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BRIEF REPORT

Brief Report: Group Social-Multimodal Intervention for HFASD

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Abstract Current study is the second part of a 2-year cognitive-behavioral-ecological (CB-E) intervention for high-functioning (HF) children with autism spectrum disorder (ASD). We examined the utility of a group-centered intervention on children's ability to interact cooperatively with peers during structured and non-structured social situations. Direct (e.g., social problem solving) and indirect (theory of mind; executive function) treatment effects on social cognitive capabilities were also examined. Participants were 26 preadolescent HF children with ASD. Study results demonstrated direct and indirect treatment effects on social cognition and mixed results regarding children's social interaction capabilities. Although children's cooperative capabilities within the intervention group improved, dyadic, and group social interactions during school recess did not. Discussion focused on the utility of such group-intervention in increasing social functioning.

Keywords High-functioning children with autism · Asperger syndrome · Social skill intervention · Cognitive behavior therapy · Group intervention

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Introduction

Ongoing group interactions comprise a unique area of difficulty for high-functioning (HF) children with autism spectrum disorder (ASD), inasmuch as such interactions require complex listening skills, theory of mind capabilities, and conversational and cooperative skills (Travis & Sigman, 1998; Sigman & Ruskin, 1999; Klin & Volkmar, 2000), which are considered to be core deficits in ASD (American Psychiatric Association, 2000). However, the social-emotional deficit in ASD is multifaceted and encompasses difficulties in social cognitive processes (e.g., social-emotional knowledge, social problem solving) in addition to children's difficulties in peer group interaction (Howlin, 1998; Klin & Volkmar, 2000; Krasny, Williams, Provencal, & Ozonoff, 2003; Frith, 2004). Thus, intervention should be designed to enhance integral social-emotional functioning in HF children with ASD, including their social interaction and social cognitive capabilities.

The current study is part of a 2-year comprehensive project examining the effectiveness of a multi-modal cognitive-behavioral (e.g., Hart & Morgan, 1993; Ronen, 1998), ecological (Bronfenbrenner, 1979, 1992), social skills training (SST) intervention. This SST aimed to enhance social-emotional understanding and dyadic and group cooperative social interaction with peers among HF children with ASD over 2 years: individual training in the first year and group training in the second year. A more thorough description of the social-emotional deficit and of the implementation of the first-year individual cognitive-behavioral-ecological (CB-E) intervention for HF children with ASD is provided in Bauminger (in press—in this volume).

Study-Specific Aims

To Examine the Efficacy of a CB-E Group-centered Intervention on:

Social behavior: (a) ability to interact cooperatively with peers during a structured group social situation; and (b) dyadic and group social interaction in a non-structured social situation (school recess).

Social cognitive capabilities: (a) *direct* treatment effects including social problem solving, emotion knowledge, and recognition; and (b) *indirect* treatment effects including theory of mind and executive functions (sorting).

Based on former CB-E results, improvement in social cognition could be hypothesized as a result of treatment, as reflected in problem solving and in emotion knowledge and recognition. Improvement in problem solving may lead to better executive function capabilities. Children's increase in cooperative skills within the group could also be hypothesized, but children's group interaction outside the intervention group was difficult to predict.

Methods

Participants

Current Study included 26 HF children with ASD divided into two separate groups. The first group (termed the ''original group'') included 11 children (seven HF-ASD and four Asperger's syndrome; one girl) who participated in the individual intervention during the first year of the project (Bauminger, in press) and whose educational settings were willing and available to implement another year of social intervention and to meet the requirements of the second-year group-intervention. Altogether, eight children did not continue from year 1 to 2, including two children who moved to a different school setting that did not meet the study requirements, one child who refused to continue in the second year because he insisted that he no longer needed treatment, and five children whose schools dropped out of the program, due to principals' transitions.

To increase the strength of the examination of study effectiveness, another group of 15 children (ten HF-ASD and five Asperger's; one girl) was recruited and matched to the 11 from the original group on: CA; verbal, performance, and full IQ scores; and ADI-R social, communication, and behavior scores (see Table 1 for participants' characteristics). All clinical diagnoses derived from prior assessment using the *DSM-IV* (American Psychiatric Association, 1994) by licensed psychologists within the child's educational system who were not associated with the current study. Children's clinical diagnosis was verified in this study by the ADI-R (Lord, Rutter, & LeCouteur, 1994). Recruitment and selection processes resembled the first-year individual intervention (see Bauminger, in press).

