Changes in Solitary Play following Acquisition of Cooperative Play by Children with Autism

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Abstract

The purpose of this study was to identify potential collateral changes in solitary play following the acquisition of cooperative play in three children with autism. An approach combining observation, verbal description and imitation of modeled interactive play, utilizing a multiple exemplar strategy, was applied to establish cooperative play. Both the number of consecutive play responses and the extent of response variability in the children's solitary play were assessed prior to, and immediately after criterion for mastery were met for cooperative play. A corresponding change in solitary play was found, both in terms of episode length and variability following mastery of cooperative play. The results were maintained at 3 and 14 months follow-up measures.
Key Words: solitary functional play, cooperative play, response variability, children with autism.

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Introduction

Descriptive accounts on the progression of play behavior in typical development are numerous, and the results on both sequencing of play forms and at what age one can expect different play forms to appear are fairly consistent across studies. During the first year of infancy, play is predominantly characterized by simple manipulation of objects such as mouthing, banging, sucking and throwing (e.g., Fenson, Kagan, Kearsley, & Zelazo, 1976). Functional play, which involves the capacity to handle objects as their function denotes (e.g., Libby, Powel, Messer, & Jordan, 1998), tends to emerge in the beginning of the second year and the number of functional acts increases linearly with increasing age (e.g., Belsky & Most, 1981; Largo & Howard, 1979). The ability to combine or relate objects into topic related sequences appears by the end of the second year and is a regular part of the child's play repertoire when around 30 months of age (e.g., Largo & Howard, 1979; Sinclear, 1970).

Children with autism will not necessarily follow the transition from single play acts towards combinatorial functional play as seen in typical children. In fact, numerous studies have revealed deficits in functional play in this group (e.g., Jarrold, Boucher, & Smith, 1996; Lewis & Boucher, 1988; Sigman & Ungerer, 1984; Stone, Lemanek, Fichel, Fernandez, & Altmeier, 1990). Studies show that spontaneous functional play in children with autism is reduced compared to typical children (e.g., Jarrold et al., 1996; Lewis & Boucher, 1988; Ungerer & Sigman, 1981), but also compared to children with other conditions such as moderate learning difficulties (Jarrold et al., 1996). When functional play occurs, it appears to be less varied with more repetitions than novelty, consisting predominantly of single acts involving single objects (Boucher, 1977; Sigman & Ungerer, 1984; Williams, Reddy, & Costall, 2001). Hence, elaborated functional play that involves several objects in integrated chains of actions is less likely to be observed with these children (e.g., Williams et al., 2001).

Although children with autism show a reduction in spontaneous functional play with multiple objects, they show no impairment compared with controls when provided with cues, either in terms of specific instructions (e.g., "Give the dolly a drink of juice") or "open prompts" (e.g., "What can you do with these?") (Charman & Baron-Cohen, 1997; Jarrold et al., 1996). Since children with autism are able to carry out elaborated functional play under cued circumstances, but show difficulties doing so spontaneously, it has been suggested that the difficulty relates to the ability to generate actions and to produce available skills (Jarrold et al., 1996). A potential outcome of such a deficit could be a predominance of repetitive responding over novelty and variability (Jarrold, 1997). Others have suggested that the very tendency to persevere interferes with the production of novel play responses (e.g., Lewis & Boucher, 1988). A more recent hypothesis concerning the reduced variability and elaboration of functional play seen in children with autism suggests difficulties in acquisition rather

than production (Williams, Costall, & Reddy, 1999; Williams et al., 2001). According to these researchers, the difficulties with variability and elaboration of functional play are an emergent product of their difficulties in social interaction. While simple functional play can be acquired through simple exploration with the objects, elaborated functional play may be more dependent upon social mediation and hence fail to develop (Williams et al., 2001).

Taking the above suggestions into account, then, a reasonable assumption would be that extended chains of variable functional play performed solitarily would emerge through the acquisition of interactive functional play. In a recent study by Jahr, Eldevik, and Eikeseth (2000) cooperative play was established in six children with autism following a behavior modeling procedure that combined observation, verbal description and imitation of modeled interactive play, utilizing a multiple exemplar strategy. Following this approach, all participants: a) could initiate episodes and sustain episodes initiated by their play partner; b) could take turns in episodes that were considerably longer than the episodes practiced during training; c) could vary their play within and between play episodes; and, d) could transfer those skills across partners, setting and time. Given the hypothesis that complex solitary play is an outgrowth of interactive play, we decided to provide additional data on solitary play, obtained on three of the participants from the Jahr et al. study (2000) to examine the possible transfer and maintenance to solitary play following intervention in cooperative play.

