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Promoting child-initiated social-communication in children with autism: Son-Rise Program intervention effects[☆]



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ABSTRACT

This study examined the effects of the Son-Rise Program (SRP), an intensive treatment aimed to improve child-initiated social communication in children with autism. Six children between the ages of 47 and 78 months were provided with 40 h of SRP, with pre- to post-treatment behavioral changes tested using a novel passive interaction probe task. Results showed an increase in the frequency of spontaneous social orienting and gestural communication for the experimental children, compared to six age- and behaviorally-matched control children with autism. In addition, for the children who received treatment, the duration of social dyadic interactions and total time spent engaged in social interaction increased from pre- to post-treatment. These findings suggest that intensive intervention focused on fostering child-initiated interaction increases social-communicative behaviors in children with autism.

Learning outcomes: Readers will be able to describe the principles underlying the Son-Rise Program, a developmental approach to treatment for autism. Readers will be able to explain the methods of the investigation of a 5-day intensive Son-Rise Program and the results that report change in social communication in children with autism.

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1. Introduction

One major approach to treatment of autism spectrum disorder (ASD) emphasizes social communication. Based on developmental theory (Greenspan & Lourie, 1981; Rogers & Ozonoff, 2006) and social-pragmatic models of language acquisition (Bruner, 1983), this approach considers autism within the context of typical developmental trajectories, based on the ideas that (a) children, regardless of ability, follow a similar developmental sequence in social-communication skill learning (Gerber, 2003; Lifter, Sulzer-Azaroff, Anderson, & Cowdery, 1993) and (b) they learn through reciprocal interactions with responsive adult caregivers (Hoff-Ginsburg & Shatz, 1982; Prizant, Wetherby, & Rydell, 2000). Several interventions utilizing this approach have been advanced, with empirical support emerging, including the SCERTS (social communication, emotional regulation, and transactional support) Model (Prizant, Wetherby, Rubin, & Laurent, 2003), the Denver Model (Rogers & DiLalla, 1991; Rogers & Lewis, 1989), Responsive Teaching (Mahoney & Perales, 2003), Relationship Developmental Intervention (RDI, Gutstein, Burgess, & Montfort, 2007), and the Developmental Individual-Difference, Relationship-Based (DIR) model that encourages interactive “Floor-time” and emotional connection (Greenspan & Wieder,

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1998, 1999). Developmental intervention procedures emphasize child-initiated social interaction, which provide a context for learning, and focus on improving social orienting and social-communicative abilities (i.e., social engagement). Child, rather than clinician, initiated teaching episodes, developmentally appropriate materials and activities, and naturalistic feedback in naturalistic settings are featured in these approaches.

Notably, developmental methods also have been combined with Applied Behavior Analysis (ABA), a widely used treatment for children with autism (Lovaas, 1987; see Ingersoll, 2010). These naturalistic behavioral methods include incidental teaching (Hart & Risley, 1968), milieu teaching (Hancock & Kaiser, 2002), and Pivotal Response Training (PRT; Koegel, Koegel, Harrower, & Carter, 1999; Koegel, Koegel, Shoshan, & McNeerney, 1999). PRT, for example, targets “pivotal” behaviors that have widespread effects on development, such as self-initiation and motivation, using a variety of stimuli based on the child’s interests. In addition to the use of response contingent reinforcement as in traditional ABA intervention, PRT uses natural feedback, embedding reinforcers in natural social interaction. Studies examining the effects of PRT and its variations show increases in child-initiated questions, speech intelligibility, and language skills associated with treatment (Koegel, Camarata, Koegel, Ben-Tall, & Smith, 1998; Koegel, Koegel, Harrower, et al., 1999; Koegel, Koegel, Shoshan, et al., 1999; Koegel, Vernon, & Koegel, 2009; Whalen & Schreibman, 2003). Kasari and colleagues also reported improvement in joint attention, symbolic play, and expressive language in children with autism following intervention using a combination of behavioral and developmental methods (Kasari, Freeman, & Paparella, 2006; Kasari, Paparella, Freeman, & Jahromi, 2008). Similarly, Dawson and colleagues (2010) found that two years of the Early Start Denver Model (ESDM), which combines developmental and ABA principles, produced significant improvements in adaptive behavior and IQ test scores in toddlers with autism.

Regardless of approach, deficits in social interaction observed in autism have become an important target for intervention. Children with autism are impaired in orienting to social stimuli and show deficits in both dyadic (i.e., sharing of behaviors and affect between social partners) and triadic joint attention (i.e., coordinating attention and communication with another in reference to a third entity, usually an object) (Charman, 2003; Leekam & Ramsden, 2006). It also has been suggested that children with autism evince particular difficulty with initiated joint attention (IJA), whereby children draw the attention of another to an object/entity, as compared to responsive joint attention (RJA), in which children respond to another by shifting attention to an identified object/entity (e.g., Mundy, Sullivan, & Mastergeorge, 2009; Tasker & Schmidt, 2008). Indeed, joint attention has been identified as critical for creating social learning opportunities and acquiring language abilities in early childhood (Mundy & Burnette, 2005). Hence, recent research has highlighted the importance of targeting initiated joint attention in autism intervention as this has been found to have collateral effects on untargeted language as well as cognitive and social development (Jones, Cara, & Feely, 2006; Kasari et al., 2006, 2008; Whalen, Schreibman, & Ingersoll, 2006). However, most autism research addressing joint attention has focused on the more advanced triadic joint attention rather than dyadic joint attention and few studies have charted changes in joint attention or other aspects of social interaction following treatment (see Eisketh, 2009; Rogers & Vismara, 2008; Seida et al., 2009).