CB-E intervention: Peer-group Cooperative Skills and Related Social Cognitions

Procedure

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 implemented in the child's school, within teacher-led small groups of peers that included both typical age-mates and HF children with ASD and met twice weekly in the school to work on the intervention curriculum. The intervention lasted 7 months and was implemented by each child's special education teacher, who specialized in HF children with ASD. Each of the HF children with ASD also met individually once weekly with the teacher to rehearse, practice, and clarify issues that were taught in the small-group sessions. Each peer group included two typical peers (of the same age as HF children with ASD) and between 1 and 3 HF children with ASD. Altogether, the schools formed three groups of five children each (two typical and three HF-ASD); six groups of four children each (two typical and two HF-ASD); and five groups of three children each (two typical and one HF-ASD). The research coordinator

Table 1 Participants' ages, IQ Scores, and ADI-R Scores

	Original group (n = 11)	Newly recruited group (n = 15)	Group differences (t_{24})
CA (in months)			
M (SD)	105.40 (7.24)	110.78 (15.06)	1.09
Verbal IQ			
M (SD)	104.09 (14.28)	110.62 (14.44)	1.10
Performance IQ			
M (SD)	109.73 (9.12)	116.92 (16.44)	1.29
Full IQ			
M (SD)	108.09 (8.62)	115.08 (13.68)	1.46
ADI Social			
M (SD)	17.45 (3.90)	17.64 (3.62)	0.12
ADI Communication			
M (SD)	13.27 (4.88)	13.71 (4.28)	0.24
ADI Behavior			
M (SD)	5.00 (1.34)	5.79 (1.52)	1.34

supported each teacher in her school once monthly, and teachers underwent extensive training before beginning the group intervention.

Curriculum: Conceptual Basis and Structure

Each group lesson included both a teaching process and practice. The teaching process aimed to provide a ''definition'' and a set of ''rules'' to help the children understand the social context of each learned social construct or skill. Practicing enabled rehearsal of each learned skill within the small-group setting. Based on the CBT model, the teaching process incorporated interpersonal problem solving based on short social vignettes as stimulation for discussion concerning the required social skill, as well as affective education and cognitive reconstructing using cartoon figures (Gray, 1998) to demonstrate the differences between what a person may think, say, and feel and also to demonstrate interaction states between children. Group interaction was taught through participation in cooperative social group activities and through role play with the child's age-mates.

The SST intervention comprised 50 lessons that focused on understanding social group behavior and practicing such behavior within this setting. The lessons covered the following five topics: (a) instruction in prerequisite concepts for group involvement, such as what a group is, activities that can be held within a group, group rules of behavior like how to listen and take turns; (b) affective education focusing mainly on higher processes of emotional understanding, such as comprehending verbal and non-verbal social-emotional and behavioral markers of complex emotions, grasping rules for displaying emotions and mixed emotions; (c) group conversation skills; (d) cooperative skills, beginning with the definition of cooperation as shared interactive activity, mutual planning, and shared implementation of different social tasks, and continuing with a focus on the separate prosocial skills necessary for effective cooperation such as compromising, encouraging, comforting; and (e) double message issues such as recognizing cynicism or irony.

Assessment Measures

In line with the current study objectives, Study's comprehensive assessment battery included assessment of: (a) children's change in overt cooperative skills within and outside the group; and (b) direct (e.g., problem solving, emotional understanding) and indirect (e.g., theory of mind) treatment effects on children's social cognition. All measures were administered twice, immediately before and immediately after treatment. The same three MA students in special education from the first-year individual intervention (Bauminger, in press) also collected data in the current study, again blind to study hypotheses and goals.

Cooperative Skills

Companionship Measure (N. Bauminger, 2004, unpublished data)

The companionship measure was developed to assess change in children's ability to interact more efficiently with their peer group. Children were assessed within their assigned small groups. The group received a large blank sheet of paper, a box of colored markers, children's magazines, scissors, glue, and instructions to design a shared picture during a 20-minute time period. One observer recorded the verbal and non-verbal behaviors of the HF children with ASD in the group, for the following five categories: (a) mutual planning; (b) cooperative behavior; (c) negotiation; (d) eye contact; and (e) sharing. Immediately after the observation, the observer coded children's behaviors along a 5-point frequency scale: *Did not appear at all* (1), *Appeared less than 50% of observation time* (2), *Appeared half of the time* (3), *Appeared more than 50% of the time* (4), and *Appeared during the entire observation* (5). A global companionship score based on the total of the five behavior categories was also computed. In addition, the observer coded children's active involvement in the interaction in the role of either leader or follower, versus off-task time. Three observers underwent training for 1 month in observing and coding social interactions among children unassociated with the study during school scenarios such as lunch, art, sport, and music lessons. Training ended when observers reached overall interrater agreement of 90% or above on recording children's interactions and on the post-observation coding process (see Appendix for description of the categories).

