Incorporating the Thematic Ritualistic Behaviors of Children with Autism into Games:

Increasing Social Play Interactions with Siblings

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Abstract: This study systematically investigated an intervention increasing sibling social play interactions by incorporating the thematic ritualistic activities of children with autism into typical games. Data collected revealed very low levels of sibling play, joint attention, and affect during the baseline condition and high levels of thematic ritualistic behaviors. In contrast, when the children with autism were taught a play interaction based on their thematic ritualistic behavior (e.g., for a child who perseverated on movies, incorporating that theme into a Bingo®-style game), the percentage of social interactions and joint attention increased and maintained in 1- and 3-month follow-up measures. All of the children's affect improved, and the rate of thematic ritualistic behaviors decreased to a minimum or no occurrence. The children's social interactions also generalized to other games and settings. These results imply that children with autism can learn social skills through play and natural interactions in their environment.

The severe social disabilities found in autism have been consistently emphasized as a, if not the, central defining feature of the disorder (Kanner, 1943; Mundy & Sigman, 1989; Rutter, 1978). The diagnosis of autism in the *Diagnostic and Statistical Manual of Mental Disorders-IV* (DSM-IV; American Psychiatric Association, 1994) includes a deficit in three main areas: (a) qualitative impairment in social interactions; (b) qualitative impairment in communication; and (c) markedly restricted, repetitive, and stereotyped patterns of behavior, interests, and activities. However, some authors have suggested that these may not be distinct impairments (Garfin & Lord, 1986; Walters, Barrett, & Feinstein, 1990). In fact, social impairment may be considered a primary deficit in which secondary deficits (i.e., communication, self-stimulatory behaviors) may develop (L. K. Koegel, Valdez-Menchaca, & Koegel, 1994). The Autism Society of America (1990) has stated that children with autism have dysfunctional social behaviors that interfere with their development; these include a rigid adherence to structure and schedules, a general lack of social interactions, and ritualistic perseverations on objects and/or topics. Therefore, it is extremely important to understand the role of social interactive deficits for children with autism and the relationship that social interactions have with other maladaptive behaviors pertinent to autism, such as thematic ritualistic behaviors, or otherwise perseverative fixations.

Often early social development for children begins with interactions with their siblings. Sibling interactions play an important part in the social life of a child with or without disabilities (Knott, Lewis, & Williams, 1995). J. Dunn (1988) has argued that sibling relationships are particularly important in the development of social skills. Cicirelli (1985) stated that sibling interactions are essential and powerful components of socialization because they foster the development of important instrumental and affective relationship skills. There is also evidence that children develop a style of social exchange with their siblings that they subsequently use with their peers (Abramovitch, Pepler, & Corter, 1982).

Unfortunately, much of the research performed in the area of increasing social interactions for individuals with autism has not used their siblings. Yet, those investigators who have studied sibling relationships with children with disabilities have noted the importance of the sibling relationship for the development and well-being of both the child with a disability and his or her nondisabled brothers and sisters (e.g., Breslau, Weitzman, & Messenger, 1981;

Gath, 1974; Powell & Ogle, 1985). Children with autism, however, tend to have problems interacting with their siblings as well as their peers. They may not naturally play with their brothers and sisters. This lack of interaction may be a reflection of the general tendency of children with autism to appear very unmotivated to interact (R. L. Koegel & Egel, 1979).

One area where many children with autism appear to be especially motivated is that of idiosyncratic thematic ritualistic activities (Baker, Koegel, & Koegel, 1998). Studies assessing the reinforcing properties of thematic ritualistic activities for children with autism have demonstrated that these activities are child preferred and highly motivating, and generally occur at a high frequency (Lovaas, Newsom, & Hickman, 1987). More recently, investigators have shown that such behaviors can be incorporated effectively into intervention programs that increase appropriate behaviors without increasing the time engaged in the thematic ritualistic behavior (Charlop, Kurtz, & Casey, 1990; Charlop-Christy & Haymes, 1996; Wolery, Kirk, & Gast, 1985). Additionally, Baker et al. (1998) found that thematic ritualistic behaviors can be used appropriately to increase social interactions between higher functioning children with autism and their school peers.

Nevertheless, the literature on incorporating thematic ritualistic activities (objects, topics, or themes the child perseverates on across multiple settings) into appropriate games is very limited. Further, it is unclear whether such transformations would have an impact on the social development of children with autism who appear more severely involved (as measured by low standardized test scores and high levels of dysfunctional behaviors).

Specifically, it was hypothesized that an intervention based on incorporating thematic ritualistic activities of a child with autism into an appropriate social game will (a) increase the percentage of time engaged in social play with a sibling, (b) increase the level of joint attention behaviors, (c) result in maintenance and generalization to other social play, (d) result in increased positive affect during the social play for both the child with autism and for his or her typically developing siblings, and (e) decrease the child's frequency of participation in thematic ritualistic behaviors.

Method

PARTICIPANTS

Three children who were diagnosed with autism according to DSM-IV criteria by an independent agency and objective assessments participated in this study. The selection criteria for the children with autism included (a) having a sibling close enough in age so that social play was appropriate, (b) exhibiting low levels of social play, and (c) displaying high levels of thematic ritualistic behaviors rated as problematic by parents, teachers, and child observations in at least three different settings (e.g., home, school, community). The participants were low- to moderate-functioning children with autism determined by standardized cognitive and language assessment measures and the Childhood Autism Rating Scales (CARS; Schopler, Reichter, & Renner, 1988). Individual child descriptions are as follows.

Ken was a young boy with a chronological age of 5 years 8 months at the start of the study. His sister, who also participated in the study, was 7 years 7 months. Ken attended a full inclusion kindergarten class at a public elementary school in his community. He was able to participate in most of the academic activities during classtime, although he frequently engaged in off-task behavior, consisting primarily of incessant repetitive speech about certain thematic, perserverative topics (e.g., number lines and locations on a map). He played in isolation during recess and free-play periods. He would spend much of his free-time play engaged in repetitively making number lines on multiple pieces of paper at both home and school. His mother reported that Ken used from up to 20 to 40 pieces of plain paper per day performing his number line ritualistic activity. Ken rarely played with peers at school and even less frequently engaged in social play interactions with his sibling. His sister reportedly did not play with Ken due to his lack of response to her initiations.

On standardized assessments, Ken earned a standard score of 75 on the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984). His age-equivalent score on the Expressive One-Word Picture Vocabulary Test–Revised (EOWPVT-R; Gardner, 1990) was 4 years and 9 months. His overall score on the CARS was 32, indicating that he was moderately autistic, and his perseveration score was in the moderately impaired range. Ken was able to combine four to five words to form grammatically correct sentences, but he rarely engaged in social communication.

Wayne was a young boy with a chronological age of 5 years 5 months at the start of the study. His sister, who also participated in the study, was 8 years 7 months of age. He attended a special education school setting 3 days a week and a full inclusion classroom with a full-time teacher's assistant 2 days a week. Both schools were within his extended community environment. He was able to participate in the academic activities with one-to-one support. He frequently engaged in disruptive behaviors consisting of aggressive behaviors toward peers and objects, noncompliance, and extreme perseverative speech about certain thematic ritualistic topics (e.g., cars, crashing cars, and vacuums). He exhibited immediate echolalia and repetitive question asking without acknowledgment of others' responses. He generally played in isolation, engaging in perseverative behaviors, crashing toy cars over and over again. He was also ostracized by peers and his sibling

due to aggressive behaviors. His sister stated that she would not play with Wayne because "he was mean and he never listened." His parents reported that Wayne engaged in repetitive behaviors the majority of the day, and he was often difficult to redirect.

On standardized assessment measures, Wayne's age-equivalent score on the Peabody Picture Vocabulary Test–Revised (PPVT-R, L. Dunn & Dunn, 1981) was 3 years 0 months with a standard score of 56. He received an age-equivalent score of 3 years 5 months and a standard score of 74 on the EOWPVT-R. On the Assessing Semantic Skills Through Everyday Themes, a test that assesses both receptive and expressive language using a variety of tasks, Wayne earned an age-equivalent total score of 2 years 10 months. Wayne's school assessment documented that he was delayed 1 to 2 years in the area of fine motor skills and functioned at a 2½- to 3½-year-old range in the area of social and emotional development. His overall score on the CARS was a 36, indicating moderate autism, and his perseveration score was in the moderately impaired range. Wayne was able to combine three to four words in grammatically correct sentences, but he rarely engaged in social communication.

Annie was a young girl with a chronological age of 6 years 10 months at the start of the study. Her sister, who also participated in the study, was 8 years 7 months. Annie attended a full inclusion kindergarten class with a full-time instructional aide for support. The elementary school was in her neighborhood community. Annie was able to participate in most of the academic activities during classtime with support, yet often engaged in off-task behaviors consisting of incessant repetitive speech of particular movie scripts and other isolating behaviors. Annie often spoke at a fast rate, at times in a loud voice, and frequently used jargon. This affected her intelligibility and in turn her ability to interact and converse meaningfully with peers. At home and in community settings, Annie spent hours watching and rewatching particular movie clips. She often aggressively refused to engage in alternative activities and insisted on remaining in isolation. Annie would tantrum when redirected from the television and VCR. Her sister reported, "She never lets me play with her."