The present study examined the effects of the Son-Rise Program (SRP), a developmental approach to treatment for ASD (Kaufman & Kaufman, 1976). SRP is an intensive intervention, intended to be implemented in home-based programs and includes a five-day, 40-h, clinician-delivered intensive program, aimed to familiarize parents and caregivers with SRP procedures. SRP is provided in one-on-one, child-adult dyads in a distraction-free, naturalistic environment and emphasizes spontaneous, child-initiated social interaction. The intervention employs techniques used in other developmental pragmatic approaches, such as providing naturalistic feedback, but it differs in that the adult never initiates interactions with the child. Instead, the adult engages in parallel imitation for as long as necessary until the child initiates an interaction. The aim is to increase the frequency of spontaneous social orienting and child-initiation as well as the duration of social interactions, thereby increasing children’s social interaction abilities. Although case studies suggest that SRP is an effective intervention for children with autism (Kaufman, 1982, 1995; Kaufman & Kaufman, 1976), this study is the first to experimentally evaluate its efficacy. In the present study we examined the effects of the intensive clinician-delivered SRP program on the frequency of spontaneous social orienting and use of communicative behaviors, as well as the duration of social engagement episodes. We predicted that SRP would impact these abilities and, hence, establish the feasibility of the approach for future randomized control trials with a greater number of participants.

2. Methods

2.1. Participants

Twelve children (11 males, 1 female) with a diagnosis of autism were included in the study. The diagnosis was determined by pediatricians and/or psychologists based on criteria listed in the 4th ed. of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 2000). None of the children presented with any other diagnosis, including intellectual disability. The children were between the ages of 47 and 78 months and resided at home in either the United States or the United Kingdom. All participants were selected from families who had participated in an initial SRP parent-training course offered at the Autism Treatment Center in Sheffield, Massachusetts, which provided parents with an overview of basic SRP principles, but none of the children had received any SRP intervention prior to the study. Six of these families, whose children met our inclusionary and exclusionary criteria, were enrolled in the SRP intensive

Table 1
Demographic data.

Participant	Gender	Age (months)
SRP-1	M	67
SRP-2	M	68
SRP-3	M	47
SRP-4	M	74
SRP-5	M	55
SRP-6	F	50
Mean (SD)		60.2 (11.0)
CC-1	M	74
CC-2	M	48
CC-3	M	71
CC-4	M	65
CC-5	M	78
CC-6	M	65
Mean (SD)		66.8 (10.5)

Note: Demographic data for children enrolled in the Son-Rise Program (SRP 1–6) and control children (CC 1–6).

program. These children comprised the experimental treatment group. Six additional families, with children matched for age and severity of autism with the experimental children, were included in the control group.¹ Control children did not receive SRP or any other training during the study period. Reimbursement for travel expenses and housing and meals during the study were provided at no cost to them.

The *Autism Diagnostic Observation Schedule* (ADOS, Module 1) (Lord et al., 2000) and the *Autism Diagnostic Interview-Revised* (ADI-R) (Lord, Rutter, & Couteur, 1994) were administered to all children prior to participating in the study. Each child's parents also completed the *Vineland Adaptive Behavior Scales* (Sparrow, Balla, & Cicchetti, 1984). Children presented with an expressive language level of 32 months or less.² Children in the experimental and control groups did not significantly differ on any subscale of the ADOS, ADI-R, or Vineland Adaptive Behavior Scales (Mann–Whitney *U* tests, all *p*-values > 0.05). See Tables 1 and 2 for demographic and diagnostic data for each child.

2.2. Environment and equipment

The study was conducted at the Autism Treatment Center of America (Sheffield, Massachusetts) where each child (both experimental and control) resided, together with their parents, for a 13-day period in small apartments designed for delivery of intensive SRP. All families travelled at least 100 miles from their homes to participate in the study. Each apartment included a child's playroom, equipped with age appropriate equipment (i.e., a small table and chairs and a small structure for climbing) and toys (situated on a shelf, visible but out of reach the children's reach). One wall of the playroom was a two-way mirror, allowing for direct observation of intervention sessions. In addition, cameras mounted in the four corners of the room recorded all passive interaction probe sessions (see Section 2.3). All SRP intervention took place in the playroom of each apartment.

2.3. Experimental design and procedure

The study was completed in a 13-day period. In order to control for the effects of the children travelling and acclimating to the treatment environment, no treatment was provided on days 1–7. On these days, the child and his/her parents were instructed to interact with their children in their apartments as they usually did at home. On days 1 and 7 each child participated in baseline passive interaction probes (PIPs 1 and 2), and on day 13 a final passive interaction probe (PIP 3) was administered, with SRP provided on days 8–12 for children assigned to the experimental group.