Observations of Social Interaction

The group intervention included the same Social Interaction Observation Scale (Bauminger, 2002; Bauminger, Shulman, & Agam, 2003) as in the individual intervention to tap changes in participants' actual social interaction capabilities along the same three main categories: positive, low-level, and negative social interactions. (For an expanded description of the observation scale and its categories, see Bauminger, in press.). However, due to the current study's focus on groups, the coding of children's initiations and

responses was replaced with the coding of peer setting for children's interactions during school recesses: within small-group situations versus within dyadic situations.

Social Understanding: Assessment of Direct Effects

Problem Solving

The same Problem-Solving Measure (Lochman & Lampron, 1986) as implemented in the individual intervention (Bauminger, in press) was used here; however, this version included three additional hypothetical social problems that were directly related to coping with group interactions, such as entry into a group's social conversation. Thus, the measure comprised 12 stories. In addition, raters in the current study also coded whether children's solutions to the given problems described the story character as an initiator or a respondent.

Social Understanding: Assessment of Indirect Effects

Theory of Mind: Strange Story Measure

The strange story measured children's progress in their theory of mind capabilities as a result of indirect treatment effects. Five of Happe's (1994) ''Strange Stories'' (lie, white lie, persuade, double bluff, and hiding emotions) were utilized to assess children's understanding of another person's motivation to make utterances that are not literally true. At the end of each story, the examiner asked the child a comprehension question (''Was it true, what X said?'') (1 = correct, 0 = incorrect) and a justification question (''Why did X say that?'') (incorrect = 0; incomplete or partially correct = 1; full and complete answer = 2).

Executive Functions

The sorting subtest of the Delis Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2001) was utilized to assess executive functions. The D-KEFS sorting subtest is considered a test of conceptualization and reasoning skills, problem solving, and cognitive flexibility. The subtest consisted of two testing conditions: free sorting to assess ability to sort spontaneously, and sort recognition to identify sort strategies utilized by the examiner. In the free sorting condition, the child received two sets of six shuffled cards that displayed both perceptual stimuli and printed words, thus giving participants the option of relying on non-verbal or verbal sorting strategies. The examiner asked the child to sort the cards into two groups, three cards per group, according to as many different categorization rules or concepts as possible, and then to describe the concepts or strategies that he or she used to generate each sort. Each of the two card sets could be grouped into a maximum of eight target sorts, thus yielding a total of 16 possible strategies. In the sort recognition condition, the examiner sorted the same two sets of cards separately, each sorted into two groups with three cards per group according to the eight target sorts, for a total of 16 sorts. After each sort made by the examiner, she asked the child to attempt to identify the correct categorization strategy, rule, or concept used to generate the sort. Altogether, three scores (each out of a possible 16) were obtained: (a) the sorting score: the total number of free sorts completed; (b) the sorting description score: the total number of free sorting strategies described by the child; and (c) the recognition description score: the total number of examiner sorting strategies recognized and described by the child. Each child's raw score was transferred into a scaled score based on the child's CA, with a mean score of 10 and SD = 3 for each of the three categories (sorting, sorting description, and recognition description). The D-KEFS sorting subtest has exhibited acceptable levels of internal consistency, test–retest reliability, and validity.

Emotional Understanding

Emotional Recognition and Knowledge

Similarly to the individual intervention (Bauminger, in press), the group intervention also implemented both the Affective Matching Measure (adaptation of N. Feshbach, 1993, unpublished data; Bauminger, Shorr-Edelsztein, & Morash, 2005) and the Emotion Inventory (Seidner, Stipek, & Feshbach, 1988) to assess, respectively, children's ability to recognize emotions from their social context and their knowledge about basic and complex emotions. However, in the group intervention, beyond analysis of the Emotion Inventory's scores in the three domains (knowledge, audience, and specificity), an emotion's definition domain was added. Two raters coded each of the children's emotion definitions as either correct (1) or incorrect (0). Moreover, in the current study, two complex emotions (disappointment and insult) were added to the six complex emotions utilized previously in the individual intervention (i.e., pride, embarrassment, loneliness, guilt, affection, and jealousy).

The two raters each coded the same 40% of the children's responses to these two emotion measures.

The raters obtained 100% agreement for recognitions' accuracy and for explanations' relevancy on the picture recognition task. They obtained 85% agreement on reference to an audience in children's examples in the emotion inventory and 100% agreement for the definition's accuracy, knowledge dimension, and specificity in that test.

