoff, Attwood, & Hinton, 2005). The first such empirical efforts focused on enhancing social understanding (Gray, 1998) and promoting social cognitive capabilities such as theory of mind and emotion recognition (mainly of basic emotions) (Ozonoff & Miller, 1995; Baron-Cohen & Howlin, 1998). In general, these studies demonstrated improvement in the learned domain but less success in applying the learned skill to other domains of social competency. Other CBT efforts that presented good outcomes in the targeted skill comprised the treatment of mood disorders such as anxiety (Sofronoff et al., 2005), anger in children with Asperger's syndrome (Attwood, 2004), and obsessive–compulsive symptoms in one girl with Asperger (Reavan & Hepburn, 2003). Solomon et al. (2004) implemented a social adjustment

curriculum combining CBT techniques such as problem solving and affective education together with behavior techniques such as modeling, rehearsing, and role playing to enhance emotion recognition, theory of mind, and problem-solving capabilities in HF children with ASD. The authors reported progress in recognition of facial expression and in problem solving but not in theory of mind. However, inasmuch as their intervention was in a clinical setting, their study provided little knowledge about improvement in children's actual social understanding and behavior in their natural social settings.

Bauminger (2002) implemented a multi-modal SST program for HF children with ASD in a school setting, to enhance both social-emotional functioning and social interactions. That study demonstrated both improvement in the learned skills and also generalization to the children's social interactions during school recesses with peers who were not related to the treatment. However, the 2002 study provided individual training by the teacher and practice with an older typical peer, thus furnishing little data about progress in children's conversational or cooperative skills in peer groups. Also, the earlier study's limitations included an observer who was not blind to study aims and a teacher who both implemented the training and reported on children's progress. The 2002 findings called for several directions of future research: to establish treatment efficacy while using blind observers and more objective evaluation sources, to determine long-term maintenance of children's improvement in social interactions, to extend the SST model beyond dyadic interactions to target peer group interactions, and to examine the efficacy of such a group-centered intervention.

A comprehensive intervention project was designed to meet these recommendations by conducting two studies—an *individual* intervention (first year) and a *group* intervention (second year)—that evaluated the effectiveness of SST using a cognitive-behavioral-ecological (CB-E) approach for HF children with ASD to enhance social-emotional understanding and dyadic and group cooperative social interaction. The scope of the current paper is the description of the individual intervention (first year), whereas the group-centered CB-E SST is reported in Bauminger (in press—in this volume).

Study-Specific Aims

Current study reexamined the potential of the CB-E intervention model presented in Bauminger (2002) to

enhance social problem solving, emotional knowledge and recognition, and social interaction abilities among HF children with ASD by utilizing observers and data collectors who were blind to the specific intervention goals. The study also expanded on the 2002 model by examining: (a) teacher reports of children's overall progress in social skills by a teacher who was unrelated to the SST implementation; (b) long-term intervention effects (4 months after treatment) on children's social interaction capabilities; and (c) change in children's reported loneliness and self-perception. Based on Bauminger's (2002) study, hypotheses included improvement in social cognition and social interaction skills after treatment. Long-term effects on children's social interactions and change in loneliness and self-perception were difficult to predict.

Methods

Participants

Participants in Study 1 included 19 children (18 males and one female) ranging in age from 7 years and 7 months to 11 years and 6 months with prior clinical diagnosis (based on the *Diagnostic and Statistical Manual of Mental Disorders—DSM-IV*, American Psychiatric Association, 1994) of either HF autism ($n = 10$) or Asperger's syndrome ($n = 9$). Diagnosis was also verified in this study by the Autism Diagnostic Interview-Revised (ADI-R; Lord, Rutter, & LeCouteur, 1994). Inclusion of both HF children with autism and children with Asperger's syndrome was based on the wide consensus that social interventions during middle childhood share common characteristics for both populations (see, e.g., Krasny et al., 2003; Paul, 2003; Frith, 2004; Macintosh & Dissanyake, 2004; Solomon et al., 2004). The primary distinction between these two diagnoses pertained to significant language delay before the age of 3 years (warranting a diagnosis of HF autism). Additional sample selection criteria were: (a) Full IQ and/or verbal IQ of 75 or above; (b) Consent from the child's educational supervisor, school principal, classroom teachers, and parents for participation in the program; and (c) No serious conduct problems such as an ADHD diagnosis or severe temper tantrums. The sample's mean full-scale IQ score, as measured on the WISC-R (Wechsler, 1974), was 106.42 (SD = 11.62), with a range of 79–128. Mean verbal scale IQ was 101.74 (SD = 14.93), with a range of 75–128. Mean performance scale IQ was 109.53

(SD = 10.68), with a range of 87–129. Schools and children were recruited through the Special Education Department in the Israeli Ministry of Education. Participants attended seven regular educational settings in middle-class, large urban areas around the country. All children were already fully included in regular education at least 1 year before the beginning of the intervention.