On standardized assessments, Annie was delayed approximately 1½ years in the areas of social development and communication development on the Developmental Profile-II (Alpern, Ball, & Shearer, 1986). On the Preschool Language Scale–3 (Zimmerman, Steiner, & Pond, 1992), Annie's age-equivalent score on the auditory comprehension portion of the test was 3 years, 5 months, and on the expressive communication portion of the test her score was 2 years, 5 months. Annie earned an age-equivalent score of 3 years, 1 month on the Peabody Picture Vocabulary Test–III (PPVT-III; L. Dunn, Dunn, Williams, & Wang, 1997) and an age-equivalent score of 4 years, 9 months on the Expressive Vocabulary Test (Williams, 1997). Her overall score on the CARS was a 34.5, indicating moderate autism and her perseveration score was in the moderately to severely impaired range. Annie often used one-word utterances with less frequent two- to three-word phrases. Her more expansive utterances were often delayed echolalic phrases from television shows. She rarely exhibited social communication and rarely responded appropriately to others' social communication attempts.

SETTING

This study was conducted in playrooms at the University of California, Santa Barbara that were equipped with child-size furniture and typical play materials. The data were collected in 10-second continuous intervals for the duration of each play activity (typically about 10 minutes for this age child). The children had the opportunity to engage in multiple play activities, if so desired, until the allotted 40-minute session time had expired. The generalization probes were taken at both the child's home and the child's school. The home probes were conducted in the room the children typically spent the most time engaged in play activities. The school probes were taken during either the child's free-choice play period or child's recess period. The data were collected in independent play sessions for the duration of each play period (approximately 10 minutes) during the probes.

THERAPISTS AND OBSERVERS

All training sessions were conducted by advanced undergraduate and graduate students. Each naive observer had training and experience in the use of applied behavior analysis. Prior to recording data from play sessions, all observers received brief training (involving reading the operational definitions and practice ratings from training tape) in scoring for social play interactions, joint attention, thematic ritualistic behavior, and affect ratings. In order to control for possible observer bias, two data recorders, who were naive to the experimental design and hypotheses, served as observers for all three child participants.

MATERIALS

Toys used in the study were selected on the basis of requiring two or more players to play, age appropriate for both the target child and sibling, and preferred for children of this age. See Table 1 for a list of games.

The intervention game was constructed for each individual child and was based on a common game played by children of this age (Bingo®), but modified to include the thematic ritualistic interests of the child with autism. The toys utilized for generalization probes were those available within that particular context, for example, toys that the school or family owned. The intervention game was made

Table 1. List of Games Available for Play During Baseline, Intervention, Maintenance, and Follow-up Clinic Sessions

Bingo®[a]	Farm Families®[a]
Barnyard Bingo®[a]	Dizzy Dryer®
Milk & Cookies®	Penguin Pile Up®
Tic Tac Tony®	Slobbering Slam®
Jumpin' Monkeys®	Hungry Frogs®
Scrambled Eggs®[a]	Catnip®
Lucky Ducks®[a]	Don't Wake Daddy®

[a]Denotes the games based on equivocal objectives in play involving matching a random stimulus item to a chosen board to win (e.g., Bingo®).

available only during and after the intervention condition in the clinic setting and after the maintenance condition in the home setting.

DESIGN AND PROCEDURES

A multiple baseline across participants design (Barlow & Hersen, 1984) was employed to assess whether an intervention based on incorporating a child's thematic ritualistic activity into an appropriate social game would increase the time spent socially interacting with his or her sibling. Data were collected in randomly selected 10-minute probes, two per week, from 30 to 40 minutes in clinic play sessions during the baseline, intervention, maintenance, and follow-up conditions. The baseline condition ranged from 12 to 18 sessions per participant over 1½ months to 2½ months. The intervention condition consisted of 11 to 14 sessions over a 1- to 2-month time period, and the maintenance conditions ranged from 10 to 14 sessions over a 1- to 2-month time period. Therefore, in accordance with the multiple baseline design, the number of sessions per condition was staggered, resulting in Ken participating in the study over the course of 6 months, Wayne participating over the course of 8 months, and Annie participating over the course of 10 months.

Baseline

In order to assess the level of social interactive play and frequency of ritualistic behavior of the children with autism, the baseline assessed the children's social play behaviors under naturally occurring conditions with a variety of age-appropriate toys and games. Over one third of these popular children games encompassed the play theme of matching a random stimulus item to a chosen board to win (e.g., Bingo®).

The children were requested to play with their sibling with the toys/games provided in the clinic until the allotted time period of 30 to 40 minutes had expired. No special manipulations or instructions were provided. In order to help control for the effect of (a) the stimulus thematic ritualistic activity materials and (b) an adult initiating and teaching an interactive game (variables that would be present during the intervention condition), these variables were incorporated throughout the baseline condition. Throughout the baseline, an adult would attempt to initiate game play and teach a game in which the children were observed to show an interest. These initiated play sessions are indicated in Figures 2 through 5 by squares. Additionally, the stimulus thematic ritualistic materials (i.e., television, VCR and movies, toy cars, markers, and paper) were made available throughout the baseline (indicated by the triangles in Figures 2 through 5).

Intervention

The intervention took place in the same rooms with the same stimulus games as in the baseline condition with the exception of introducing and teaching the children to play a game that incorporated the child's thematic ritualistic activity. Each child's ritualistic activity was chosen from a combination of teacher or teacher's aide interview, parent interview, parent survey, and child observations. For the ritualistic theme to be chosen, it was considered by *all* of the observers and interviewees mentioned above as abnormally perseverative and problematic. Pilot data suggested that the intensity of the same thematic behavior across a variety of settings is important to the design of the study. In order to ensure that the ritualistic theme could be incorporated into a readily available game, each ritualistic theme was incorporated into a common childhood game, Bingo®, encompassing equivocal rules of play and an identical object of the game.

The intervention consisted of an intervention provider prompting each target child and sibling pair to play the intervention game, which was a modified version of a bingo type game that included the child's ritualistic interests as the theme of the game. During the intervention, an adult taught the children the constructed theme game, including the necessary rules for fair play and the object of the game. Because the children with autism did not initially understand that the object of game play was "to win" the game, additional reinforcement for "winning" was provided to facilitate their understanding. All three children showed evidence of understanding the concept of winning after two to five intervention sessions. Participation in the game was voluntary for both the target child and his or her sibling, and no extrinsic reinforcers were provided for play. If the children approached the play materials and neither child initiated an interaction, the target child was prompted to initiate play during the intervention condition and was given a verbal phrase to use with his or her sibling (e.g., to say, "Let's play the [ritualistic theme] game".) The adult's involvement was systematically faded until the children met the criterion for independent game

play: demonstration of (a) an understanding of the object of the game (i.e., to win), (b) an understanding of the rules of game play, (c) initiating play, (d) setting up the game play, and (e) independent continuous game play for a minimum of 5 minutes (without adult prompts). After criterion was met, and for the remainder of the study, all of the children's selections of and participation in games and activities were entirely independent and voluntary, with no adult initiations or prompts.

Child 1. Ken's thematic ritualistic behavior was a number line activity he had learned in school. It consisted of writing consecutive numbers in a line and putting triangles around each number that was a multiple of 5. Ken spent all of his free time at home, school, friends' homes, and the clinic engaging in this behavior. This ritualistic theme was used to modify a typical game (Bingo®). The number line bingo game featured a laminated game board, dry erase markers, individual play boards with 4" × 4" squares with random numbers (matching those numbers on the playing cards), plastic clips as markers, and playing cards with numbers on them. The game board had four rows; the first row began with a number that was a multiple of 10 and the following rows began with the next multiples of 10 (e.g., 10, 20, 30, and 40). In the middle of each row was the multiple of 5 in the sequence (e.g., 15, 25, 35, and 45). The playing cards had numbers on them that could be written on the game board. Before the game play began, each child chose the numbered play board of choice, colored dry erase marker of choice and a stack of plastic clips to use to mark their boards. Game play involved, as in Bingo®, a random selection of stimuli to be marked on the play board, accomplished by the players taking turns picking a card from the stack and reading the number out loud. The player would then write that number on the game board and ask if anyone had it on their play boards. Any player who had that number on his or her play board could put a plastic clip on the space and mark it (it did not have to be his or her turn to mark the board). If the player picked a number that was a multiple of 5, then a triangle was drawn around the number and the player took an additional turn after the players marked their boards. Every chosen number was called out for all players to mark their boards in an attempt to get their boards filled and have a number line bingo. The game was won by the first player to complete his or her play board by having each number called and marked by a clip.

Child 2. Wayne's thematic ritualistic activity was crashing cars together. He engaged in this behavior at home, at school, and at the clinic. He often used toy cars in his perseverative behavior, throwing them across rooms and stating that they crashed. He was observed to crash the vehicles he rode at school during recess into peers' vehicles, and he asked repetitively to engage in video games that involved racing and crashing cars. This ritualistic theme was used to modify a typical game (Bingo®). The crash car bingo game featured a game board with pictures of cars randomly placed covering the board, a toy car track with a jump at the end, individual play boards with 4" × 4" squares with random pictures of cars (matching the cars on the game board), plastic clips as markers, a cork backboard, and multiple toy cars. The cork backboard was placed against a wall and the game board was laid in front of the backboard. The track was lined up so that the jump faced the backboard. Before the game play began, each child chose the car play board of choice, two to three toy cars of choice, and a stack of plastic clips to use to mark his or her board. Because Wayne liked the idea of physically crashing the cars, a simple way of incorporating that activity into the game involved using a toy car track and jump. As in Bingo®, game play involved a random selection of stimuli to be marked on the play board, accomplished by the players taking turns racing their chosen car down the track and off of the jump. The car would launch into the air, hit the backboard, and land onto a picture of a car on the game board, crashing into it and providing a randomly selected stimulus. All players would then check their play boards and place a marker on the car picture on their board that matched the one that was crashed into on the game board. Every car that was crashed into on the game board was called out for all players to mark their boards in an attempt to get their play boards filled and have car crash bingo. The game was won by the first player to complete his or her play board by having each car picture called and marked by a clip.