2.4. Passive interaction probes (PIPs)

Passive interaction probes (PIPs) consisted of 90-min sessions during which each child's social and communicative behavior was observed. These probes took place in the playroom of each child's apartment with only the child and a female examiner, who used a passive style of interaction (after Wimpory, Hobson, & Nash, 2007). Seated on the floor in the corner of the playroom, the examiner quietly doodled on a pad of paper while covertly attending to the child's behavior, making no attempts to interact with the child. When the child initiated a social interaction by using a communicative act (i.e., head orientation (look) toward the examiner, use of communicative gesture or vocalization, the examiner responded immediately to the child with an

¹ Because the experiment was conducted within a clinical setting as part of regular treatment delivery, randomized assignment to groups was not possible.

² Data from the Vineland for one child in the experimental group (child T2) were lost.

Table 2
Diagnostic test scores.

Participant	Autism diagnostic observation schedule (ADOS)			
	Communication	Social interaction	Play	Stereotyped behaviors
SRP-1	6	14	4	4
SRP-2	5	11	2	4
SRP-3	4	10	4	3
SRP-4	6	11	2	3
SRP-5	5	8	4	1
SRP-6	7	13	4	1
Mean (SD)	5.5 (1.0)	11.2 (2.1)	3.3 (1.0)	2.7 (1.4)
CC-1	6	8	4	2
CC-2	6	12	4	0
CC-3	6	12	4	2
CC-4	5	10	4	1
CC-5	4	10	2	4
CC-6	9	14	4	3
Mean (SD)	6.0 (1.7)	11.0 (2.1)	3.7 (0.8)	2.0 (1.4)
Participant	Autism diagnostic interview-revised (ADI-R)			
	Social interaction	Communication	Stereotyped behaviors	Before 36 months
SRP-1	24	12	8	5
SRP-2	22	14	8	4
SRP-3	22	18	8	4
SRP-4	17	15	8	3
SRP-5	21	13	6	3
SRP-6	28	14	6	5
Mean (SD)	22.3 (3.6)	14.3 (2.1)	7.3 (1.0)	4.0 (0.9)
CC-1	20	12	8	3
CC-2	19	15	8	5
CC-3	29	14	6	3
CC-4	28	12	7	4
CC-5	24	14	6	5
CC-6	28	5	3	2
MEAN (SD)	24.7 (4.4)	12.0 (3.6)	6.3 (1.9)	3.7 (1.2)
Participant	Vineland adaptive behavior scales			
	Communication	Daily living	Socialization	Motor skills
SRP-1	17	16	20	16
SRP-3	32	30	28	18
SRP-4	21	27	26	20
SRP-5	24	25	27	19
SRP-6	17	24	18	18
Mean (SD)	22.2 (6.2)	24.4 (5.2)	23.8 (4.5)	18.2 (1.5)
CC-1	17	16	20	18
CC-2	38	37	39	28
CC-3	18	21	17	16
CC-4	22	27	26	28
CC-5	21	24	25	21
CC-6	19	21	20	19
Mean (SD)	22.5 (7.8)	24.3 (7.2)	24.5 (7.9)	21.7 (5.2)

Note: Diagnostic test scores for children enrolled in the Son-Rise Program (SRP1-6) and control children (CC1-6).

appropriate action. For example, if the child looked toward the examiner, turning his/her head toward her, the examiner looked at the child and said “hi”. If the child used a gesture such as waving to the examiner, the examiner waved back. If the child produced a verbalization, e.g., “want ball”, the examiner gave a ball to the child and then resumed attention to her paper. Importantly, PIP examiner responses to child-initiated behaviors were not accompanied by contingent praise or suggestions for follow-up activities. Only in instances in which the child continued to interact by emitting another communicative act did the examiner respond further. The same examiner participated in all PIPs for a given child. However, examiners were not involved in any intervention provided. Separate clinicians provided treatment (see Section 2.5).

2.5. Intervention

Children assigned to the SRP experimental group received a total of 40 h of intervention provided for five consecutive days (8 h per day), in keeping with one of the basic tenets of SRP that training is provided on an intensive schedule. The same six

clinicians provided training for all of the children for 2-h periods on each of the five days, rotating in and out of the playroom of each apartment where SRP was provided. No family members were present during treatment. All clinicians were extensively trained in SRP procedures, completing an 18-month training program at the Autism Treatment Center of America and demonstrated ability to reliably administer the treatment. Except for bathroom breaks, the child remained in the playroom for the entire 8-h period each day, including during lunchtime, with food delivered to and eaten in the playroom. The six control children received no intervention of any kind during the study period. Parents were told only to interact with their child in a typical manner throughout the day in any of the rooms in the apartment, including the playroom, which was set up exactly like the playrooms used for the experimental children's SRP intervention. The parents were told that they could, but were not required to, use any of the toys in the playroom when interacting with their child. At the end of the study families in the control group were provided a full-day training session, with an SRP-trained clinician, focused on implementation of SRP principles in their homes.