Social-Emotional Intervention

Current study curriculum and procedure replicated the CB-E intervention model implemented in Bauminger (2002). Following an ecological conceptual basis, which views children's natural environment as strongly influencing their social-emotional characteristics (Bronfenbrenner, 1979, 1992; Ronen, 1998), intervention was conducted in the schools, implemented by the child's main teacher, and also involved one typically developing older peer and the child's parents. Each participant's individual education plan included work on the SST curriculum for 3 h per week over a 7-month period in class with the teacher. In addition, to practice the learned social skills, each participant met with the assigned peer twice weekly during that period: 1 day after school and during one school recess. To apply the learned skill in another social setting, parents also completed social tasks with their children, based on the learned skills during the entire social curriculum. The intervention curriculum included three sections: (a) instruction in prerequisite social concepts such as the understanding of friendship—concept formation stage; (b) affective education related to four basic emotions (sad, happy, afraid, and angry); and (c) social interpersonal problem solving, focusing on 13 core social objectives such as initiating a conversation with a friend (for more details on the CB-E intervention, see Bauminger, 2002).

Assessment Measures

For brevity, measures are only briefly summarized here, and a more detailed description of their coding may be found in Table 1. All measures were administered twice, immediately before and immediately after treatment. Observations of social interactions were also conducted a third time, 4 months after treatment termination. Three MA students in special education, who were blind to study hypotheses and goals, collected the data.

Table 1 Description of the Individual Intervention Assessment Measures

Replication of Bauminger (2002)	
Overt social behavior	
Social Interaction Measure (Bauminger, 2002)	Initiations and responses in three categories:
	Positive interaction—Eye contact, eye contact with smile, smile, sharing object and sharing experience, and social communication (which combined low-frequency behaviors of: affection, social greeting, talk that expresses an interest in another, and giving help)
	Low-level interaction—Looking, close proximity, functional communication, and repetitive behaviors
	Negative interaction—Physical/verbal aggression and avoidance
Social Skills Rating Scale—Teacher Version (SSRS-T; Gresham & Elliott, 1990)	*Cooperation*: "Easily makes transition from one classroom activity to another"
	Assertion: "Joins ongoing activity or group without being told to do so"
	Self-control: "Compromises in conflict situations by changing own ideas to reach agreement"
Social Cognition	
Social understanding of social scenarios:	*Activity-passivity*—scored as 1 if story character suggested an active step to solve the problem, and 0 if the problem resolved itself
Problem Solving Measure (Lochman & Lampron, 1986)	*Relevancy*—scored as 1 if the proposed solution led to the given end, and scored as 0 if the solution was irrelevant
	Four content-type solutions:
	Help—story character offered or asked for help as a solution to the problem
	Social solution—the character suggested a solution that involved direct social interaction with peers (e.g., "Let's play")
	Non-social solution—the character solved the problem in a non-social way (e.g., "Dan took a ladder and got the ball out of the tree")
	Non-confrontational—the solution dealt with other issues such as the character's feelings but ignored the problem (e.g., "Dan sat and cried")
Emotional knowledge: *Emotion Inventory* (Seidner *et al.*, 1988)	*Knowledge*—emotions for which the child was able to provide an example (scored 0,1)
	Audience—child's awareness of another person observing him/her while the child experienced that emotion (2 = explicit inclusion of audience, 1 = implicit inclusion of audience, 0 = audience absent)
	Specificity:
	General (0)—when the child provided a broad stereotypical example
	Specific (1)—when the example referred to a particular, possibly personal experience in the child's mind
Measures Unique to Current Study	
Emotional Recognition	
Affective Matching Measure (Bauminger *et al.*, 2005)	Example: to tap embarrassment, the participant received a picture depicting a boy losing a race while his friends laugh at him
	Coding
	Accuracy of emotion identification ("How does the boy/girl in the picture feel?")—0 for incorrect identification (e.g., sad instead of happy); 1 for an emotion with the same hedonic tone (e.g., angry instead of sad); 2 for correct identification
	Relevancy of explanation ("Why?")—relevant = 1, irrelevant = 0
Self-Reports	
Self-Perception Profile for Children (Harter, 1985)	Scholastic competence: Does well at school work
	Social acceptance: Has a lot of friends
	Athletic competence: Does well at different sports
	Physical appearance: Likes one's body
	Behavioral conduct: Usually does the right things
	General self-worth: Is happy with oneself
Loneliness Rating Scale (Asher *et al.*, 1984)	Sixteen items focusing on feelings of loneliness and social dissatisfaction: "I have nobody to talk to in class"