Method

Participants, Setting and Materials

Table 1, below, summarizes the age, gender, IQ and Vineland scores of the participants. As indicated on the table, the participants included three boys' aged 4, 7, and 12 years with diagnoses of autism based on the DSM-III-R or DSM-IV criteria. The children were identical to participant 3, 4 and 5 in Jahr et al. (2000) showing an IQ of 81, 46 and 81 and an *Adaptive Behavior Composite Score* of 52, 38 and 67 respectively. The reason to include assessment of solitary play was based on information from parents and school and kindergarten staff of participant 1 and 2 in the original study, reporting more elaborate and sustained solitary play following the cooperative play intervention. Participant 6 in that study was excluded from the current analysis because of inadequate data collection (i. e., only one pre assessment and no follow-up measure of solitary play in addition to variation in types of probes between pre- and post probe measures).

Table 1. Description of Participants

Participant	Age	Gender	IQ	Vineland[c]
1	7 years	Male	81[a]	52
2	10 years	Male	46[a\]	38
3	4 years	Male	81[b]	67

[a]Wechsler Intelligence Scale for Children-Revised

[b]Bayley Sclaes of Infant Development-II

[c]Vineland Adaptive Behavior Scales

At the time of this study, the three participants demonstrated spontaneous functional play with an array of play objects, but they rarely combined objects and elaborated upon play topics beyond two responses unless they were specifically instructed to do so. For remaining information on the participants we refer to Jahr et al. (2000).

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Training of cooperative play and probe sessions for solitary play were both conducted in small workrooms in the children's kindergarten and schools.

A minimum of 40 different toys were present during both probe sessions and training and were those typically found in kindergartens (e.g., Lego®, Brio®, dolls, wooden blocks, toy animals, cars, miniature furniture, etc.).

Play response

As outlined in Jahr et al. (2000) and in Jahr and Eldevik (2002), a play response was defined as a discrete manipulation of toys in a conventional manner (e.g., running a horse, driving a car or feeding a doll). A play response began once the participant touched the toy and it was ended when the participant signaled that the play response was completed by either letting go of the toy or stopping the play response, with no attempts to manipulate toys within a period of 5 s. The toy play observed both in probe sessions for cooperative play and solitary play were assessed in accordance with this definition.

Procedure

Training with Modeling, Verbal Description, and Imitation. A full description of the procedure used to establish cooperative play is given in Jahr et al. (2000) and will not be detailed here. In brief, two adult models performed a scripted play episode. After observing, the participant was required to describe the modeled play episode, and next, to take the place of one of the two models and to participate in the play episode just observed and described. Verbal prompts were used to assist the participant, and individualized reinforcement was given contingent on displaying the behaviors that had been modeled.

Probe Session. Probe sessions for both cooperative and solitary play were conducted prior to training, immediately following training and at follow-up.

In probe sessions for *cooperative play*, the participant was seated on the floor, facing his play partner, who initiated play by saying "Let's play" while emitting a play response (i. e., play-partner-initiated probes). In a second kind of probe, the play partner would just say "Let's play" and wait for the participant to respond (i. e., participant-initiated probes).

In probe sessions for *solitary play*, the child was seated alone on the floor, with all the toys available and within reach. He was then given a general instruction to play with the materials (e. g., "play with the animals"). The child was then allowed 30 seconds to start playing with the materials in his own way. If the child refused to respond or persevered on the same response during a 30 second period, the probe was terminated and the next probe was initiated, again with a general instruction to play with the materials (e. g., "play with the train set"). Hence, each general instruction to play signaled a general topic without specifying any particular performance connected to that topic. The instructions given during probe sessions for solitary play were standardized for each participant across sessions, but varied slightly across participants. The objects used in these sessions were the same as for probes for cooperative play and they were present throughout the whole probe assessment.

Design, Data Collection and Inter-observer Agreement. The program used to establish cooperative play was originally evaluated using a non-concurrent multiple baseline design across participants (Jahr et al., 2000). Additional probe measures on the children's solitary functional play were carried out following the probe sessions for cooperative play prior to training, immediately following training and at follow-up. Participants 1, 2 and 3 were assigned to baseline lengths of 2, 3 and 6 months respectively. Probe measures on solitary play were conducted twice for each participant pre training. Follow-up measures were obtained on the average of 3 and 14 months following the termination of the program. Probe measures for solitary play were recorded both in terms of the total number of play responses that occurred within each instructed episode (e. g., "play with the tea set") and the extent of play variability within each episode. Play responses within an episode were scored

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as variable, either if the child selected a new object or changed his response towards an object (e. g., running the horse, then feeding the horse). Identical repetitions of responses upon a particular object were scored as perseverance. Percent variability was calculated by counting the number of variable play responses, dividing it by the total number of play responses, and multiplying by 100.