SRP training involved three basic techniques: (a) joining, (b) provision of immediate and naturalistic feedback to child-initiated interactions (i.e., praise and acknowledgement), and (c) prompts/expansions of child responses and/or suggestions for new activities. Joining, or imitating the child's activities or movements, has been used in other developmental approaches and has been shown to enhance spontaneous social-communicative behaviors (Dawson & Adams, 1984; Dawson & Galpert, 1990; Ingersoll & Schreibman, 2006; Lewy & Dawson, 1992; Tiegerman & Primavera, 1984). The difference between SRP and other approaches employing imitation is that SRP clinicians never initiate interactions with the child. Instead they engage in parallel imitation (and display interest in doing so) for as long as necessary until the child initiates an interaction. Throughout the intervention period, the clinician joined the child, imitating his/her activity whenever the child engaged in repetitive, exclusive behavior until the child initiated a communicative act by orienting his/her head toward the clinician, using a communicative gesture, or verbalizing with apparent intent to communicate. Repetitive, exclusive behavior included stereotypical behaviors such as hand flapping and plate spinning as well as appropriate behaviors such as building blocks when the child demonstrated these behaviors exclusively. When, and only when, the child initiated a communicative act, the clinician immediately responded to the child. When the child looked toward the examiner, for example, while both the child and the examiner were spinning the wheels of upside down toy cars, the clinician praised and acknowledged the child, saying "hey, good looking at me, thank you!" with excitement and exaggerated expression. She then attempted to engage the child by expanding/prompting the child's behavior (e.g., rolling her car toward the child's car, and saying "let's play cars!"). When a communicative gesture or vocalization was produced, the clinician acknowledged/praised this and followed with an attempt to engage the child in an activity (e.g., the child says "vroom vroom" while rolling his/her car toward the clinician's car; the clinician then rolls her car toward the child's car, saying "yah, my car goes vroom too, let's play cars, let's have a race!"). If the child continued the interaction, the clinician once again responded naturalistically, expanding and prompting the child's behavior and suggesting new activities (e.g., saying with excitement "yeah; let's race with these trucks!"). Importantly, clinician prompts and expansions were based on the abilities and interests of the child. When the child stopped responding and engaged in repetitive or exclusive behavior, the clinician once again imitated whatever activity the child performed until the next child-initiated interaction occurred. See Fig. 1 for a flowchart of intervention.

2.6. Data analysis

Sixty minute video-recorded PIP sessions, prepared for data analysis by deleting the first and last 15 min of each recorded PIP session, were independently coded by one of six trained coders for communicative acts produced by each child, and the time of occurrence of each act was recorded. See Table 3 for operational definitions of the outcome measures. The coders were blind to the experiment, the group assignment of the child (i.e., experimental or control), and which PIP was being coded (e.g., PIP 1, 2, or 3), and they were not involved in the study in any other way (i.e., they did not perform any testing, participate in PIPs, or provide treatment for the children). Coders were trained to 90% reliability prior to coding the children's PIP sessions by the 1st and 4th authors. All achieved this level for all three dependent variables (i.e., head orientations, gestures, and verbalizations).

The number of occurrences of head orientations, gestures, and verbalizations was tallied for each child for each PIP session, and the duration of social interaction episodes was calculated. The mean number of communicative acts produced during the three PIP sessions for the two participant groups was then calculated. The average duration of social interaction episodes also was computed, with an interactive episode defined as an instance in which two or more successive communicative acts were initiated by the child, beginning at the onset of the first interaction (by the child) and ending at the end of the final interaction (by the child) (i.e., when the child did not respond to the examiner's response within 10 s). For example: the child turned his/her head toward the examiner (beginning of interactive episode); the examiner responded by looking at the child; the child then pointed to the doll on a shelf (second communicative act); the examiner responded by giving the doll to the child; the child then played exclusively with the doll, with no further interaction with the examiner for 10 s or more. In this example, the interactive episode ended at the offset of the child's second communicative act. Finally, the total time spent engaged with the examiner was computed (i.e., the sum of all interactive episodes in min). These data were then analyzed statistically.

For reliability purposes, a randomly selected 30% of each session was re-coded by one of the authors (KH, CT), and point-to-point interobserver (percent) agreement was calculated: $\text{agreements}/(\text{agreements} + \text{disagreements}) \times 100$. To be considered an agreement, both coders were required to enter the same behavior (head orientation, gesture, verbalization)

Son-Rise Program Intervention Flow Chart

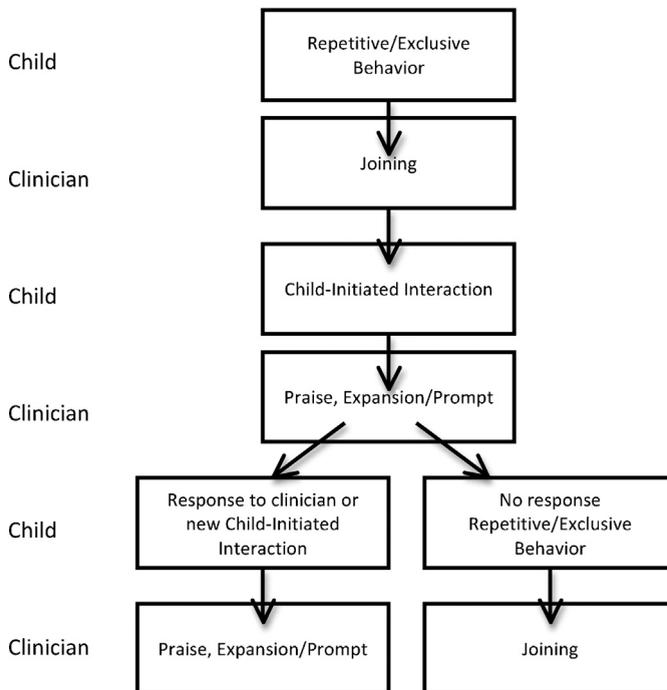


Fig. 1. SRP intervention. Flow chart of child and clinician behaviors during SRP intervention sessions.