Measures Replicating Bauminger ([2002](#))

Actual Social Behavior and Manifest Social Skills

Observations of Social Interaction

The Social Interaction Observation Scale (Bauminger, [2002](#); Bauminger *et al.*, [2003](#)) tapped changes in participants' actual social interaction capabilities. Children were observed interacting with peers unrelated to the intervention during school recesses for two 15-min periods before treatment, two 15-min periods after treatment, and two 15-min period 4 months after completion of treatment. In most cases, observations took place on six different days. The observer watched the child's behaviors for 50 s and then recorded them for 10 s. As seen in Table [1](#), the observers coded the appearance of initiations and responses along three main social interaction categories: positive, low-level, and negative. Three different observers underwent training in observing HF children with ASD who were not associated with the current project, over a period of a month to obtain an inter-observer agreement level of 90%. All three observers were MA students in special education who were familiar with the current population. Observers were blind to study hypotheses and goals. The observers were assigned to the same children at each of the three intervals.

Teacher-Rated Social Skills

The 30-item Social Skills Rating Scale—Teacher Version (SSRS-T; Gresham & Elliot, [1990](#)) measured children's change in overall social skills capabilities. The scale included three 10-item subscales, rated on a three-point frequency scale (often true, sometimes true or never true): Cooperation ($\alpha = .79$); Assertion ($\alpha = .85$); and Self-Control ($\alpha = .89$). Unlike Bauminger ([2002](#)), in the current study two teachers completed the questionnaire for each child: the special education teacher who actually implemented the intervention and the child's regular teacher who was uninvolved in the training.

Social Cognition: Social and Emotional Understanding

Problem Solving

The Problem-Solving Measure (PSM) (Lochman & Lampron, [1986](#)) assessed children's problem-solving skills through nine hypothetical social problems (e.g.,

initiating a conversation and play with a friend, coping with teasing). Each contained a beginning and an end, and the child was asked to compose possible solutions to the given problem. Coding procedure is detailed in Table [1](#). Interrater agreement between two coders on 40% of children's responses was 95% for the active–passive category, 100% for relevancy, and 90% for content areas.

Emotional Knowledge

The Emotion Inventory (Seidner, Stipek, & Feshbach, [1988](#)) assessed children's ability to provide an example of a time they experienced each of four simple emotions (happy, sad, fear, and anger) and six complex emotions (pride, embarrassment, loneliness, guilt, affection, and jealousy). Two coders assigned scores in three domains (Seidner *et al.*, [1988](#)): knowledge, audience, and specificity (see Table [1](#)). Interrater agreement between two coders on 40% of children's examples was 85% for audience and 100% for general versus specific.

Measures Added to the Original Bauminger ([2002](#)) Study

Emotional Recognition

The Affective Matching Measure (Bauminger, Shorr-Edelsztein & Morash, [2005](#); adaptation of N. Feshbach, 1993, Unpublished data) assessed children's ability to recognize emotions from their social context. The child received 12 different pictures depicting social scenarios of eight different emotions: one picture for each of four basic emotions (happiness, sadness, anger, and fear) and two different pictures for each of four complex emotions (embarrassment, loneliness, guilt, and pride). In each picture, one of the figures (a child) was presented without facial expression; therefore, the picture's social context provided the clues for participants' identification of the appropriate emotion. Children's answers were coded according to: accuracy of emotion identification and explanation's relevancy (see Table [1](#)). Two coders coded the same 40% of children's answers and obtained 100% interrater agreement on accuracy and relevancy.