Results

Cooperative Skills

Companionship Measure

Analyses of the companionship scores for the specific companionship behaviors (mutual planning, cooperation, eye contact, negotiation, and sharing), the global companionship score, and the score for active involvement in leader and follower roles revealed differences between the original group of participants and the new recruits at the pre-test interval. Therefore, the examination of group differences at the post-test interval controlled for Time 1 differences using univariate analysis of covariance (ANCOVA) for the global companionship variable and for the active involvement as leader/follower category and using multivariate ANCOVA (MANCOVA) for the five specific companionship behaviors.

Results of the ANCOVA for the global companionship score demonstrated a significant difference over time between the two groups, $F(1, 23) = 8.81, p < 0.01$, $\eta^2 = 0.27$. Newly recruited children who were higher in their global companionship ability before treatment also demonstrated a greater increase over time in this ability compared with the original group of children. An ANOVA with repeated measures on time (pre-test/post-test) conducted separately for each group revealed significant differences over time in each group as follows: Original group: $F(1, 10) = 4.80$, $p < 0.05$, $\eta^2 = 0.32$ ($M = 7.90$, SD = 2.38 at Time 1 and $M = 9.45$, SD = 2.58 at Time 2); New recruits group: $F(1, 14) = 15.83, p < 0.001, \eta^2 = 0.53$ ($M = 10.53$, SD = 2.19 at Time 1 and $M = 14.26$, SD = 3.10 at Time 2). Overall, the new recruits revealed a higher change over time, but both groups progressed in their global companionship ability over time.

Neither the ANCOVA for active involvement as leader/follower nor the MANCOVA for specific companionship behaviors was significant. Thus, time effects were examined for both groups together, using ANOVA with repeated measures on time for active involvement as leader/follower and MANOVA with repeated measures on time for the specific companionship behaviors. A significant main effect for time emerged for active involvement, $F(1, 25) = 6.06$, $p < 0.05$, $\eta^2 = 0.19$ (Time 1: $M = 3.03$, SD = 0.95; Time 2: $M = 3.69$, SD = 1.12). Children in both groups took a more active part in the group activities (whether as leaders or followers) after treatment. A significant time effect also emerged for three of five specific companionship behaviors, $F(5, 21) = 4.23$, $p < 0.01$, $\eta^2 = .89$. As seen in Table 2, children who participated in the intervention significantly progressed over time in their mutual planning, cooperation abilities, and ability to share.

Social Interaction Observation Scale

Analyses of the social interaction scores for the three main social interaction categories (positive, low-level, and negative; each divided into individual and group behaviors) did not reveal pre-test group differences. Therefore, a $2 \times 2 \times 2$ ANOVA (Time 1/Time 2 × Original/Newly recruited groups × Dyadic/Group peer interaction type), with repeated measures on time and on interaction type, was conducted for each of the three main categories (positive, low-level, and negative).

Results for the *positive social interaction* category revealed a significant effect only for dyadic/group interaction type, $F(1, 24) = 38.27, p < 0.001, \eta^2 = 0.61$. As seen in Table 3, children in both groups were more likely to perform dyadic interactions compared with group interactions, at both time intervals. Although the time × group × interaction type was not significant, an opposing trend did appear between the two groups of HF children with ASD, whereby the original group increased their dyadic behaviors and reduced their group behaviors over time, whereas the new recruits demonstrated a decrease in their dyadic behaviors and an increase in their group behaviors. In as much as only

Table 2 Means, standard deviations, *F*-values, and η for the specific companionship behaviors in HF children with ASD

Behavior	Time 1 ($n = 26$)		Time 2 ($n = 26$)		Time differences	
	M	SD	*M*	SD	$F(1, 24)$	η^2
Mutual planning	1.69	0.73	2.19	0.84	7.92**	0.24
Cooperation	2.08	1.16	3.58	1.39	23.40***	0.48
Eye contact	2.50	0.76	2.65	1.12	0.46	0.02
Negotiation	1.15	0.36	1.23	0.65	0.57	0.02
Sharing	2.00	0.93	2.58	1.20	5.11*	0.17

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

Table 3 Means and standard deviations for dyadic and group social behaviors on major categories of observed social interaction at pre-test and post-test among the two groups

Social interaction category	Original group (n = 11)				New recruits (n = 15)			
	Dyadic		Group		Dyadic		Group	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Positive								
M	25.45	29.45	8.27	4.36	34.86	27.73	9.86	14.26
SD	23.98	9.67	10.01	6.75	30.15	18.01	8.82	16.48
Low-level								
M	15.36	11.09	14.09	14.36	21.00	14.86	10.73	11.86
SD	10.26	5.50	7.10	4.41	15.40	10.02	8.14	7.33
Negative								
M	5.09	6.09	0.91	1.00	2.26	2.46	0.60	0.87
SD	5.32	4.82	1.22	1.34	2.21	3.90	1.12	1.41

the interaction type effect was significant, no follow up analyses were conducted to examine the time change for the specific positive behaviors (e.g., eye contact with and without a smile, etc.).