Table 3
Dependent measures.

Variable	Operational definition
Head orientation	Child physically and observably turns head toward the examiner
Gesture	Arm or hand motion signaling communication with the examiner, e.g., waving, pointing, reaching
Verbalization	Single word, multiple word utterance, or socially directed sounds, e.g., “up”, “want ball”, “na, na, na”
Social interaction episode duration	Time (in seconds) during which the child participates in two or more successive communicative exchanges, beginning at the onset of the first interaction and ending at the end of the final interaction (following which the child does not respond to the examiner or initiate another social behavior within 10 s), e.g., Child: Turns head toward examiner (beginning of interaction) Examiner: Looks at child Child: Points to doll on shelf (end of interaction) Examiner: Gives doll to the child Child: Plays exclusively with doll
Proportion of time spent engaged	Sum of all social interaction episodes (in minutes)

occurring within a 2 s time window. Across all children and PIP sessions, mean overall agreement was 93% (range 89–97%). We also examined interobserver agreement by PIP session and by child, with no significant differences found for either analysis (Kruskal-Wallis; $p > .05$).

The fidelity of the examiner’s behavior during PIP sessions was also examined by two judges (blind to the purpose of the study and any study detail). Fifteen-minute video segments were randomly selected from each PIP session for each child ($n = 34$ segments) and the segments were randomly ordered into 8 1-h videos and 1 30-min video (total 8.5 h of video). For each segment, trained judges evaluated (yes/no) whether the examiner responded to (a) each communicative behavior emitted by the child during the sample and (b) each act in accordance with experimental protocol. Results indicated that across all 34 samples (total 2496 child-initiated responses), the examiner responded to 94% (range 93–100%), with no significant differences in the proportion of child-initiated communicative acts responded to by PIP session (PIP 1 $M = 96%$; PIP 2 $M = 94%$; PIP 3 = 92%) or by child (Kruskal Wallis; $p > .05$). With regard to appropriateness of responding, 97% of examiner responses were considered appropriate, and only 3 instances of examiner-initiated interactions were noted.

Table 4
Frequency of social/communicative behaviors.

Group	Head orientations			Gestures			Verbalizations		
	PIP1	PIP2	PIP3	PIP1	PIP2	PIP3	PIP1	PIP2	PIP3
<i>Experimental</i>									
SRP-1	47	32	55	21	15	17	49	4	26
SRP-2		144	270		116	174		78	67
SRP-3	80	89	168	53	36	61	65	106	111
SRP-4	60	63	56	15	18	20	20	49	54
SRP-5	200	199	280	59	55	99	69	58	186
SRP-6	46	84	105	28	50	98	21	27	56
Mean (SD)	87 (65)	102 (60)	156 (101)	35 (20)	48 (37)	78 (59)	45 (23)	54 (36)	83 (58)
<i>Control</i>									
CC-1	40	34	30	36	35	27	27	25	20
CC-2	135	150	90	51	32	55	118	141	112
CC-3		101	58		152	52		99	26
CC-4	45	36	32	19	18	17	20	21	17
CC-5	53	57	79	24	25	28	50	20	52
CC-6	138	165	161	128	189	168	106	187	109
Mean (SD)	82 (50)	91 (57)	75 (49)	52 (44)	75 (75)	58 (56)	64 (45)	82 (71)	56 (44)

Note: Frequency of social/communicative behaviors in passive interaction probes (PIPs) during baseline on days 1 (PIP 1) and 7 (PIP 2) and following treatment on day 13 (PIP 3) for children enrolled in the Son-Rise Program (SRP 1–6) and control children (CC 1–6). SRP = Son-Rise Program; CC = control child.

3. Results

Results of the baseline data (i.e., pre-treatment probes PIP 1 and PIP 2) showed numerical increases in the frequency of head orientations, gestures, and verbalizations from PIP 1 to PIP 2 for both the experimental and control children, as expected; however, the duration of social interaction and total time spent engaged per session was stable across probes. Further, statistical analysis of the data showed no significant differences in performance between the two pre-treatment sessions for any measure for either the experimental or control group (related-samples Wilcoxon signed rank tests: all p -values > 0.05).³ In addition, statistical tests comparing performance between the experimental and control children during PIP 1 resulted in no significant differences between groups on any variable. Similarly, the same comparisons for PIP 2 were not significant (all p -values > 0.05).