Self-Perceptions

The Self-Perception Profile for Children (S. Harter, 1985, Unpublished data) consisted of a 36-item self-report to assess children's perceptions of themselves

across six domains: scholastic competence ($\alpha = .75$); social acceptance ($\alpha = .70$); athletic competence ($\alpha = .54$); physical appearance ($\alpha = .82$); behavioral conduct ($\alpha = .70$); and general self-worth ($\alpha = .55$). The examiner presented the child with a question such as: "Some kids find it hard to make friends, but for other kids it's pretty easy." The child indicated which of the two types of children he or she most resembled, and then to decide whether the description was "sort of true" or "really true." The score for each item ranged from perceived low competence (1) to perceived high competence (4). Scores for each six-item subscale were summed and then averaged.

Loneliness

The Loneliness Rating Scale (Asher, Hymel, & Renshaw, 1984) included 24-items rated on a five-point scale (1 = not true; 5 = always true). Sixteen items focused on feelings of loneliness and social dissatisfaction, and eight filler items covered hobbies, interests, and school subject preferences. Child's perceived loneliness was calculated based on the 16 loneliness items, with higher scores indicating a greater sense of loneliness ($\alpha = .85$).

Results

Overt Social Behavior: Social Interaction

Overall, descriptive analyses of the three major observation categories (e.g., positive, low-level, and negative) revealed that at Time 1 (pre-test) most of the children's behaviors were coded as low-level behaviors, whereas after treatment the low-level behaviors appeared at a rate similar to positive interactions (see Table 2). Negative interaction behaviors were infrequent both before and after treatment. A 2×2 analysis of variance (ANOVA) for Time 1/Time 2 × Initiations/Responses behavior type, with repeated measures on time, was conducted for each of the three major social interaction categories (positive, low-level, and negative) and for the specific behaviors within each of these three categories.

Positive Social Interaction Behaviors

Results for the positive social category revealed a significant main effect for time only, $F(1, 18) = 5.72$, $p < .05$, $\eta^2 = 24$. As seen in Table 2, HF children with ASD were more likely to initiate and respond positively to peers at the post-test interval than at pre-test. Results of the repeated ANOVAs (time × type of behavior) for the examination of change in *specific* positive behaviors yielded two significant main effects for time, where HF children with ASD revealed more initiations and responses of both behaviors after treatment: in eye contact, $F(1, 18) = 5.63$, $p < .05$, $\eta^2 = .24$ ($M = 4.84$, SD = 4.69 at Time 1 and $M = 7.84$, SD = 5.55 at Time 2), and in sharing behavior, $F(1, 18) = 4.20$, $p < .05$, $\eta^2 = .19$ ($M = 4.36$, SD = 4.21 at Time 1 and $M = 12.08$, SD = 10.26 at Time 2). A significant effect for behavior type (initiation/response) emerged only for social communication, where, regardless of treatment, HF children with ASD were more likely to initiate ($M = 3.25$, SD = 4.66) than to respond ($M = .99$, SD = 1.63) in social communication, $F(1, 18) = 7.18$, $p < .05$, $\eta^2 = .28$. No significant time × behavior type effects emerged for any of the variables.

Low-Level Social Interaction Behaviors

Results for the low-level interaction category revealed a significant main effect for time only, $F(1, 18) = 4.94$, $p < .05$, $\eta^2 = .21$. HF children with ASD were less likely to initiate and respond using low-level behaviors to peers after treatment (see Table 2). Results of the repeated ANOVAs (time × type of behavior) for the examination of change in *specific* low-level behaviors yielded only two significant behavior type effects: for close proximity, $F(1, 18) = 22.59$, $p < .001$, $\eta^2 = .55$, and for functional communication, $F(1, 18) = 7.02$,

Table 2 Differences Between Times 1 and 2 on Three Major Categories of Observed Social Interaction

Social interaction category	Behavior type				Time	
	Initiations		Responses		F(1,18)	η^2
	Time 1	Time 2	Time 1	Time 2		
Positive M (SD)	9.78 (6.86)	15.68 (8.09)	10.31 (7.29)	14.21 (9.36)	5.72*	.24
Low-level M (SD)	20.10 (9.75)	14.00 (7.78)	16.00 (6.86)	12.95 (5.04)	4.94*	.21
Negative M (SD)	2.52 (3.11)	1.16 (1.74)	1.68 (1.70)	1.73 (1.82)	.99	.05

* $p < .05$

$p < .05$, $\eta^2 = .28$. In both behaviors, HF children with ASD initiated ($M = 8.84$, SD = 8.72; $M = 1.15$, SD = 2.18, respectively) more than they responded ($M = 2.58$, SD = 3.81; $M = .32$, SD = .94, respectively), regardless of treatment.