Child 3. Annie's thematic ritualistic activity was repetitively viewing specific movie clips. She would frequently rewind the video so as to watch preferred scenes. She would engage in echolalic monologues from movies throughout her day at home, at school, and at the clinic. This ritualistic theme was used to modify a typical game (Bingo®). The movie game used a game board with movie video box pictures randomly placed along the parameter, a set of pictures of movie video boxes (matching those pictures on the game board), cards that had either a fast-forward or a rewind symbol and a number between 5 and 20 written on them, and a videotape of random preferred movie clips. The game video was constructed using 10- to 30-second video clips that were observed to be of interest from approximately 10 child-oriented movies (e.g. *Spot, Beauty and the Beast, The Jungle Book,* etc.). Before the game play began, the picture cards were passed out evenly to each player. As in Bingo®, game play involved a random selection of stimuli to be marked on the player's play board, accomplished by the players taking turns picking a card from the stack and following the written directive (i.e., "rewind 5," meaning "rewind to the count of 5"). The players would count out loud to the number the card

stated and then press "play" on the video. Specifically, whatever movie clip was shown acted as the random stimulus for a match, and any player who had a picture of that video could place the picture card on the board, thus marking the board. The players had the choice of viewing the entire clip or moving on to the next player's turn. The game was won by the first player to complete the play board by having each of his or her movie pictures viewed and marked on the board.

Maintenance

The maintenance condition was a return to the baseline condition (including opportunities for play without any adult initiations) with the same toy materials as were available in the baseline condition, occurring in the same play setting, with the exception of the availability of the new intervention game materials (provided during the intervention). As in the baseline condition, the children were free to engage in any games or activities of choice.

Follow-Ups

Follow-up sessions were conducted at 1 month and 3 months after the end date of the maintenance condition to assess long-term maintenance of social play behavior. All settings and play materials were exactly the same as in the baseline and maintenance conditions, with no adult initiations.

DEPENDENT MEASURES

Six dependent variables were selected to adequately assess if incorporating thematic ritualistic activities of children with autism into games had a meaningful effect on their social behavior. These variables are as follows.

Percentage of intervals engaged in social play was determined for each session. Engaging in social play included actively participating in the activity with the child's sibling, using the play materials as designed for play; attending to the game; playing with the sibling and not just with the materials; exhibiting reciprocal turn taking as per the rules of the game; remaining oriented toward the activity (or remaining in position to play and ready to participate in the activity); and/or engaging in positive social communication, engaging in interactive pretend play with the sibling, and *not* ritualistically engaging in perseverative behaviors. In contrast, nonsocial play behaviors were defined as playing alone, engaging in inhibiting stereotypic behavior, engaging in repetitive thematic ritualistic behaviors, engaging in inappropriate behaviors (i.e., tantrumming, leaving room), engaging in negative motor–gestural acts (e.g., grabbing toy away from sibling), engaging in negative vocal–verbal acts (e.g., yelling at sibling to "go away"), and/or not responding to or not attending to the sibling during an activity. These definitions were constructed specifically for this study, with the exception of motor–gestural and vocal–verbal acts, which were adapted from Odom and Strain (1986). Time engaged in social play interactions was calculated as the percent of 10-second full intervals with social play during each 10-minute probe.

The sessions were also scored to assess the following *attention behaviors* (adapted from Lewy & Dawson, 1992; Pierce & Schreibman, 1995): Negative nonengagement behaviors included the following: (a) nonengagement—the child had no clear attentional focus on the sibling or activity (e.g., staring at the ceiling); (b) onlooking—the child passively watched the activities of the sibling but did not maintain interaction with the sibling; and (c) object engagement—the child was actively engaged solely with a toy or game that he or she possessed (e.g., manipulated the toy with sustained visual attention). Positive joint attention behaviors included the following: (a) supported joint attention—the child was actively involved with a toy or game that the sibling manipulated to alter the child's experience with that object (e.g., the target child laughed at the sibling's action with the toy or reached for the toy) or actively watched the sibling's activities while maintaining an interaction (e.g., watched the sibling as she manipulated a toy); and (b) coordinated joint attention—the child was actively involved with the sibling and a toy or game (e.g., the target child and the sibling engaged in the same activity with alternating periods of eye gaze to the sibling). The attention behaviors were calculated as the percentage of occurrence in 10-second intervals during each 10-minute probe.

In order to obtain data pertaining to levels of *child affect,* an observer rated the child with autism and his or her sibling on two 6-point scales relating to interest and happiness (based on Dunlap & Koegel's 1980 affect scale). The items on the scale range from 0 (*disinterested/unhappy*) to 5 (*interested/happy*). The ratings were made at the end of each 10-minute probe.

Percentage of intervals engaged in thematic ritualistic activities were assessed in each session. The thematic ritualistic activity was defined as an activity the child engaged in repetitively in which he or she was preoccupied with a certain object, topic, or theme; the behavior was abnormal in intensity or focus; and the actions resulted in dysfunctional, isolated behaviors. Time engaged in thematic ritualistic activities was calculated as the percentage of 10-second partial intervals with ritualistic perseverative behaviors during each 10-minute probe.

In addition, as a measure of external validity, the parents completed an *obsessional activity survey* (the term *obsessional* was used according to the parent's usage, not the scientific meaning in the field of psychology). One parent, who typically spent the most time with the children, rated the thematic ritualistic behavior on two 6-point scales relating to the frequency (occurring 0% to 100% of the day) and intensity (*not problematic* to *severely problematic*) of the behaviors throughout the child's day. The parents also rated the frequency of sibling play on a 6-point scale ranging from *never engaged* to *always engaged* in play. The mea-

1. If permitted, what percentage of time during the day would your child spend in the "obsessional activity"?

0	up to 20%	up to 40%	up to 60%	up to 80%	up to 100%

2. How problematic are your child's "obsessional activities"?

not at all	slightly	somewhat	moderately	very	severely

3. How often does your child play appropriate social games with his or her sibling/s?

never	rarely	seldom	occasionally	regularly	always

Figure 1. Parent subjective rating scales.

sure was completed by the parents at pretest, posttest and follow-up. The rating scales are shown in Figure 1.

As a supplemental assessment of social validation, a semistructured *sibling interview* was given at pre- and postintervention. This qualitative measure was used to provide a more comprehensive understanding of the efficacy of the intervention in improving sibling interactions. The 12 interview questions were developed to assess the sibling's perceptions of the target child's ability to play, willingness to play, and interest in play, and to assess the sibling's cooperativeness, willingness, and interest in playing with his or her brother or sister with autism.

RELIABILITY

Two observers who were naive to the experimental design and hypotheses independently recorded each behavior separately across all experimental phases by measuring occurrences and nonoccurrences of the behaviors from videotapes. The behaviors measured were percentage of time engaged in positive social interactions, percentage of time engaged in attention behaviors, percentage of time engaged in thematic ritualistic behaviors, and child affect. Reliability was computed on an interval-by-interval basis for approximately 33% of the sessions in all conditions for each child. An agreement was counted when both of the observers recorded an interval with the occurrence or lack of occurrence of each behavior. Disagreements were defined as one of the observers recording a behavior as occurring and the other observer recording the behavior as not occurring during the interval. Reliability was calculated for each session using the following formula: number of agreements divided by the number of agreements plus disagreements multiplied by 100. Agreements for recording affect were defined as both observers recording the identical score or recording scores within 1 point of each other when both scores were within the same category (positive, neutral, or negative).

The average percentage agreement for social play interactions for Ken was 93% (range = 77%–100%); for Wayne, 94% (range = 83%–100%); and for Annie, 94% (range = 75%–100%). Mean Kappa coefficients (correcting for chance in interobserver agreements) for social play interactions across participants was .83.

The average percentage agreement for attention behaviors for Ken was 93% (range = 78%–100%); for Wayne, 94% (range = 83%–100%); and for Annie, 91% (range = 78%–100%). The average percentage agreement for thematic ritualistic behaviors for Ken was 99.5% (range = 95%–100%); for Wayne, 98% (range = 78%–100%); and for Annie, 94% (range = 63%–100%). The mean Kappa coefficient (correcting for chance in interobserver agreements) for thematic ritualistic behaviors across participants was .92. Percentage of agreement for the affect measure for Ken was 96.5% (range = 87.5%–100%); for Wayne, 92% (range = 75%–100%); and for Annie, 95% (range = 80%–100%).

Results

PERCENTAGE OF SOCIAL PLAY INTERACTIONS

Figure 2 shows the percentage of intervals with the children with autism engaged in positive social play interactions during play sessions. In the baseline condition, all three children exhibited low levels of social play interactions with their siblings. For example, Ken socially interacted with his sibling an average of 22% (range = 0%–69%) of the intervals for 13 sessions. Wayne minimally socially interacted with his sister, averaging 16% (range = 0%–53%) of the intervals with social play interactions for 15 sessions. Similarly, Annie averaged 18% (range = 0%–70%) of the intervals with social play interactions with her sibling for 18 sessions.