Results for the *low-level interaction* category revealed significant effects only for the interaction of time by dyadic/group type, $F(1, 24) = 6.70$, $p < 0.05$, $\eta^2 = 0.22$. Differences between dyadic and group behaviors were higher at Time 1 compared with Time 2, regardless of group. None of the follow-up repeated ANOVAs for the specific low-level behaviors (i.e., looking, close proximity, functional communication, and repetitive behaviors) emerged as significant.

Individual and group behaviors of *negative social interactions* were very few both before and after treatment (see Table 3); therefore, analysis only tested the intervention effect for the global negative interaction scale. Results of the ANOVA revealed a significant main effect for dyadic/group type, $F(1, 24) = 22.91$, $p < 0.001$, $\eta^2 = 0.48$, and also a significant interaction effect for dyadic/group type by original/newly recruited group, $F(1, 24) = 5.26$, $p < 0.05$, $\eta^2 = 0.18$. Children in both groups demonstrated more negative dyadic interactions than negative group interactions; however, differences within the original group between dyadic and group behaviors were higher compared with differences within the newly recruited group, regardless of time.

Social and Emotional Understanding: Direct and Indirect Effects of Treatment

Analyses of all social and emotional understanding measures did not reveal pre-test differences between the original group of participants and the new recruits.

Social Understanding: Direct Effects of Treatment

Problem Solving

A 2×2 (time $\times$ group) MANOVA with repeated measures on time was conducted for the following problem-solving categories: activity, passivity, relevancy, initiation, and response. The analysis was significant only for time effect, $F(5, 20) = 2.97$, $p < 0.05$, $\eta^2 = 0.42$. Follow-up ANOVAs revealed a significant difference only regarding initiation behaviors: children in both groups suggested significantly more solutions with the child as an initiator after treatment compared to before treatment, $F(1, 24) = 12.32$, $p < 0.01$, $\eta^2 = 0.34$ (Original group: $M = 4.72$, SD = 2.41 at Time 1 and $M = 6.54$, SD = 4.03 at Time 2; Newly recruited group: $M = 4.33$, SD = 2.52 at Time 1 and $M = 5.80$, SD = 2.33 at Time 2).

To examine differences over time in the content profile of children's solutions (i.e., help-seeking, social, non-social, and non-confrontational solutions), a $2 \times 2 \times 4$ (time $\times$ group $\times$ content) ANOVA with repeated measures on time and on content (in the percentages of the different content areas among the children's suggested solutions for the 12 hypothetical social problems) was computed. Results revealed a significant content effect, $F(3, 72) = 57.49$, $p < 0.001$, $\eta^2 = 0.70$, and a tendency toward significance for the time effect, $F(1, 24) = 4.00$, $p = 0.057$, $\eta^2 = 0.14$. To examine possible changes before and after treatment in the four specific content areas, a series of univariate analyses with repeated measures on time was computed. Results of the ANOVAs revealed a significant difference between Times 1 and 2 only for social solutions, $F(1, 24) = 4.44$, $p < 0.05$, $\eta^2 = 0.16$. After treatment, children in both groups suggested a higher number of social solutions (Original group: $M = 55.71$, SD = 17.80 at Time 1 and $M = 58.60$, SD = 23.74 at Time 2; Newly recruited group: $M = 47.25$, SD = 17.74 at Time 1 and $M = 59.32$, SD = 13.99 at Time 2).

Indirect Effects of Treatment

Theory of Mind: Strange Stories

Theory of mind change (comprehension and justification) was examined by a 2×2 (time $\times$ group) MANOVA with repeated measures on time. Results demonstrated a significant time effect, $F(2, 23) = 3.92$, $p < 0.05$, $\eta^2 = 0.25$. Univariate analyses for the two separate categories revealed a significant difference for justification only. Children in both groups could

provide a higher level of justification for the different stories after treatment. Comprehension scores were close to a ceiling effect at both time intervals (see Table 4).

Executive Functions: Sorting Subtest

A series of 2 × 2 (time × group) ANOVAs with repeated measures on time was conducted to examine time changes in children's executive functions dimensions (e.g., sorting, sorting description, and recognition description). As seen in Table 4, a significant main time effect emerged for both the ability to conceptualize and to recognize sorting strategies, and the time effect neared significance on the number of sorts completed. After treatment, HF children with ASD could provide richer conceptualizations of their sorting strategies and could recognize more sorting strategies generated by the examiner. Moreover, their own sorting ability tended to increase after treatment.