Negative Social Interaction Behaviors

Initiations and responses of negative social interactions were very few before and after treatment; therefore, analysis only tested the time effect for the global negative interaction scale, which was non-significant.

Social Skills: Teacher-Reported Overall Social Skills

At the pre-test interval, no significant differences emerged between the reports by the two teachers (special education, regular teacher). Children's scores on the SSRS-T from both teachers were compared using 2×2 (time $\times$ teacher type) multivariate analysis of variance (MANOVA) with repeated measures on time for the three social skills subscales (cooperation, assertion, and self-control) as the dependent variables. Results of the MANOVA revealed a significant main effect for time only, $F(3, 16) = 7.47$, $p = .002$, $\eta^2 = .58$. Follow-up ANOVAs demonstrated significant improvement from pre-test to post-test on all three areas of social skills (see Table 3).

Social and Emotional Understanding

Problem Solving

A MANOVA with repeated measures (time: before/after intervention) was conducted for the following problem-solving categories: activity, passivity, and relevancy of solution. Results showed a significant effect for time, F(Wilks criterion) (3, 16) = 6.63, $p < .01$, $\eta^2 = .55$. Follow-up univariate ANOVAs revealed that the differences between Times 1 and 2 stemmed from significant differences in relevancy,

$F(1, 18) = 5.21$, $p < .05$, $\eta^2 = .22$, and in passivity, $F(1, 18) = 17.18$, $p < .001$, $\eta^2 = .48$. After treatment, HF children with ASD suggested significantly more relevant solutions ($M = 7.84$, SD = 1.25 at Time 1 and $M = 8.31$, SD = 1.24, at Time 2) and significantly fewer passive solutions ($M = 7.05$, SD = 3.73 at Time 1 and $M = 3.89$, SD = 2.15 at Time 2).

To examine whether a change occurred over time in the percentages of the different content-type domains, a 2×4 (time $\times$ content dimension) univariate ANOVA with repeated measures on time (before and after training) and on content dimension (help/social/non-social/non-confrontational) was conducted. Results were significant for content dimension, $F(3, 54) = 11.26$, $p < .001$, $\eta^2 = .38$, and for the time $\times$ content dimension interaction, $F(3, 54) = 3.40$, $p < .05$, $\eta^2 = .16$. To determine the source of the significant interaction, a series of univariate analyses with repeated measures on time (before/after) was computed for the different content dimensions. These revealed significant differences for social and non-social solutions and a tendency toward significance for solutions involving help. Compared with the pre-test scores, children in the post-test provided fewer non-social solutions, $F(1, 18) = 4.90$, $p < .05$, $\eta^2 = .21$ ($M = 14.80$, SD = 14.94 at Time 1 and $M = 9.85$, SD = 11.57 at Time 2); more social solutions, $F(1, 18) = 4.74$, $p < .05$, $\eta^2 = .21$ ($M = 34.28$, SD = 18.54 at Time 1 and $M = 43.82$, SD = 18.54 at Time 2); and a tendency to also provide more help-seeking solutions, $F(1, 18) = 4.05$, $p = .059$, $\eta^2 = .18$ ($M = 14.62$, SD = 9.40 at Time 1 and $M = 20.84$, SD = 11.48 at Time 2).

Emotional Knowledge

A series of MANOVA analyses (Wilks criterion) with repeated measures on time (before and after treatment) was conducted to examine change in each of the three domains of the Emotion Inventory (knowledge, audience, and specificity) for basic emotions, complex emotions, and the overall score (i.e., combined for basic and complex).

Table 3 Differences Between Times 1 and 2 on Teacher-Reported Social Skills

Social skill	Special education teacher		Regular class teacher		Time	
	Time 1	Time 2	Time 1	Time 2	F(1,18)	η^2
Cooperation M (SD)	1.21 (.59)	1.42 (.57)	1.11 (.62)	1.18 (.56)	4.88*	.21
Assertion M (SD)	.62 (.42)	.94 (.49)	.75 (.52)	.92 (.50)	15.14**	.45
Self-control M (SD)	.84 (.48)	1.03 (.50)	.65 (.44)	1.04 (.54)	18.51**	.51