All three children exhibited increases during the intervention condition and showed continued increases in their

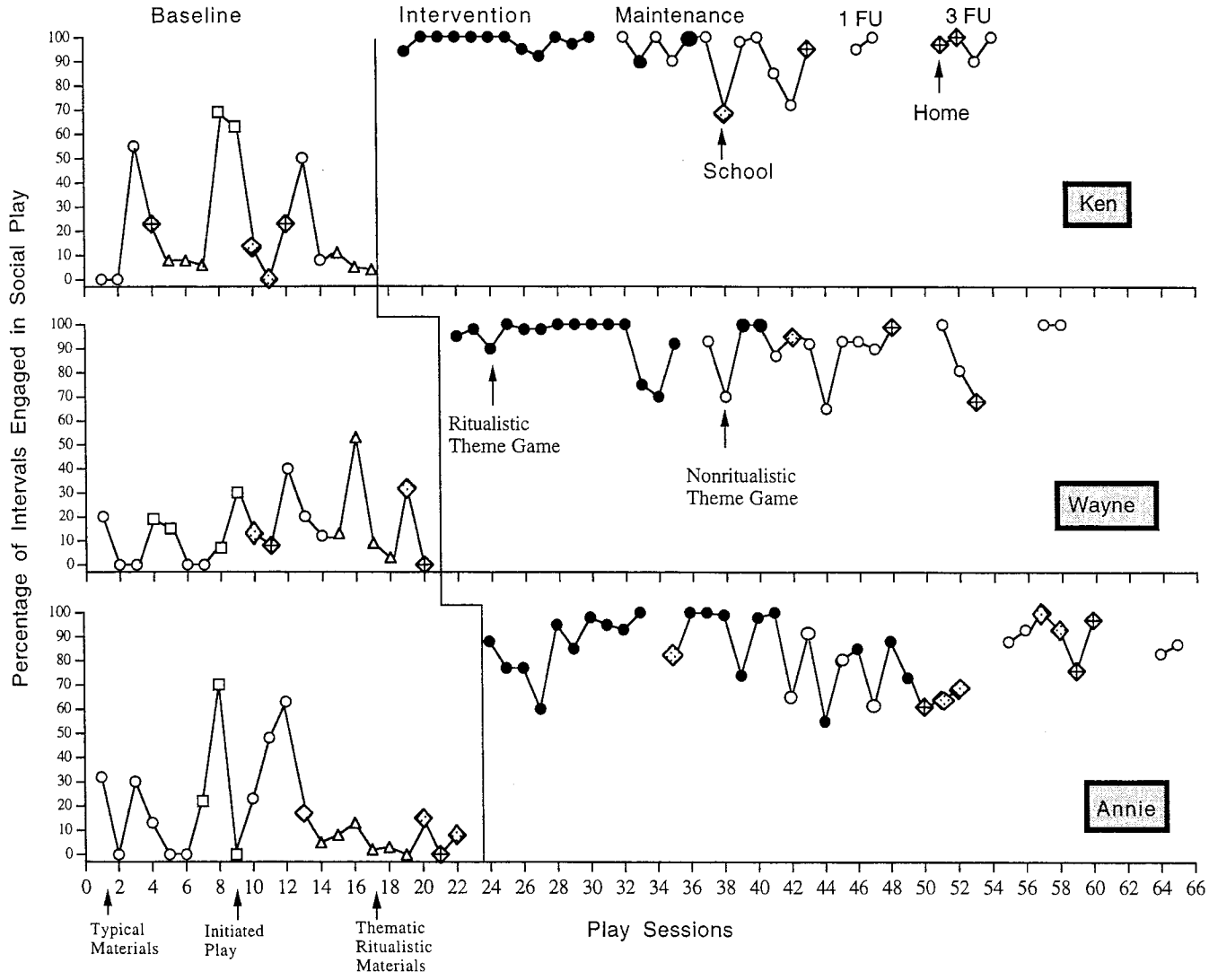

Figure 2. The percentage of intervals the children with autism engaged in social play interactions during the baseline (left panel: circles indicate sessions with typical play materials, squares indicate sessions with adult initiations, and triangles indicate sessions with thematic ritualistic materials), intervention, maintenance, and follow-up conditions. Generalization probes are indicated by open spotted diamonds for school probes and crossed diamonds for home probes. Solid circles refer to the ritualistic theme game, and open circles refer to nonritualistic theme games.

social play behavior during the maintenance and follow-up phases. Specifically, during intervention, Ken averaged 98% (range = 92%–100%) of the intervals with social play interactions. He continued these behaviors during maintenance, averaging 93.5% (range = 72%–100%) of intervals with social play and during the 1-month and 3-month follow-ups, averaging 96% (range = 90%–100%) of intervals with positive social play behaviors. Interestingly, Ken and his sibling were observed to engage in "other" games available in the room that did not incorporate the thematic ritualistic activity. Ken played other games during 8 of the 10 play sessions in the maintenance condition and during all of the four follow-up play periods resulting in high averages of social play as reported above. See Figure 2, in which the open circles indicate other games that do not involve the ritualistic theme and the filled circles indicate the intervention game incorporating the ritualistic theme.

Wayne exhibited large increases in his social behavior as well, averaging 94% (range = 70%–100%) of intervals with social play interactions during the intervention condition. During the maintenance condition he averaged 88% (range = 65%–100%) of intervals with social play and averaged 95% (range = 81%–100%) of intervals with social play interactions during the 1-month and 3-month follow-up conditions. Wayne also engaged in "other"

games (nonritualistic theme games, indicated by open circles in Figure 2) the majority of the play sessions during the maintenance condition, 8 out of 10 play periods, and during all four of the follow-up play periods.

Annie's social behavior increased during the intervention, averaging 87% (range = 60%–100%) of intervals with social play interactions that were sustained during the maintenance condition, averaging 84% (range = 55%–100%) of intervals and during the 1-month and 3-month follow-up condition, averaging 88% (range = 83%–93%) of intervals with positive social interaction behaviors. She engaged in the thematic ritualistic game during 10 of the play periods (indicated by filled circles) and engaged in other nonritualistic theme games during 4 of the 14 play periods (indicated by open circles in Figure 2). She engaged in "other" non-intervention games during all four of the follow-up play periods.

Furthermore, all three children demonstrated increases in positive social interactions during the generalization probes taken at their homes and at school after the intervention. Specifically, Ken's average play interaction with his sibling at home during baseline was 23%. His average interaction with peers at school was 6.5%. His behaviors increased in both generalized settings without interventions occurring in the home or at school. His positive interactions with his sibling increased in the home to interacting an average of 95% during the maintenance condition and averaging 98.5% during the 1-month and 3-month follow-up condition. Ken's positive interactions with peers increased to 68% at school during the maintenance condition. Wayne also exhibited large increases in positive interactions in his home and in school settings after the in-clinic intervention without interventions occurring in the generalized settings. During baseline, Wayne averaged 4% of interactions with his sister in their home and 22.5% of interactions with peers at school. His behaviors increased to 97% of sibling social play interactions at home and 95% of peer social interactions at school. Wayne continued to interact with his sister during the 1-month follow-up 68% of the time. Annie exhibited large increases in her generalized settings at home and school without interventions occurring in those settings as well. Annie showed no interactions with her sibling in the home during baseline, 0%, and minimal interactions with peers at school, averaging 13%, during baseline. Her positive interactions increased to 61% at home and averaged 61% at school during the maintenance condition. She continued to increase her positive behaviors and interacted with her siblings, averaging 98.5% at home, and interacted with peers, averaging 84.5% at school at follow-ups. See Figure 2; the spotted diamonds indicate generalization data collected at a child's school, and crossed diamonds indicate generalization data collected at a child's home.

PERCENTAGE OF JOINT ATTENTION BEHAVIORS

Figure 3 shows the percentage occurrence of joint attention behaviors. Specifically, Ken exhibited minimal positive joint attention behaviors, averaging 20% during baseline. He demonstrated increases in his positive joint attention behaviors during intervention, averaging 97%. These gains continued throughout the study, averaging 93.5% during the maintenance condition and 97.5% during the 1-month and 3-month follow-up conditions.

Wayne presented with a similar pattern. He exhibited minimal positive joint attention behaviors during the baseline condition, averaging 15%. His positive attention behaviors increased during the intervention condition, averaging 95%, and his behaviors remained at high levels of positive joint attention during the maintenance period, averaging 89%, and during the 1-month and 3-month follow-up period, averaging 95%.

Annie also exhibited low levels of positive joint attention behaviors during the baseline condition, averaging 21%. However, her attention behaviors increased during the intervention condition, averaging 82% of intervals with positive joint attention. Her high levels of positive joint attention behaviors continued during the maintenance condition, averaging 84%, and during the follow-ups, averaging 87%.

CHILD AFFECT

The target child and sibling were scored on two dimensions of affect related to the social play: interest and happiness. Due to the close relationship of the two dimensions, an average was obtained for each 10-minute play period to form composite ratings of affect. In Figure 4, a rating of 3.3 to 5 indicates a positive score (i.e., *very interested, very happy*), 1.71 to 3.29 indicates neutral affect (i.e., *neither interested nor disinterested, neither decidedly happy nor particularly unhappy*), and 0 to 1.7 indicates a negative score (i.e., *disinterested, unhappy*). The data show that during the intervention condition, all three children's ratings of affect increased, as did the affect of their siblings. These increases in affect were evident during the maintenance and follow-up conditions as well.

Ken's average affect score during the baseline condition was 2.46 (neutral), and his sibling's average affect score was 2.38 (neutral). During the intervention condition, Ken's average affect score increased to 4.05 (positive), and his sister's affect score increased to 4.59 (positive). The positive affect continued for both Ken and his sister during the maintenance and follow-up conditions. Ken's average affect score during the maintenance play periods was 4.2 (positive), and it was 4.5 (positive) during follow-ups. His sibling's average affect score during the maintenance condition was 4.3 (positive), and during the follow-up condition it was 4.75 (positive).