The frequency of head orientations, gestures, and verbalizations produced during PIP 2 and PIP 3 are shown in Table 4 and Fig. 2a–c, reflecting the frequency of occurrence of each variable emitted per hour prior to and following treatment for the experimental group and over the same time period for the control children. These data indicate increases from pre- to post-treatment for the experimental children for both head orientations and gestures (except for SRP-4 for head orientations). Wilcoxon signed rank tests, examining differences between PIP 2 and PIP 3 scores, indicated that these increases were statistically significant (head orientations: $Z = -2.0$, $p < 0.05$, gestures: $Z = -2.2$, $p < 0.05$), with medium–large effect sizes (head orientations: $r = -0.58$; gestures: $r = -0.64$). In addition, increases were noted in verbal behavior for the experimental children from pre-treatment to post-treatment (except for SRP-2), although this difference was not significant ($Z = -1.6$, $p = 0.116$). In contrast, for the control children, no significant differences were found between probes for any of the behaviors measured (head orientations: $Z = -1.4$, $p = 0.17$; gestures: $Z = -0.7$, $p = 0.46$; verbalizations: $Z = 1.4$, $p = 0.17$), with all children showing decreases in the frequency of communicative acts from PIP 2 to PIP 3 (with the exception of CC-2 for gestures and CC-5 for verbalizations).

The average duration of social interaction episodes and total time spent engaged with the examiner for each child from PIP 2 to PIP 3 is shown in Table 5 and Fig. 2d and e. A significant difference was found across PIP sessions for the children who received SRP for both measures ($Z = -2.2$, $p < 0.05$; $Z = -2.2$, $p < 0.05$, respectively), with medium–large effect sizes (episode duration: $r = -0.64$; time spent engaged: $r = -0.64$). However, for the control group, there were no significant differences for either of these variables between PIP 2 and PIP 3 ($Z = -1.4$, $p = 0.18$; $Z = -1.4$, $p = 0.17$, respectively).

4. Discussion

The results of this feasibility study suggest that the five-day intensive Son-Rise Program resulted in increases in social-communicative behaviors of children with autism and thus warrants further investigation in the form of randomized controlled clinical trials. Stable performance was noted across baseline probes (i.e., from Passive Interaction Probe 1 to

³ Due to the small sample size, tests of normality and homogeneity of variance were performed, which indicated that the data violated assumptions of parametric statistics (i.e., ANOVAs). Therefore, nonparametric statistics were used.