Inter-observer agreement was collected on 20% of the probe measures on solitary play, distributed evenly across participants. The co-rater scored each play response that occurred in each episode. Point by point agreement ratio was then calculated by dividing the total number of agreements by the total number of agreements plus disagreements multiplied by 100. The resulting mean agreement in these probe measures was 98% (range 87%-100%).

Results

Figure 1 shows the number of play responses that occurred in each episode of solitary play during probe measures conducted pre- and post training. As seen in this figure, the participants showed only modest abilities to relate objects and actions in their solitary play prior to training. The mean number of play responses that occurred during these probes was 1 (range 0-6). Following training on cooperative play, all three participants showed a clear change in their solitary play, towards longer chains of play responses. The mean number of play responses in probe measures after reaching mastery of cooperative play was 6 (range 2-10). Furthermore, the participants continued to demonstrate longer episodes of solitary play at follow-up, with a mean number of play responses across children of 6 (range 4-9) and 9 (range 6-14) after an average of 3 and 14 months respectively. This increase in play responses during post training probes and follow-up measures on solitary play coincides with the improvement shown in cooperative play. As reported in Jahr et al. (2000), the mean length of episodes of cooperative play during probes post training and at the two follow-ups for these participants were 8, 8 and 11 play responses respectively.

Figure 1 also displays the mean percentage of play variability for each child across probe sessions for solitary play (mean percentage of variability pre training are presented combined). The mean variability for participant 1-3 pre training was 25% (range 20-30%) while the mean play variability in probe sessions conducted post training had increased to 98% (range 94-100%). This high degree of variability was maintained on follow-up measures obtained after an average of 3 and 14 months showing a mean variability of 97% (range 92-100%) and 95% (range 89-100%) respectively. Level of response variability again coincides with the levels of response variability during cooperative play (mean percentage of variability during these probe sessions were 96, 92 and 99 respectively, as reported in the original study).

Discussion

The possibility that elaborated functional play could emerge from social interactive contingencies was pursued in the present investigation. Probe measures on solitary functional play were collected before and after the establishment of cooperative play in three children with autism. Results showed that even though solitary play was not targeted directly, significant changes occurred, both in terms of the number of consecutive play responses in each play episode and the extent of response variability within each episode. While the children rarely combined actions with objects prior to training, they consistently did so after they had shown mastery of cooperative play. For example, when instructed to play with the animals, participant 3 produced only one act during pre training measures (i.e., put up one animal) but he produced 10 consecutive acts towards the objects in the first probe measure obtained after training (i.e., put up cows; built a fence around the cows; sheep walked in and said “baah”; cow walked over and said “moo”; horse jumped inside fence; elephant walked in; dinosaur ran beside the fence; put up trees outside the fence; hen ran under the trees; horse ran over and ate from the threes). Finally, the children’s ability to show elaborate and varied sequences of functional solitary play was further confirmed in probe sessions conducted on the average of 3 and 14 months following the completion of the program.