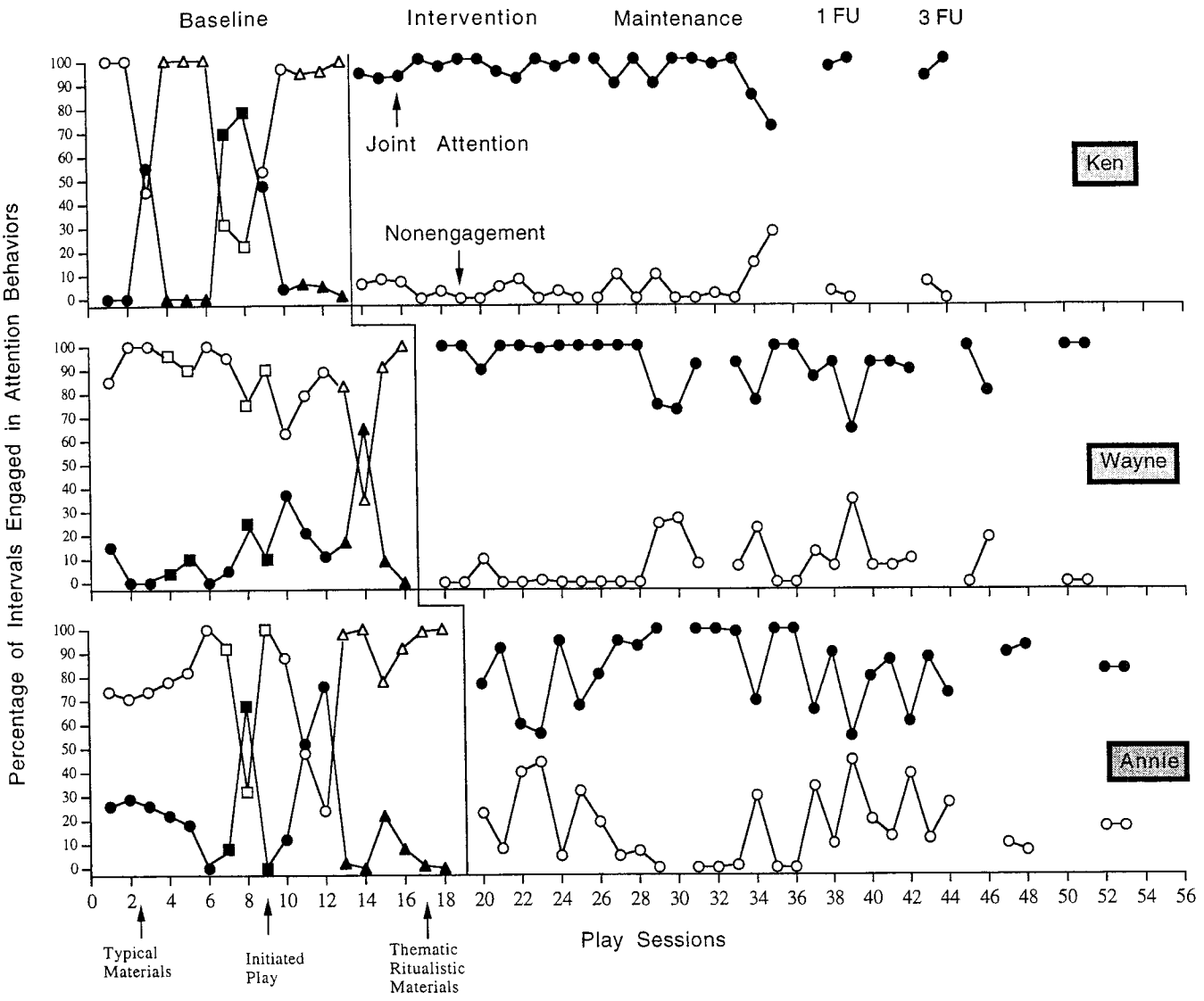

Figure 3. The percentage of intervals the child with autism engaged in attention behaviors during baseline, intervention, maintenance, and follow-up conditions. Solid symbols refer to joint attention behaviors, and open symbols refer to nonengagement behaviors.

Wayne and his sister's affect also increased from neutral during the baseline condition to positive during intervention, maintenance, and follow-up. Wayne's baseline average affect score was 2.0 (neutral), and his sister's affect score was 2.25 (neutral). During the intervention, Wayne's average affect score increased to 4.25 (positive), and his sibling's score was 4.07 (positive). Wayne's average affect was 3.9 (positive) during the maintenance condition and 5 (positive) at follow-up. His sister's average affect score was 3.75 (positive) during the maintenance condition and 4.88 (positive) at follow-up.

Similarly, Annie showed an increase in average affect scores from neutral during the baseline condition (2.21) to positive during intervention, maintenance, and follow-up (2.90). Annie's average affect score increased to 3.55 (positive), and her sibling's affect score to 3.77 (positive) during the intervention condition. The positive affect continued during maintenance and follow-up, averaging 4.14 (positive) and 4.0 (positive), respectively. Likewise, her sister's average affect score was 3.93 (positive) during maintenance and 4.5 (positive) at follow-up.

PERCENTAGE OF THEMATIC RITUALISTIC BEHAVIORS

Figure 5 shows the percentage of intervals with the target children engaged in thematic ritualistic behaviors during in-clinic sessions and school and home probes. In the baseline condition, all children showed evidence of problem-

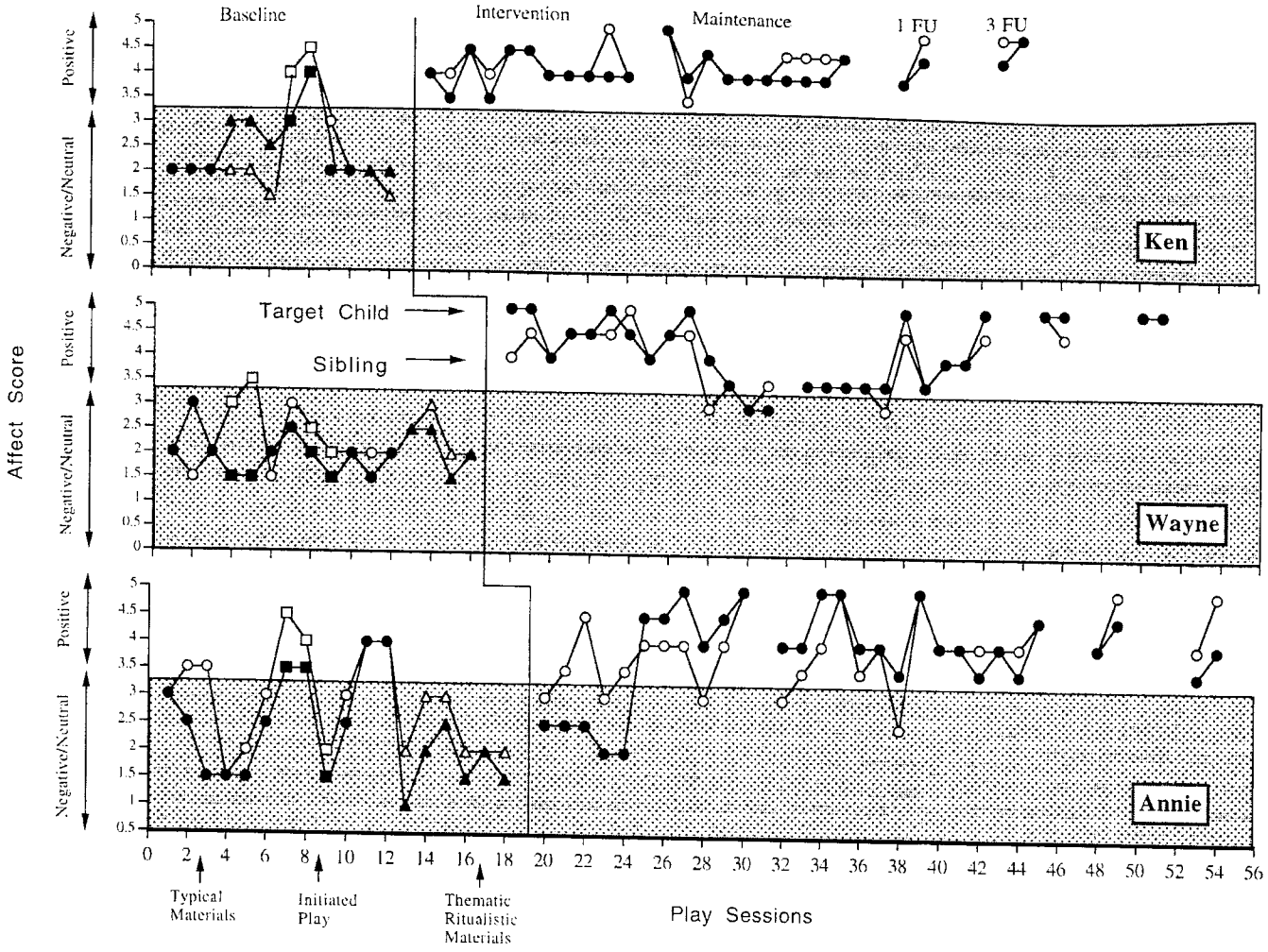

Figure 4. The average affect scores for the children with autism (solid symbols) and their siblings (open symbols) during baseline, intervention, maintenance, and follow-up conditions.

atic levels of thematic ritualistic behaviors. These negative behaviors decreased during the intervention, maintenance, and follow-up conditions in the clinic, at home, and at school.