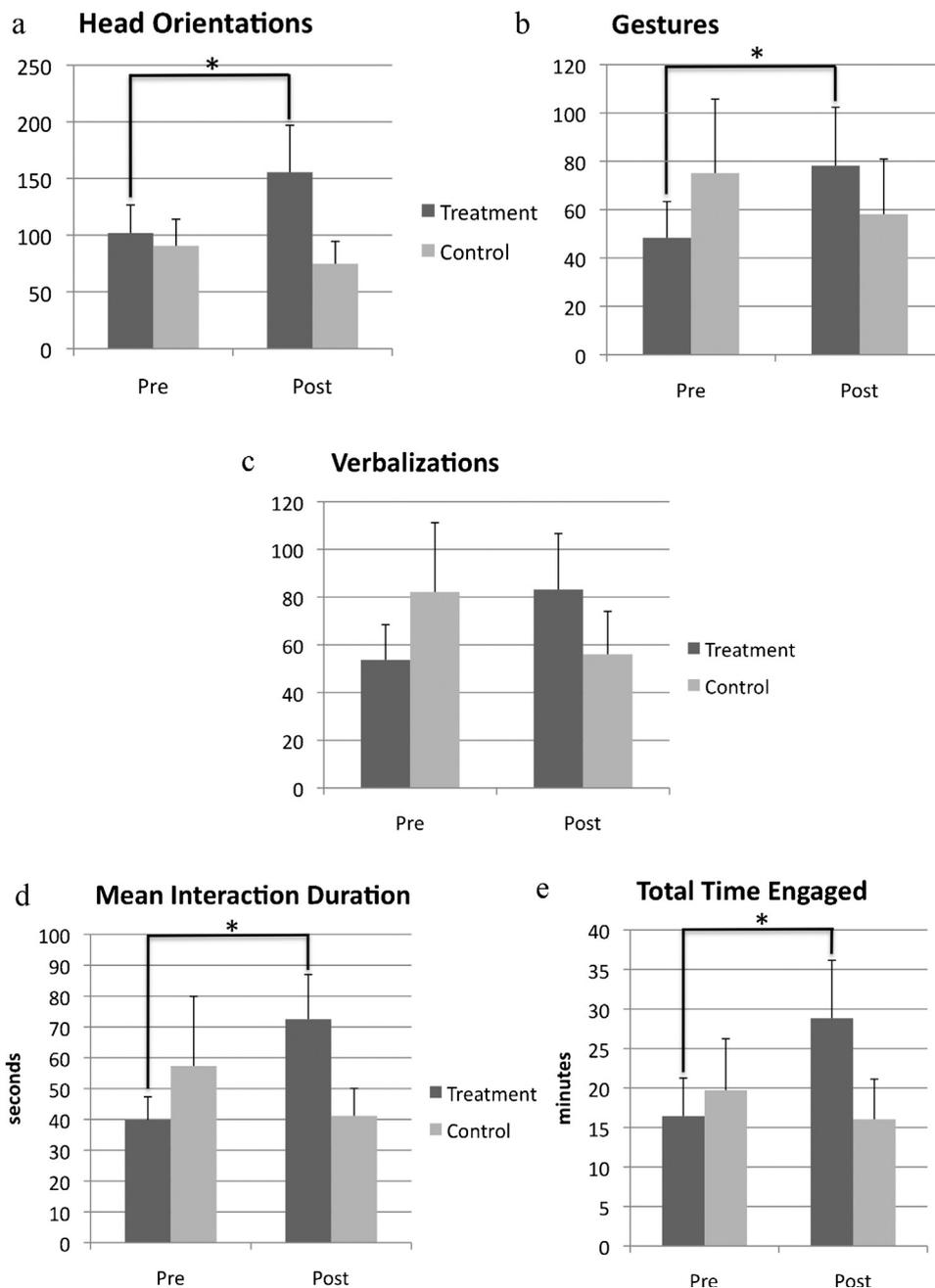


Fig. 2. Passive Interaction Probe (PIP) data. Frequency of social/communicative acts (head orientations, gestures, and verbalizations) during pre-test (PIP 2) and post-test (PIP 3) passive interaction probes for the experimental (treatment) and control children (a–c). Length of social interactions (d) and total time engaged (e) during pre-test (PIP 2) and post-test (PIP 3) passive interaction probes for the experimental (treatment) and control children.

Passive Interaction Probe 2), with no significant differences found across probes for any of the children or behaviors. Notably, some of the children from both groups and for some behaviors showed numerical increases from pre-treatment probe 1 to pre-treatment probe 2. We attribute this pattern to acclimation to the environment (i.e., adjusting to the apartment, the playroom, and PIP sessions). The pre-treatment probes were administered with one week intervening between them precisely for this purpose, with the expectation that children might perform more poorly on first visit with an unknown examiner in a new environment compared to subsequent visits.

Comparing pre-treatment (i.e., pre-treatment probe 2) to post-treatment (probe 3) performance, the children who received Son-Rise Program intervention showed significant increases in two of the three communicative acts measures: orientation and gestural communicative behaviors. An increase also was found for the frequency of verbalizations produced from pre- to post-treatment for the treated children, although this improvement did not reach statistical significance.

Table 5
Duration of social interactions.

Group	Mean duration of episodes (s)			Total time engaged (min)		
	PIP1	PIP2	PIP3	PIP1	PIP2	PIP3
<i>Experimental</i>						
SRP-1	24	22	25	6.0	3.6	6.1
SRP-2		71	115		33.4	39.5
SRP-3	28	42	74	12.7	16.4	46.4
SRP-4	44	22	57	6.7	7.7	20.9
SRP-5	91	46	112	39.7	27.6	47.1
SRP-6	38	36	52	8.5	10.0	13.0
Mean (SD)	45 (27)	40 (18)	73 (34)	14.7 (14)	16.5 (12)	28.8 (17.8)
<i>Control</i>						
CC-1	22	24	19	6.3	5.1	4.1
CC-2	69	41	33	37.3	26.7	17.5
CC-3		28	33		18.0	12.8
CC-4	44	39	39	7.2	5.9	3.2
CC-5	35	43	40	16.8	14.9	22.1
CC-6	122	169	83	39.2	47.8	36.5
Mean (SD)	58 (39)	57 (55)	41 (22)	21.4 (16)	19.7 (16)	16.0 (12)

Note: Duration of social interaction episodes (in seconds) and total time spent engaged (in minutes) in passive interaction probes (PIPs) during baseline on days 1 (PIP 1) and 7 (PIP 2) and following treatment on day 13 (PIP 3). SRP = Son-Rise Program; CC = control child.

Notably, in addition, the duration of social interactions and the total time spent engaged with the examiner increased from pre- to post-treatment probe sessions for all treated children. In contrast, the control children who interacted with their parents over a five-day period without receiving SRP did not show improvements on any of our measures of social interaction. These findings indicate that the Son-Rise Program results in increases in child-initiated communicative actions and time spent engaged in interactive exchanges with an adult. These findings are especially remarkable considering the relatively short (five-day) time period of intensive training, which the experimental children received.

Because all episodes of social interaction noted during passive interaction probes were initiated by the child, these gains reflect increases in the pivotal skill of child-initiated social behavior, which as pointed out by Koegel et al. (2009) may be “dormant” in children with autism, but susceptible to development in the context of social environments that emphasize child initiation. In addition, the emergence of spontaneously initiated interactive behaviors such as those observed in the present study has implications for development of joint attention skills and may, therefore, have widespread benefits for children with autism. Importantly, in typical development dyadic joint attention forms the basis of early social experience in the first three months of life, prior to increasing motor and cognitive development, which allows expansion into triadic joint attention involving objects (Legerstee, 2005; Mundy & Newell, 2007), usually in the latter part of the first year of life (e.g., Trevarthen, 1993). The present study is one of few autism intervention studies targeting dyadic orienting and spontaneous social behaviors, which may be important precursors for children to advance to triadic joint attention. However, further research examining the effects of the Son-Rise Program or other interventions targeting child-initiated dyadic social interaction over a longer period of time is required to fully understand the impact of this approach on the emergence of triadic initiated joint attention.