* $p < .05$
** $p < .001$

First, the MANOVA for emotional knowledge yielded a significant time effect, $F(2, 17) = 17.53$, $p < .001$, $\eta^2 = .67$. Follow-up ANOVAs demonstrated improvement in children's ability to explain complex emotions and in their overall ability to explain emotions, after treatment. Second, the MANOVA for attribution of an audience yielded no significant time effect, $F(2, 17) = 2.82$, $p = .08$, $\eta^2 = .25$. However, ANOVAs examining the differences on basic, complex, and overall emotion scores revealed significant progress after treatment in children's ability to attribute an audience to the examples of complex emotions. Third, the MANOVA for specificity of examples yielded a significant time effect, $F(2, 17) = 3.53$, $p < .05$, $\eta^2 = 29$. Follow-up ANOVAs revealed significant differences over time on complex emotions and on the overall score. Children could provide more specific examples of complex emotions after treatment. Means, standard deviations, and F-values for knowledge, audience and specificity are presented in Table 4.

Emotional Recognition

Two MANOVAs with repeated measures for time were conducted for recognition and relevancy of basic and complex emotions and revealed significant time effects: $F(2, 17) = 6.88$, $p < .01$, $\eta^2 = .45$ for recognition; and $F(2, 17) = 4.21$, $p < .05$, $\eta^2 = .33$ for relevancy.

Follow-up univariate ANOVAs for recognition revealed a significant time difference for complex emotions, $F(1, 18) = 13.07$, $p < .01$, $\eta^2 = .43$ ($M = 9.10$, SD = 2.51 at Time 1 and $M = 10.74$, SD = 2.30 at Time 2) but not for the recognition of

basic emotions, $F(1, 18) = 1.48$, $p > .05$, $\eta^2 = .07$ ($M = 10.21$, SD = 3.93 at Time 1 and $M = 11.57$, SD = 2.71). Univariate analyses for relevancy revealed a significant improvement over time in basic emotions, $F(1, 18) = 5.70$, $p < .05$, $\eta^2 = .24$ ($M = 6.73$, SD = 1.19 at Time 1 and $M = 7.58$, SD = .83 at Time 2) and in complex emotions, $F(1, 18) = 4.21$, $p < .05$, $\eta^2 = .19$ ($M = 5.94$, SD = 1.68 at Time 1 and $M = 6.58$, SD = 1.38 at Time 2).

Self-Perception and Loneliness

The MANOVA with repeated measures on time yielded no significant time effect on the self-perception questionnaire, $F(6, 13) = .41$, $p > .05$. Similarly, a univariate ANOVA with repeated measures on time for the global sense of loneliness revealed no significant effect for time, $F(1, 18) = .24$, $p > .05$ ($M = 2.46$, SD = .85 at Time 1 and $M = 2.55$, SD = .49 at Time 2).

Follow-Up on Long-Term Efficacy of Children's Social Interaction

In examining the treatment's effect on children's social interactions 4 months later, only 16 of 19 children were included in analyses because three children had moved to a different school. This subset of children resembled the full sample from Study 1 in their CA (ranging from 7;7 to 11;00) and their IQ scores (verbal: $M = 103.80$, SD = 13.26; performance: $M = 110$, SD = 8.59; full: $M = 107.93$, SD = 8.60).

A MANOVA with repeated measures on time (before intervention = Time 1; immediately after intervention = Time 2; and 4 months after intervention = Time 3) was calculated for positive, low-level, and negative categories of social interactions, revealing a main effect of time, $F(3, 13) = 4.63$, $p < .01$, $\eta^2 = .73$. Simple effects for positive interactions revealed a tendency toward improvement over time between Times 1 and 3, $F(1, 15) = 3.78$, $p = .07$, $\eta^2 = .20$, and also between Times 2 and 3, $F(1, 15) = 3.60$, $p = .07$, $\eta^2 = .19$. Simple effects for low-level interactions revealed a significant decrease over time, between Times 1 and 3, $F(1, 15) = 12.43$, $p < .01$, $\eta^2 = .45$. No significant time change emerged for negative interaction. Means and standard deviations are presented in Table 5.