For example, Ken averaged 18% (range = 0%–63%) during the baseline sessions involving typical play materials. However, Ken's thematic ritualistic behaviors averaged 78% (range = 56%–89%) during the baseline sessions involving ritualistic materials. Ken exhibited ritualistic behaviors for 71% of the negative behavior intervals during a home probe and 21% during a school probe at baseline. His thematic ritualistic behaviors receded during the intervention condition and decreased to no occurrence during the maintenance and follow-up conditions, averaging 0%. Furthermore, Ken did not engage in thematic ritualistic behaviors at home or school during the probes at postintervention and follow-up, averaging 0%.

Wayne also showed decreased intervals with thematic ritualistic behaviors postintervention. During the baseline, Wayne engaged in thematic ritualistic behaviors during sessions involving typical play materials, averaging 26% (range = 0%–63%), during sessions involving initiated play, averaging 36% (range = 0%–59%) and during sessions involving ritualistic materials, averaging 25% (range = 0%–68%). Wayne was observed to perform his ritualistic behaviors at school, averaging 29.5% (range = 29%–30%) during baseline play periods. His thematic ritualistic behaviors decreased during the intervention, with only 2 sessions out of 15 including these negative behaviors, averaging 2.3% (range = 0%– 25%). He did not engage in ritualistic behaviors during the maintenance condition and exhibited these behaviors at only one follow-up session in the clinic, with no thematic ritualistic behaviors at school or home postintervention.

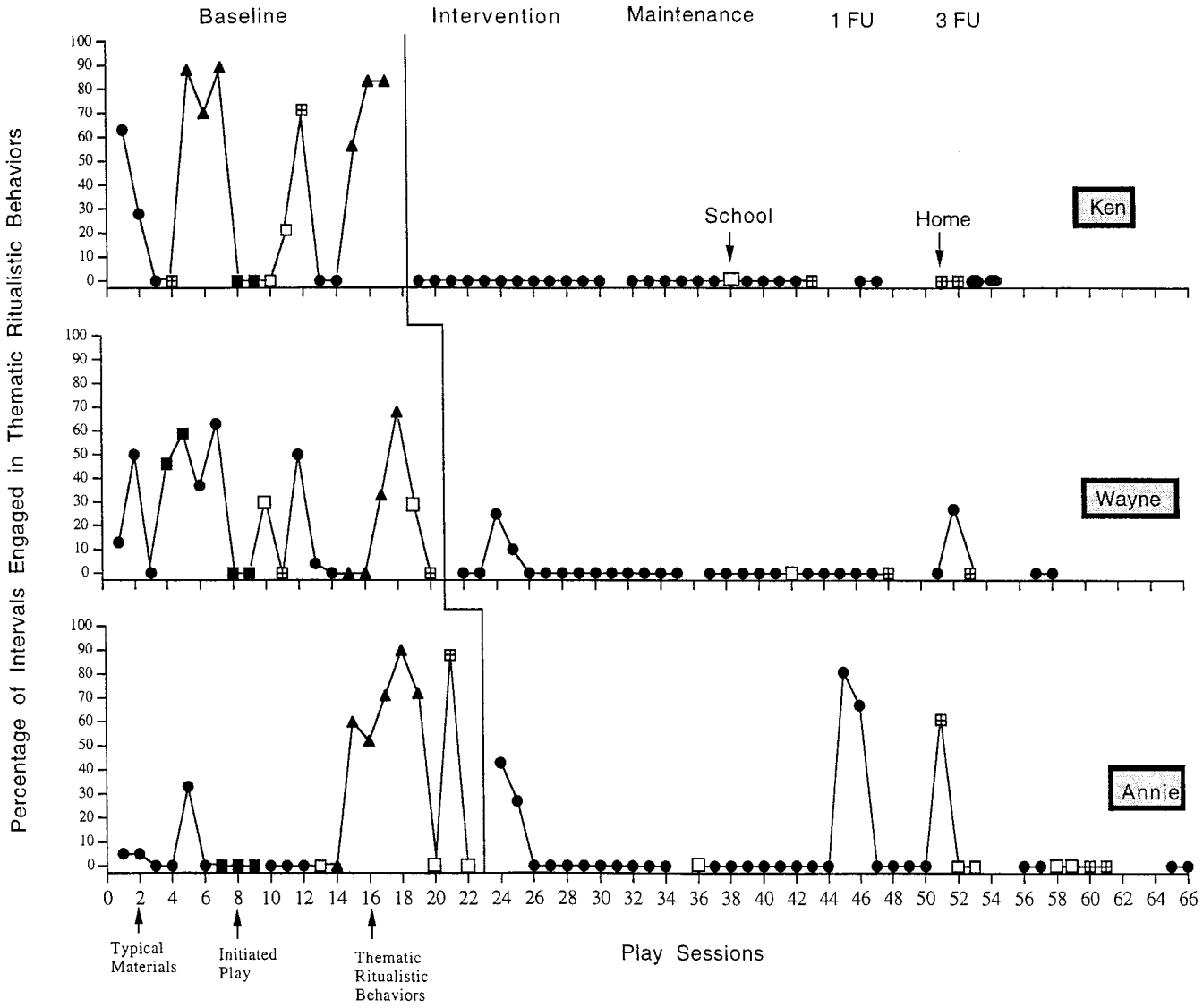

Figure 5. The percentage of intervals the children with autism engaged in thematic ritualistic behaviors during the baseline, intervention, maintenance, and follow-up conditions. Open squares refer to school probes and crossed squares refer to home probes.

Annie also showed evidence of reduced thematic ritualistic behaviors postintervention. During baseline, she engaged in ritualistic behaviors in sessions involving typical play materials, averaging 9% (range = 0%–33%), and during sessions involving ritualistic materials, averaging 58% (range = 0%–90%). Annie was also observed engaging in ritualistic behaviors at home 88% of the time. These behaviors decreased to occurring in only the first two intervention sessions, with an average score for the intervention phase of 7% (range = 0%–43%). Annie's reduction in ritualistic behaviors continued during the maintenance and follow-up conditions. Annie exhibited ritualistic behaviors in only 2 of the 14 maintenance sessions, averaging 11% (range = 0%–81%). She did not engage in thematic ritualistic behaviors at follow-up, averaging 0%. Her decline in these negative behaviors was evident in the home as well, with a decrease to 61% postintervention and 0% at follow-up.

PARENT RATINGS

The parent, who typically spent the most time caring for the children, rated the children's behavior on three 6-point likert scales. The subjective ratings were completed at pretest, posttest and follow-up. The parents rated the percentage of time their child with autism engaged in "ob-

sessional activities." Figure 6 shows the parent ratings at pretest, posttest and follow-up. Ken's mother estimated that his thematic ritualistic behaviors occurred 80% of the day prior to the intervention. These behaviors decreased to no occurrence, according to the parent rating, occurring 10% at posttest and 0% at follow-up. Wayne's behaviors also decreased, according to the parent rating. His father estimated that his thematic ritualistic activities occurred about 40% of the day during baseline. These behaviors decreased to 10% at posttest and 20% at follow-up. Annie also showed evidence of decreased thematic ritualistic behaviors according to her mother. Her mother estimated that the behaviors occurred 40% of the day during baseline. These decreased to 10% at posttest and 10% at follow-up.

The second subjective rating required the parents to rate how problematic the target child's thematic ritualistic activities were (*severely* to *not at all*). Ken's mother rated his behaviors as "very" problematic at baseline, which dropped drastically to "slightly" problematic at posttest and "not at all" problematic at follow-up. Wayne's father rated his behaviors as "slightly" problematic at baseline, maintenance, and follow-up, with no change. Annie's mother rated her behaviors as "slightly" problematic at baseline, which dropped to "not at all" at posttest and "barely" at follow-up.

The parents also subjectively rated the amount of time their child with autism played socially with his or her sibling (*always* to *never*). Ken's parent rated social play as occurring "rarely" at baseline and increasing to "regularly" at

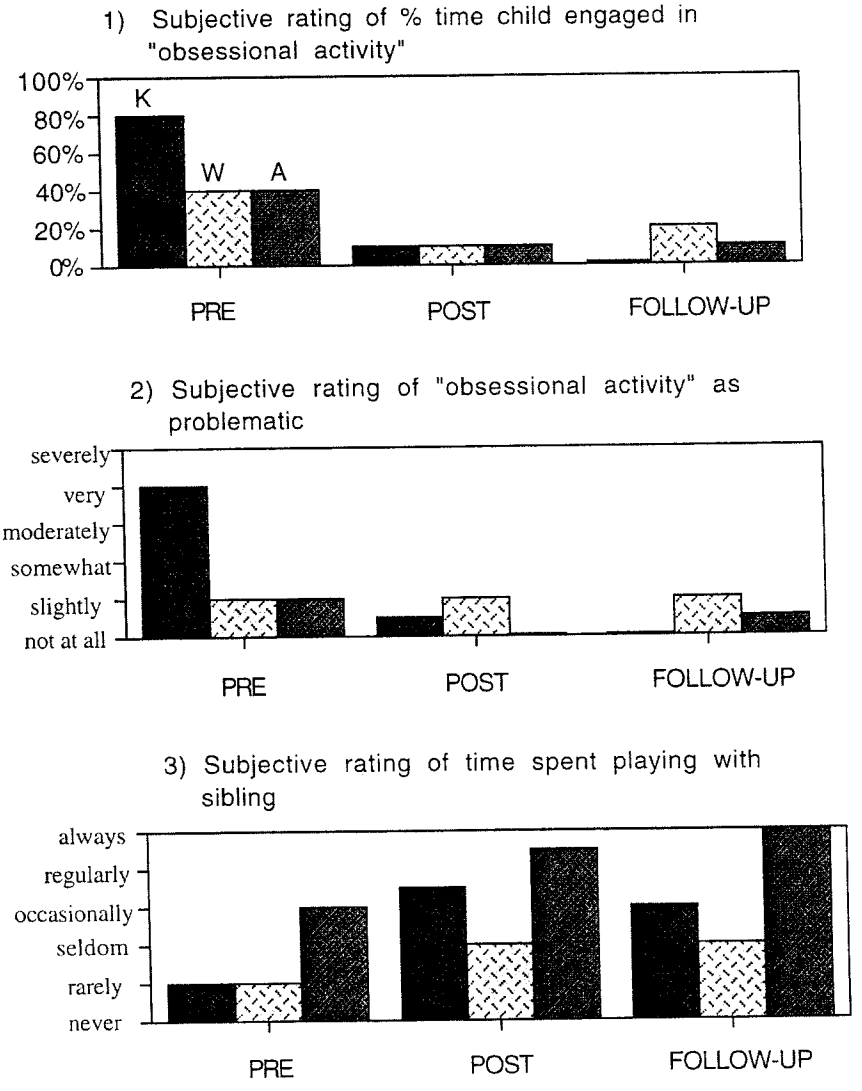

Figure 6. Subjective parent ratings on the "obsessional activity survey" at preintervention, postintervention and after 3-month follow-up condition.