Emotional Understanding

Emotion Recognition

A 2 × 2 (time × group) MANOVA with repeated measures on time was conducted to examine time changes in children's emotional recognition capabilities. Significant effects emerged for time, $F(2, 23) = 20.70$, $p < 0.001$, $\eta^2 = 0.64$, and for the time by group interaction, $F(2, 23) = 3.54$, $p < 0.05$, $\eta^2 = 0.23$. Univariate ANOVAs demonstrated a significant time effect for recognition of both basic and complex emotions. Children demonstrated better recognition of both basic and complex emotions after treatment. Despite the significant time by group main interaction effect, univariate analyses for time by group only neared significance, both for basic emotions ($p = 0.057$) and for complex emotions ($p = 0.058$). Regarding children's progress in the relevancy of their explanations, a significant main effect for time emerged, $F(1, 24) = 8.74$, $p < 0.001$, $\eta^2 = 0.43$. As seen in Table 5, children's explanations for their correctly recognized basic and complex emotions became more relevant after treatment.

Emotion Knowledge

To examine changes in children's emotional knowledge before and after treatment (definition, knowledge, audience, and specificity), a series of 2 × 2 (time × group) MANOVAs with repeated measures on time was conducted for the four basic emotions, the eight complex emotions, and the overall combined score. The results of the MANOVA for the child's ability to define emotions yielded only a main effect for time, $F(2, 23) = 9.62$, $p < 0.001$, $\eta^2 = 0.45$. Follow-up ANOVAs demonstrated improvement after treatment in children's ability to define emotions in all three dimensions: basic, complex, and overall. Means, standard deviations, and *F*-values for the follow-up univariate analyses are provided in Table 5.

The MANOVA examining children's ability to provide examples of a time they experienced each of the emotions (i.e., knowledge) revealed a time effect that neared significance, $F(2, 23) = 2.60$, $p = 0.07$, $\eta^2 = 0.26$. Therefore, univariate analyses were also computed, which demonstrated progress after treatment in children's ability to provide examples of complex emotions (see Table 5). Similarly, results of the MANOVA for awareness of an audience only neared significance, $F(2, 23) = 3.01$, $p = 0.07$, $\eta^2 = 0.21$. Therefore, follow-up univariate analyses were also computed, which demonstrated an improvement after treatment in children's attribution of an audience in their examples of complex emotions and in their overall combined measure (see Table 5). The MANOVA examining changes in children's ability to provide specific personal examples of the different emotions after treatment was not significant, $F(2, 23) = 0.85$, $p > 0.05$, $\eta^2 = 0.06$; therefore, follow-up ANOVAs were not computed.

Discussion

The current study focused on investigating the efficacy of CB-E group intervention in enhancing the capabilities for group peer interaction and for overall social cognition (social and emotional understanding) among HF children with ASD. Findings regarding children's social cognition portrayed a consistent pattern of overall improvement after treatment along most of the variables measured. At the post-test interval, children in both groups (those continuing for a second year of intervention and new recruits) showed a more advanced ability to define and recognize emotions, social situations, and constructs (such as how to solve social problems by relating to social solutions more often). They also revealed a better understanding of others (in better justifying a person's activities in the strange stories) and improved awareness of others (in the more frequent inclusion of an audience for complex emotions). Thus, treatment appeared to be efficient in promoting social perception and problem-solving capabilities, which comprise essential components of

Table 4 Indirect treatment effects on social understanding: means, standard deviations, and *F*-values for theory of mind and executive functions measures at pre-test and post-test

	Original group (n = 11)		New recruits (n = 15)		Time differences	
	Time 1	Time 2	Time 1	Time 2	$F(1, 24)$	η^2
Theory of mind: strange stories						
Comprehension						
M	4.45	4.09	4.13	4.26	0.65	0.02
SD	1.03	1.37	0.91	0.45		
Justification						
M	3.63	4.18	4.20	5.40	8.12**	0.25
SD	2.46	2.35	3.02	2.35		
Executive functions: sorting						
Number of sorts performed						
M	9.18	10.45	8.13	9.46	4.01***	0.14
SD	2.18	2.84	4.27	2.94		
Strategies generated						
M	9.18	10.63	8.00	9.46	4.47*	0.16
SD	2.52	2.90	4.05	2.92		
Strategies recognized						
M	9.00	10.27	7.40	7.80	4.70*	0.16
SD	3.13	3.19	3.92	2.47		