Several of the teaching principles embraced by the Son-Rise Program are also used in other behavioral (e.g., Alpert & Kaiser, 1992; Koegel, Koegel, Harrower, et al., 1999; Koegel, Koegel, Shoshan, et al., 1999) and developmental interventions for autism (e.g., Prizant et al., 2003; Rogers & DiLalla, 1991). For example, Greenspan and Wieder's (1999) floortime uses imitating the child's repetitive behaviors as a technique to motivate reciprocal, affective interaction based on the child's interests. Indeed, studies suggest that children with autism are more socially responsive, increase the frequency and duration of gazes at social stimuli, and play with toys in a less perseverative manner when their behavior is imitated by adults (Dawson & Adams, 1984; Dawson & Galpert, 1990; Ingersoll & Schreibman, 2006; Lewy & Dawson, 1992; Tiegerman & Primavera, 1984). As pointed out above, the Son-Rise Program also uses direct, natural reinforcement of self-initiated behavior as in Pivotal Response Training (Koegel, Koegel, Harrower, et al., 1999; Koegel, Koegel, Shoshan, et al., 1999) and heightened animation as advocated by Prizant et al. (2003). The Son-Rise Program also provides methods for prompting target behaviors, such as reinforcing and extending child-initiated behavior in a manner similar to “scaffolding”, discussed by Wood, Bruner, and Ross (1976) and using “wait time” as advocated by Manolson (1992). Which techniques are the most crucial for promoting improved dyadic social interactive and communicative skills, however, remains an empirical question and awaits further research examining the components of the Son-Rise Program and other intervention approaches.

Further research also is needed to examine the maintenance of treatment effects as well as generalized changes in the children's behavior at home or in other environments. Because the aim of the present study was to directly measure the immediate effects of treatment in a controlled clinical environment, we did not examine these important components of intervention. However, this study represents a first step toward empirical validation of the Son-Rise approach. In order to fully understand the impact of this approach on children's social-communicative interactive behavior, measuring the

long-term effects of treatment as well as the extent to which such intervention impacts the use of social and communicative behaviors across environments is essential. In addition, replication of these effects with larger numbers of children is needed before strong conclusions can be made.

Caution also is warranted with regard to the generalizability of the present results. Both the experimental and control children in the present study were selected from family members of autistic children who had completed a Son-Rise Program parent-training course. The effects of Son-Rise intervention for children selected from a more broad population of children with autism is needed to address the external validity of the present findings. We also note that the parent-training program provided information about the basic principles of intervention, although none of the children were engaged in home-based or other Son-Rise treatment prior to or during the study. It is possible that because of their having completed the parent-training course, the families were positively inclined toward the benefits of the Son-Rise Program. We point out, however, that both the experimental and control families participated in the same parent-training course, and improvements in communicative behaviors were found only for the experimental children. Nevertheless, future research is needed to examine the interaction between parental attitudes and behavioral improvement resulting from intervention. In addition, future research should examine the effects of the Son-Rise Program when it is administered by caregivers, as the intervention is intended to be implemented in home-based programs. In studies of home-based programs, it will be important to evaluate treatment fidelity and potential effects on family life as well as the effectiveness of the intervention for the child with autism (Williams, 2006; Williams & Wishart, 2003).

Future research also should, ideally, provide placebo training for the control children or compare the effects of the Son-Rise Program to another intervention approach. We were unable to accomplish this in the present study because the study was conducted within a clinical setting as part of regular treatment delivery, and resources did not allow provision of 40 h of clinical intervention for the control children. For scheduling reasons, we also were unable to randomly assign participants to experimental and control groups. Nevertheless, we studied the behaviors of both groups of children in the same novel environment, using identical testing procedures on the same time schedule. If extraneous variables influenced the behavior of the experimental children, assuming that both groups of children were exposed to the same variables in the controlled clinical environment, differences in performance patterns for the two groups might have been expected during the baseline period. Notably, it was only during the treatment phase when behavioral performance diverged for the two participant groups, with increases in performance noted for the treated children and no significant changes in performance noted for the control children. These preliminary findings are encouraging and pave the way for further research examining the effects of the Son-Rise approach.

Conflict of interest statement

The authors of this manuscript are employed by their respective institutions and have no relevant financial or nonfinancial relationships to disclose.

Appendix A. Continuing education

1. Developmental approaches to treatment for ASD
 - (a) emphasize child-initiated social interaction
 - (b) focus on improving social-communicative skills
 - (c) use developmentally appropriate materials and activities
 - (d) all of the above
2. A growing body of research suggests that targeting initiated joint attention in autism intervention results in improvements in
 - (a) joint attention and language skills
 - (b) joint attention, but not verbal language
 - (c) dyadic, but not triadic joint attention
 - (d) cognitive development, but not social skills
3. Which of the following techniques is NOT used in the Son-Rise Program?
 - (a) naturalistic feedback to child-initiated interactions
 - (b) expanding on child responses
 - (c) clinician-initiated social interactions
 - (d) joining the child's repetitive behaviors
4. The results of this study suggest improvements in social communication in children with autism following
 - (a) a five-day, 40-h, clinician-delivered intensive program
 - (b) a five-day intensive program followed by three months of home-based intervention
 - (c) a three-day parent-training program and six months of parent-led intervention
 - (d) a year of weekly treatment sessions with a clinician
5. The results of this study showed
 - (a) significant improvement in verbalizations, but not gestures, in SRP-treated children
 - (b) significant improvement in duration, but not frequency, of communicative behaviors in SRP-treated children

- (c) significant improvement in child-initiated communication in SRP-treated children and children who engaged in typical interactions with their caregivers
- (d) significant improvement in child-initiated communication in SRP-treated children, but not children who engaged in typical interactions with their caregivers

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