posttest and "occasionally" at follow-up. Wayne's parent also rated an increase in sibling social play. He was rated as engaging in social play with his sister "rarely" at baseline, which increased to "seldom" at posttest and follow-up. Annie was observed to show improvements in her interactions with her sibling. She was rated as socially playing "occasionally" at pretest, "regularly" at posttest, and "always" at follow-up.

SIBLING INTERVIEW

As a supplemental measure of social validation, the siblings of the three children with autism were asked a variety of questions pre- and post-intervention. The semistructured interview inquired about the siblings' perceptions of the target child's ability to play, cooperation or willingness to play, and interest in play. The questions also inquired about the sibling's behavior toward the brother or sister with autism, asking about his or her cooperation or willingness to play with his or her sibling with autism and his or her interest in playing with him or her (see Figure 7).

As shown in Figure 7, the siblings made very different responses pre- and postintervention regarding their brother's or sister's play. Ken's sister responded that Ken knew how to play a "little bit" before the intervention but responded, "Yes, if I teach him," after the intervention. The siblings' responses regarding their brother's or sister's ability to play the games they like to play shifted from a definite "no" to "sometimes" or "not all of them." When asked what her sibling could and could not do, Ken's sister stated that he "can't play board games" and that he "can play hide and seek but not good at it" before the intervention. She stated at posttest that, "he can play some board games like Hungry Hippos®, Monopoly Jr.®, etc., and he can play most things that I want to now," but "he still can't play Operation® very well." Postintervention, Wayne's sister stated that "he can play his own games and ride bikes" and that "he can't play games I have, like board games." Postintervention, she stated that "he is really good at pillow games, he can play easy board games and computer games," but "he's not good at card games, so I try to help him." Preintervention, Annie's sister stated that "she can watch TV, eat candy, and play with the cat, but sometimes hurts the cat" and "she can't play ordinary games." Postintervention, Annie's sister stated that "she can make up her own games," but she "can't play some games, like jumping on the trampoline." The siblings also described their brother or sister's cooperation or willingness to play with them differently after the intervention. Two of the three siblings changed their responses from definite "no" responses to positive replies to the question, "Does your sibling play with you often?" after the intervention. In response to the last question, referring to the target child's interest in playing with the sibling and friends, the siblings stated that the children with autism were more interested but still did not play with their sibling and her friends too often.

The siblings' behavior toward their brother or sister with autism appeared to change postintervention as well. To the question, "Do you ever ask your sibling to play?" the siblings reported, "No, only when there is no one else," "No," and "Yeah," before the intervention and, "I ask him if I can draw or play school with him," "Sometimes," and "Yes," after the intervention. Each sibling seemed to respond in a more positive fashion postintervention. The siblings were also asked about times when they play with their sibling with autism. Preintervention, Ken's sister stated that she played with him "when there is no one else to play with"; postintervention, she stated that she played with him "when I am bored." Preintervention, Wayne's sister responded "not very often" to this question; postintervention, she responded, "Saturday nights when I don't have homework." Annie's sister said that she played with Annie "after school and after dinner" prior to the intervention and "when home from school every day" after the intervention. All three siblings reported increased time spent playing with the child with autism.

Finally, the siblings' interest in playing with their brother or sister with autism seemed to increase. Preintervention, Ken's sister stated that she liked to play "board games like Hungry Frog®, but Ken is not good at them"; postintervention, she responded, "House, school, and drawing." Wayne's sister stated that she "didn't like to play" with her brother before the intervention and "pillow fights" after the intervention. Annie's sister liked to play "pretend fight on bed and look at books" before the intervention and "red light, green light, monster game, computer games, road rash, and imitate Rugrats® game" after the intervention. All the siblings enjoyed playing the target child's games more postintervention as well. Preintervention comments were, "He won't let me play," "*No*!" and "Yes, some." Postintervention responses were, "They're OK," "Not always," and "*Yes*." The final question, asking if the sibling liked to play with his or her brother or sister with autism, demonstrates the impact of the intervention on the sibling relationship. Preintervention, the siblings stated, "Sort of, he's weird," "*No*, he quits," and "Yes." Postintervention, all the comments were positive: "It's better," "Sometimes," and "*Yes*!"

Discussion

The results of this investigation demonstrated that thematic ritualistic behaviors of children with autism can be successfully incorporated into childhood games, facilitating the social play between siblings. These findings showed that frequently occurring thematic ritualistic behaviors, typically viewed as problematic in young children with autism, may be considered intrinsically reinforcing agents for positive change and development. Previous studies

Sibling's Perception of Child with Autism

	PRE	POST
Child's ability to play		
1. Do you think (child's name) knows how to play?		
Ken's Sib:	a little bit	yes, if I teach him
Wayne's Sib:	yeah, but doesn't like to	yes
Annie's Sib:	yes	yes
2. Does (child's name) know how to play the games you like to play?		
Ken's Sib:	no	sometimes
Wayne's Sib:	no	not all of them
Annie's Sib:	no	no
3. What can (child's name) play and do?		
Ken's Sib:	hide & seek, not good	play some board games, most things
Wayne's Sib:	play his games, ride bikes	pillow game, easy board games, etc.
Annie's Sib:	watch TV, eat candy, play cat	make up own games
4. What can't (child's name) play and do?		
Ken's Sib:	play board games	play operation too well
Wayne's Sib:	play board games	not good at card games, I teach him
Annie's Sib:	play ordinary games	play some games, jump trampoline
Child's Cooperation/Willingness to Play		
1. Does (child's name) play with you often?		
Ken's Sib:	no	sort of
Wayne's Sib:	no	yeah, usually
Annie's Sib:	yes	yes
2. Does (child's name) play with you when you ask?		
Ken's Sib:	says yes but doesn't play	yes
Wayne's Sib:	no	not always
Annie's Sib:	yes	no
Child's Interest in Play		
1. Does (child's name) ever play with you and your friends?		
Ken's Sib:	yeah, but not a lot	sometimes
Wayne's Sib:	no	no
Annie's Sib:	yes, comes & goes	yes

Sibling's Behavior Toward Children with Autism

Sibling's Cooperation/Willingness to Play		
1. Do you ever ask (child's name) to play?		
Ken's Sib:	no	I ask to draw with him, play house
Wayne's Sib:	no	sometimes
Annie's Sib:	yeah	yes
2. When do you usually play with (child's name)?		
Ken's Sib:	when there's no one else	when bored
Wayne's Sib:	not very often	Saturday nights, when no homework
Annie's Sib:	after school, after dinner	home from school everyday
Sibling's Interest in Play		
1. What games do you like to play with (child's name)?		
Ken's Sib:	board games, not good at	house, school, drawing
Wayne's Sib:	not much	pillow fights
Annie's Sib:	pretend fight on bed	red light, monster, computer, etc.
2. Do you like to play the games (child's name) plays?		
Ken's Sib:	he won't let me play	they're OK
Wayne's Sib:	no	not always
Annie's Sib:	yes, some	yes
3. Do you like to play with (child's name)?		
Ken's Sib:	sort of, he's weird	it's OK, it's better
Wayne's Sib:	no, he quits	Sometimes
Annie's Sib:	yes	yes

Figure 7. Sibling responses to semistructured interview at pre- and postintervention.

have also reported on the benefits of using ritualistic stereotypic behaviors to increase positive behaviors (Baker et al., 1998; Charlop et al., 1990; Charlop-Christy & Haymes, 1998). Additionally, this study found that the sibling pairs increased their positive social behavior after the intervention and maintained it during 1-month and 3-month follow-up sessions. The positive social interactions generalized to other (nonintervention) games and to the home setting, as well as to the school setting with peers. The target children's joint attention behaviors progressed from nonengagement to high levels of supported and coordinated joint attention postintervention. Furthermore, the affect of both the children with autism and their siblings increased positively, showing greater interest and happiness following the intervention. The children's thematic ritualistic behaviors were found to decrease in clinic sessions and in the home and school environments, according to observations and parent ratings. Parents rated the sibling pairs as interacting more in other settings throughout their typical day. Lastly, the siblings made more positive comments during semistructured interviews regarding their brother or sister with autism postintervention. They disclosed that they liked playing with their sibling after the intervention.