* $p < 0.05$

** $p < 0.01$

*** $p = 0.056$

Table 5 Means, standard deviations, and *F*-values for the two measures of emotional understanding among the two groups at pre-test and post-test

	Original group (n = 11)		New recruits (n = 15)		Time differences	
	Time 1	Time 2	Time 1	Time 2	$F(1, 24)$	η^2
Emotion recognition: affective matching measure						
Recognition of emotion						
Basic *M* (SD)	10.90 (1.86)	13.81 (2.27)	11.60 (2.16)	12.66 (2.59)	18.54***	0.44
Complex *M* (SD)	11.18 (2.08)	12.27 (2.10)	10.46 (3.22)	13.20 (2.07)	21.45***	0.47
Relevancy of explanation						
Basic *M* (SD)	6.90 (1.04)	7.81 (0.60)	6.53 (1.76)	7.46 (1.18)	15.27***	0.39
Complex *M* (SD)	7.00 (0.77)	7.45 (0.82)	6.33 (1.45)	7.20 (0.94)	7.29**	0.23
Emotional knowledge: emotion inventory						
Definition accuracy						
Basic *M* (SD)	1.09 (1.51)	1.81 (1.40)	1.06 (1.33)	1.73 (1.33)	6.81**	0.22
Complex *M* (SD)	2.36 (2.01)	4.63 (2.57)	2.80 (2.56)	3.80 (2.33)	14.28***	0.37
Overall *M* (SD)	3.45 (3.41)	6.34 (3.61)	3.86 (3.64)	5.53 (3.29)	20.06***	0.45
Knowledge (number of emotions described)						
Basic *M* (SD)	3.45 (0.08)	3.72 (0.05)	3.40 (0.91)	3.60 (0.63)	1.50	0.05
Complex *M* (SD)	4.18 (2.56)	5.18 (2.13)	4.27 (2.43)	5.33 (2.16)	4.37*	0.15
Overall *M* (SD)	8.54 (4.22)	8.90 (2.30)	7.66 (2.79)	8.93 (2.43)	1.14	0.04
Audience awareness						
Basic *M* (SD)	4.15 (1.85)	4.75 (2.03)	5.31 (1.31)	5.62 (1.47)	1.19	0.04
Complex *M* (SD)	9.56 (5.84)	12.71 (2.33)	9.58 (3.61)	11.38 (3.15)	5.92*	0.20
Overall *M* (SD)	13.71 (6.77)	17.47 (4.01)	14.89 (4.04)	17.00 (3.73)	6.19*	0.20

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

social cognition. The current finding that CBT intervention effectively boosts social cognitive skills in HF children with ASD adds support to a cumulative evidence base showing similar results. For example, Solomon, Goodlin-Jones, and Anders' (2004) treatment led to progress in facial expression recognition and in problem solving, and the children in Ozonoff and Miller's (1995) study improved their theory of

mind capabilities. More interesting and unique to the current study were the findings regarding the indirect effects of treatment on children's theory of mind and executive functions capabilities, which were not targeted by the study. Regarding theory of mind, children's ability after treatment to provide higher levels of justification to explain another person's motivation to tell a lie suggests that these children improved in their facility to relate to and consider social norms (like telling a lie to avoid hurting parents' feelings). Regarding executive functions, children showed a tendency to better sort card sets after treatment and clearly demonstrated a capacity to conceptualize sorting strategies and to recognize the examiner's strategies. Perhaps their ability for concept formation improved through treatment. Inasmuch as the sorting measure did not include social stimuli but rather objective verbal and non-verbal stimuli, it examined the more conceptual cognitive capability to solve problems and to flexibly restructure concepts by shape, by size, by verbal content, and so forth. This finding should be explored further in future studies.