Table 4 Means, Standard Deviations, and F Values for the Three Emotional Understanding Domains

	Time 1 M (SD)	Time 2 M (SD)	Time differences $F(1, 18)$	η^2
Knowledge				
Basic	3.63 (.83)	3.89 (.31)	2.44	.12
Complex	2.79 (1.75)	4.74 (1.24)	37.11***	.67
Overall	6.42 (2.26)	8.63 (1.30)	31.43***	.63
Audience				
Basic	2.05 (1.50)	1.94 (1.68)	.03	.00
Complex	2.10 (2.05)	3.42 (2.94)	4.93*	.21
Overall	4.15 (2.94)	5.36 (3.93)	1.63	.08
Specificity				
Basic	2.94 (.91)	3.36 (.76)	2.67	.13
Complex	2.15 (1.67)	3.47 (1.54)	7.39**	.29
Overall	5.10 (2.35)	6.84 (1.89)	7.08*	.28

* $p < .05$

** $p < .01$

*** $p < .001$

Discussion

Current study reexamined the effectiveness of Bauminger's (2002) individual CB-E social intervention including several modifications in assessment

Table 5 Follow-Up Observations: Means and Standard Deviations for Differences Over Time on the Three Major Categories of Observed Social Interaction

Social interaction	Time 1 (n = 16)	Time 2 (n = 16)	Time 3 (n = 16)
Positive M (SD)	24.87 (13.84)	26.43 (20.95)	33.87 (23.29)
Low-level M (SD)	37.06 (15.57)	28.62 (8.66)	26.56 (10.51)
Negative M (SD)	4.18 (4.43)	2.56 (2.42)	2.56 (1.99)

procedures (e.g., utilizing blind observers and reports from a teacher who was unconnected with the study's implementation) to increase the reliability of the generalization of the study's gain. In general, results of the current study highly corresponded with those of the previous study in both social cognition and social interaction measures.

In overt social behavior, children improved their positive social behaviors such as eye contact and sharing immediately after treatment and tended to show improvement 4 months later. The fact that HF children with ASD increased their effective positive social behaviors with peers who were unrelated to the intervention during non-structured social settings (school recesses), in both studies and in follow up, may lead to cautious conclusions (because no control group teased out natural maturation effects) about the efficacy of such a model for enhancing this population's positive social behaviors. Support for this conclusion also may be obtained from the children's higher social skills (especially in cooperation and assertion) as reported by teachers in both studies, after treatment, including one teacher unconnected with the intervention.

Differences were noted between the two studies with regard to low-level social behaviors. In the 2002 study, after treatment, children increased their general low-level social behaviors in peer interaction, mainly due to an increase in functional behavior, whereas in the current study low-level behaviors decreased significantly. It may be that the current participants' higher mental and social level (compared with children in the 2002 study) enabled them to transform their low-level interactions (e.g., functional communication) into the more competent form of positive interactions. Indeed at pre-test, most of the current sample's behaviors were coded as low-level, whereas after treatment low-level behaviors appeared at a similar frequency as positive interactions. Differences between studies may perhaps suggest that intervention outcomes relate to children's level of functioning, although all are considered HF children with ASD.

On the other hand, the current study closely resembled the earlier study regarding social cognition

outcomes, with children in both studies demonstrating progress in their problem-solving abilities and providing more relevant, socially focused solutions to social situations after treatment. The greatest achievements in emotional knowledge were noted in comprehending complex emotions. Thus, in line with other recent CBT interventions (e.g., Ozonoff & Miller, 1995; Hadwin et al., 1996; Gray, 1998; Attwood, 2003, 2004; Solomon et al., 2004), results of these two studies suggest that SST that incorporates CBT may potentially lessen social cognition deficits in HF children with ASD.

Surprisingly, despite the improvement in children's social functioning, changes in perceived self-concept or loneliness feelings did not emerge. Loneliness was rated as average both before and after treatment; thus, perhaps loneliness did not pose a problem for the children in this study. In terms of self-concept, a deeper intervention process that focuses more on cognitive reconstructing of self-image may be necessary to demonstrate change in such a deep internal construct.

The current study did not overcome an important limitation of the 2002 study—its lack of a control group. Due to the study's implementation within the school system, schools agreed to cooperate on the condition that the intervention be performed with all children who were eligible for treatment, therefore precluding the establishment of a waiting list during the school year. Thus, the question of treatment efficacy in comparison with a no-treatment group or with a group undergoing a different treatment model remains to be explored. Also, the current program's individual focus does not provide information on these children's abilities to function efficiently within a group. Therefore, a second year of intervention was executed that focused on the evaluation of the efficacy of a CB-E group-centered social intervention as described in Bauminger (in press).

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