These findings have several important implications for both theory and practice. First, even though the baseline condition involved sessions with adult initiations to play, access to age-appropriate games without the availability of thematic ritualistic activities, and sessions with access to both games and thematic ritualistic activities, these environmental controls were not sufficient to promote and maintain sibling play. These results seem to be consistent with previous studies relying on these methods and the difficulties with generalization and maintenance (Brady, Shores, McEvony, Ellis, & Fox, 1987; R. L. Koegel, Firestone, Kramme, & Dunlap, 1974; Strain, Odom, & McConnell, 1984). However, following the incorporation of the thematic ritualistic behavior into a typical age-appropriate game, based on the popular game play of Bingo®, the children with autism seemed to be highly motivated and interested in engaging in social interactions and playing games with their siblings. These results are similar to those of Baker et al. (1998). The children's high frequency of interactions and high affect in the game play incorporating their thematic ritualistic behavior provide some evidence that these stereotypies are intrinsically reinforcing and child-preferred activities.

More importantly, the children with autism engaged in other social games, not involving their ritualistic behaviors, following the intervention. Specifically, two of the three children spent all of their time engaged in other social play (nonintervention activities) during the maintenance condition, and all three children engaged in other generalized play at follow-up. The game play may have become more reinforcing than the thematic ritualistic activities. The intrinsic reinforcement associated with the play activities may have successfully competed with the intrinsic reinforcement associated with the ritualistic behaviors (Carr & Darcy, 1990; Carr & Kologinsky, 1983). Subsequently, the children's participation in thematic ritualistic behaviors decreased dramatically. In fact, child play is intrinsically motivating, reinforcing, spontaneous, and self-generated, according to researchers (Caldwell, 1986; Sutton-Smith, 1976). The play activities themselves may have been highly reinforcing. The children could choose to engage in any activity (ritualistic or social) during all of the play periods, supporting self-generated and spontaneous play. The children with autism, as found in other studies, preferred to engage in the social play activities (Roeyers, 1996; Santarcangelo, Dyer, & Lerce, 1987). They were observed to both initiate and respond in social interactions, demonstrating reciprocal interactions. The positive reciprocal play interactions may have actually replaced previous stereotypic ritualistic behavior. This may account for the long-term maintenance of social interactions, generalization to other settings (i.e., home and school), and generalization to other interactive activities, as well as reductions in thematic ritualistic behaviors.

Additional aspects of the study that may have facilitated generalization were the subtle training contingencies, such as presenting a social game that incorporated the thematic ritualistic activity to the children as an intervention (Brown, Ragland, & Fox, 1988), and the immersion of varied conditions and social responses into the play periods (Stokes & Baer, 1977).

Second, researchers have found that children with autism can learn through games to interact more capably with others (Collard, 1981; Jansma, 1982; Schleien, 1983; Schleien, Mustonen, Rynders, & Fox, 1990). This newly learned capability was also commented on by the children's siblings in the present study. Postintervention, they reported that the children knew how to play (as opposed to their preintervention responses of "no" or "a little") and they knew some of the games the sibling liked to play (as opposed to the preintervention response of "none"). Furthermore, the siblings were able to name games the children could play (as opposed to naming isolating behaviors such as "watching TV" prior to the intervention). The siblings may have spent more time engaging in and initiating activities with their brothers and sisters with autism as a result of their positive perceptions of the child's capabilities. Perceptions and/or attitudes toward the child's disability may be a determinant of sibling interaction, such that both children have an influence on and are influenced by each other (Senel & Akkok, 1996). In turn, the siblings' interactions may have acted as additional reinforcers for the children with autism, further increasing the occurrence of social play (Baer & Wolf, 1970; Tremblay, Strain, Hendrickson, & Shores, 1981). More systematic data collected on the siblings' behaviors would be beneficial in future research.

In the present study, the intervention games were designed to be enjoyable for both children while incorporating the thematic ritualistic activity of the child with autism. The inclusion of the thematic ritualistic activities seemed to be effective in two ways: (a) It appeared to be highly reinforcing for the child with autism, and (b) it provided a situation that demonstrated the target child's skill in game play. In part because of their expertise related to the ritualistic theme, which fostered an ease at playing the intervention game, the children displayed social competence. The affect data suggest that the game play was enjoyable for both children and that the children developed meaningful social relations. Guralnick (1990) has proposed that the competence of children during social interactions (and not the fact that the child has a disability) is the determining variable in terms of establishing and maintaining social interactions. To play competently and well, according to Avedon (1971), players need some degree of physical and/or strategic skill. Interestingly, all three children with autism (as well as their siblings) were observed to cheat at the game play (by purposefully not following the rules correctly) for their own advantage, deceiving the other sibling while he or she was not attending. To engage in purposeful deceit in an activity, a player needs to clearly understand the game, have strategic skill, have social knowledge and skill, and have an ability to form mental representations of self and others (i.e., theory of mind; L. A. Hughes, 1991; C. Hughes & Russell, 1993). Previous research has yielded evidence that children with autism have difficulty with strategic deception, supporting a possible theory of mind deficit (Russell, Mauthner, Sharpe, & Tidswell, 1991; Sodian & Frith, 1992). The spontaneous usage of deception in this study by the children with autism does not support the theory of mind hypothesis of social deficits; in contrast, it provides evidence of ability and competence similar to those of the typically developing siblings. Moreover, children often view a player as a competent play partner when a player is good at the activity, not just displaying the strategic skill required for play. The intervention games, based on the target children's high-frequency ritualistic behaviors, capitalized on the children's strengths, giving them opportunities to be good at the game. The apparent high social competence found in this study implies that the social abilities of children with autism may be more internally developed than previously suspected. These results need to be replicated and studied further to learn more about the specific social deficits that may be unrelated to ostensible motivational deficits for children with autism.

Third, the result showing increased affect for both the children with autism and their siblings, as well as and the qualitative interview responses by the siblings, suggests that the intervention assisted the children in developing more reciprocal relationships. Positive sibling interactions not only benefit both children but also lessen the burden that families with children with autism often have to bear (Schreibman, O'Neill, & Koegel, 1983). All siblings influence one another, but the sibling with a disability may have various effects on his or her typically developing sibling, especially on stress level, attitudes toward disabilities, and overall adjustment (Senel & Akkok, 1996). Positive and frequent sibling interactions provide sources of emotional support and skill development, whereas negative and infrequent sibling interactions may disrupt an individual's psychological growth and development (Bryant, 1982; J. Dunn & Kendrick, 1982). Prior to the intervention, the siblings' qualitative remarks were constantly negative, referring to their brother or sister's inability to play, their dislike in playing with them, and their infrequent interactions. However, positive effects on the sibling relationship were demonstrated postintervention by the overall increase in social play, the generalization to play in the home, the increase in affect, the increase in parent rating of percentage of time siblings engaged in play, and the siblings' comments during the qualitative interviews. Anecdotal comments by the parents also indicated a change in the siblings' relationship after the study, resolving the parents' earlier concerns regarding the children's infrequent and poor interactions. Past research has spent ample time assessing the effects that having a brother or sister with autism has on the typically developing sibling (Mates, 1990; McHale, Sloan, & Simeonsson, 1986; Sullivan, 1979). However, there needs to be more systematic research on the effects that positive interventions, which improve these relationships, have on the siblings, evaluating variables such as attitudes, self-concept, interpersonal skills, and stress. The research should also include more longitudinal data on the impact that sibling interactions have on the individual development of each child and on the family.

Fourth, all of the siblings in this study were older girls. The possible impact of sibling characteristics on the overall results is unknown. According to Breslau et al. (1981), older siblings, especially girls, are at greater risk for adjustment problems related to having a sibling with a disability. According to this finding, it may have been more beneficial to include the elder sisters. Yet, there is some indication that the gender and age of the sibling may have contributed to the positive results. In an earlier study, older siblings were found to initiate activities with their brothers or sisters more and display more social and teaching behaviors (Azmitia & Hesser, 1993). Sibling relationships are often asymmetrical, with the older siblings and/or typically developing siblings being responsible for making more of the initiations and leading the interactions (Knott et al., 1995). It is possible that the siblings who are younger than the child with autism do not have the necessary skills to reinforce the social interactions and promote continued play. Future studies should include more diverse sibling pairs. It is especially important to investigate interactions with siblings younger than the child with autism.

Last, the study showed that the thematic ritualistic behaviors decreased while the social play behaviors increased for all three children. The results imply an inverse relationship between social play behavior and stereotyped behavior. Many other researchers have found similar results (Charlop et al., 1990; R. L. Koegel et al., 1974; Lee & Odom, 1996; Stahmer & Schreibman, 1992). The literature also supports this study's finding that using stereotyped behaviors as reinforcers does not increase their frequency but rather decreases those behaviors (Charlop et al., 1990; Charlop-Christy & Haymes, 1996, 1998; Wolery et al., 1985). Nonetheless, this study was innovative in that it used the thematic ritualistic behaviors as an inroad into more socially acceptable behaviors. Indeed, Kanner (1973) found that the presence of thematic ritualistic interests in a child with autism, potentially of a socially acceptable kind, was highly correlated with successful social adaptation. The fact that the child engages in thematic ritualistic activities may be an indicator of a higher potential for positive social play behaviors. According to Epstein, Taubman, and Lovaas (1985), stereotypical behaviors fall on a continuum, with higher level behaviors characterized by preoccupations or thematic rituals. Therefore, the need for the ritualistic behavior to be thematic for the intervention to be successful may actually be a prognostic variable suggesting capacity for improved social behavior. Further research should continue to define the aspects of stereotyped behaviors in children with autism that may be prognostic versus those that may inhibit development.

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