Less encouraging were the current study's mixed results regarding children's abilities for peer interaction. When companionship capabilities were examined within a structured situation such as working together on a shared design, children demonstrated an overall improvement in their ability to collaborate with peers and specifically in their abilities for mutual planning, cooperative work with peers, and sharing. Working together and mutual planning may have resulted directly from the treatment's focus because during the SST intervention children practiced different activities that required them to plan together and work cooperatively. However, their improved sharing capability is of great interest. Perhaps friendships evolved between the children within the group and thus they felt more secure to share. Nevertheless, these HF children with ASD did not exhibit progress in their spontaneous dyadic and group interactions with peers during recesses. This lack of generalization into spontaneous dyadic or group interactions with peers who were not associated with the treatment is especially interesting in light of generalizations demonstrated by former research (e.g., the first-year individual intervention, Bauminger, in press; and Bauminger, 2002). Perhaps the fact that children's social agents outside the intervention group (such as parents and peers) were not actively involved in the current study may have influenced children's capacity to generalize what was learned in the small group to day-to-day interactions with peers during recesses. In the individual intervention (Bauminger, in press), the HF children with ASD met with an assigned peer during school recess and at home, and parents played an active role relative to curriculum topics. Thus, the learned behaviors underwent practice in different social settings (class, school recesses, and home), possibly fostering generalization of social behaviors to school recesses. During the present study, children met with their peers in the small group during treatment, but group activities did not require playing together during school recesses. Apparently, SST should directly include mediation to different social settings within school and maybe even outside school in order to increase the likelihood of generalization to children's spontaneous social interaction capabilities (interested readers may refer to Attwood, 2003; Paul, 2003; Spence, 2003, who expanded on increasing generalization of treatment to settings and persons). Altogether, the enhancement of spontaneous peer interaction appears to require careful consideration of setting and person generalization within CB-E intervention for this population.

Interestingly, individual differences in social functioning (beyond careful group matching on IQ, CA, and ADI-R) were highlighted, with newly recruited children who equaled (and even exceeded in cooperative skills) the level of social functioning of the original group who had already received a year of treatment. Thus, the CB-E curriculum of SST should be developmentally oriented to incorporate a continuum of social functioning levels, ranging from the more basic social capabilities such as understanding basic emotions and experiencing one-on-one interactions (as in the individual intervention; Bauminger, in press) to the more complex social capabilities such as understanding complex, hidden, or mixed emotions, and experiencing small-group peer interactions (as in the current study). This will enable the usefulness of the CB-E intervention for children located at different levels of functioning in terms of their peer interaction skills.

Lastly, a major limitation of the current study was its lack of a control group, necessitating prudence in its interpretation. Although the continued substantial difficulties in the social realm during adolescence and adulthood exhibited by the majority of HF individuals with ASD, despite some improvement in their social interest and social skills (Seltzer *et al*., 2003; Orsmond, Krauss, & Seltzer, 2004), would suggest that the influence of natural maturation effects on the current treatment were limited, the lack of a control group precludes categorical conclusions. Moreover, despite the strong recommendation to perform ongoing treatments in schools over a long duration (e.g., Barry *et al*., 2003; Krasny *et al*., 2003), such interventions pose a real challenge. Schools' unwillingness to allow children

to remain on a waiting list for a full school year precluded the formation of a control group in the current research. Future studies may want to use alternative designs such as using a multiple baseline across skills, or utilizing component analysis in which two or more groups receive either the full or partial intervention. Researchers may also include data on normative age-matched children to help determine if intervention participants reach normative performance levels.

Notwithstanding the difficulties in conducting interventions in school settings for this population, such a setting is also recommended to obtain social validity outcomes. The current study did not systematically evaluate social validity issues; however, implementation of the intervention within the schools enabled random interviews of teachers and typical peers who took part. The teachers emphasized the utility of using a structured integral social intervention to help them cope with the social difficulties of HF children with ASD. The typical peers stated that participation in such groups helped them become more familiar and develop closer relations with the HF children with ASD who were included in their schools. Taken altogether, while maintaining caution in interpreting results, it seems that the multi-modal CB-E may offer potential for improving social cognitive capabilities and several core interactive skills among HF children with ASD.

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Appendix

Definitions for Observed Companionship Behaviors

Five Categories

Mutual planning: The child makes a statement related to planning the task, for example: ''Let's draw a zoo.''
Cooperation: The child shows a behavior or makes a statement that reflects an ability to collaborate with other children's suggestions or to give up his/her own idea in favor of another child's or to consider another child's wishes, for example: agreeing to another child's suggestions regarding the type of objects to draw, expressing willingness to draw in a certain color or size or location on the shared page as suggested by another child.
Eye contact: The child looks into the eyes of another child.
Negotiation: The child makes arguments in favor of his/her idea and discusses ideas, tasks, and roles in the activity with another child, for example: ''I gave up last time and we drew what you suggested, so this time it is your turn to give up your idea and accept mine;'' ''We can combine my idea with yours and create a prettier picture;'' or ''We can draw the dolphin here and the flowers on the other side of the paper.''
Sharing: The child tells peers about his/her experiences, feelings, or thoughts (''It's so much fun drawing this'') or asks peers about theirs.
Global companionship score: Calculated by combining mutual planning, cooperation, eye contact, negotiation, and sharing.
Active involvement score: The child's productive involvement (versus off-task time) in the activity, whether as a leader or as a follower.

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