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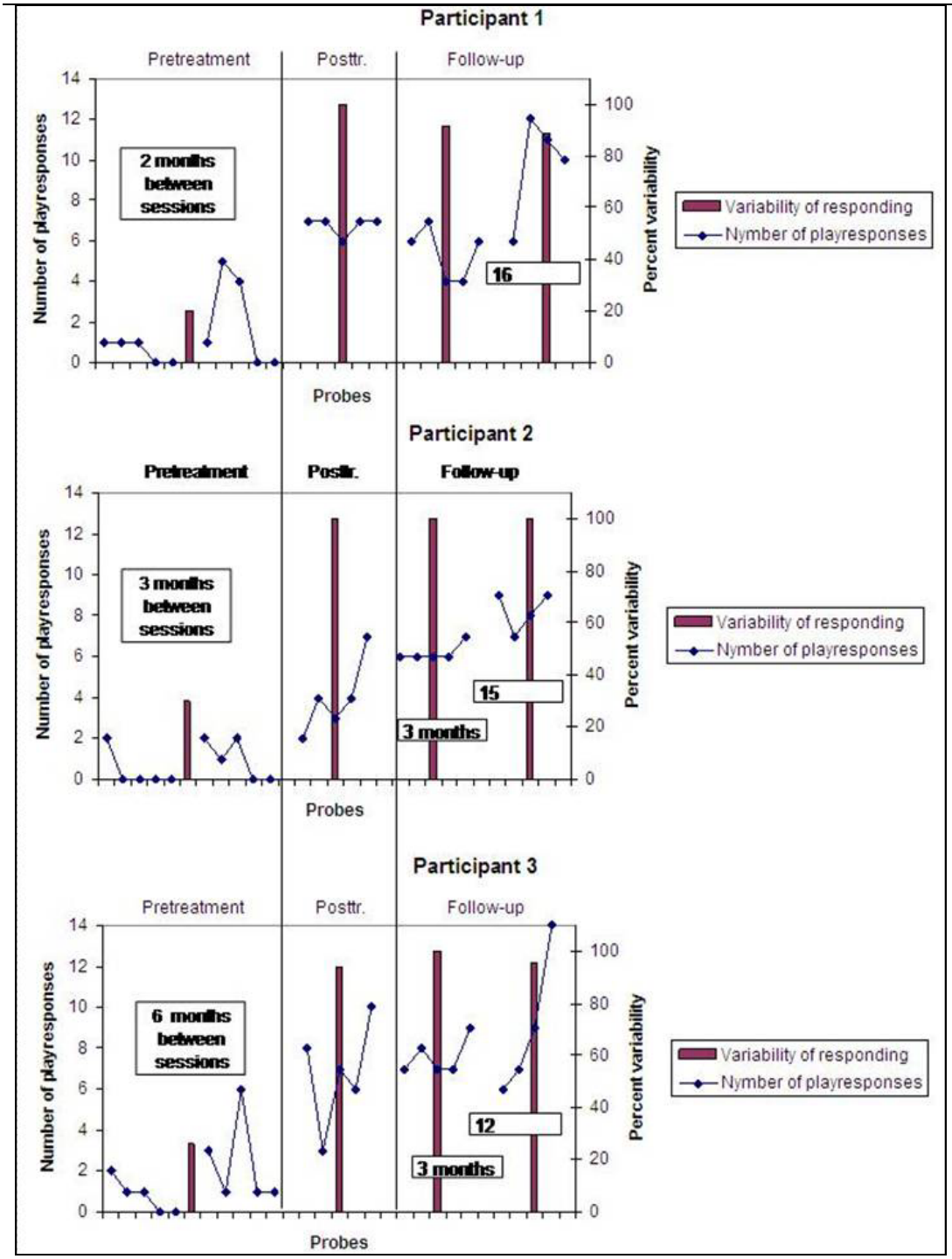

Figure 1. **Number of play responses and mean percentage of variability across sessions for each participant.**

Toy play is an activity that is either performed alone or as part of an interaction with one or more partners. The latter is usually termed social because the objects and the effort of another person jointly control its occurrence, topography, and frequency. Hence, its presence and continuation is dependent upon sensitivity to other persons' responses sharing the dual property of being both a reinforcing stimulus for the previous response and the occasion for the next (e. g., Jahr & Eldevik, 2002). Solitary play can not be termed social as such because it is limited to an interaction between the agent and the object where the continuation of play is controlled by the response product of the previous response and available objects. However, elaborated solitary play might have originated or been acquired from social contingencies. It was recently suggested by Williams et al. (2001), that single acts of functional play, which are predominant in children with autism, may be shaped by the physical structure of the objects through simple solitary exploration. They also assume that physical structure is insufficient to facilitate elaborated functional acts and that the ability to extend functional play beyond single acts necessitates social interactive skills and the ability to learn from such contingencies. Given that the relationship between the emergent ability for sustained cooperative play and the ability to produce elaborate sequences of solitary play seen in the present study is real, this assumption is given support.

Social interaction and appropriate toy play have a prominent role in the effort of constructing a curriculum for young children with autism. One important aspect of such a curriculum is to promote what we will term as repertoire dependent progression. More specifically, repertoires established at any given point (e. g., cooperative play) make more advanced repertoires available for treatment (e. g.., role-play); repertoires that would probably not have been available in the absence of those previously established skills. Another important aspect is to identify developments that emerge as collateral effects of the establishment of the skill directly targeted. It is suggested that the change in solitary play following the acquisition of cooperative play seen in the present study might be such a collateral effect. In Jahr et al. (2000), the basic strategy utilized to promote cooperative play was multiple exemplar training. This strategy was assumed to be responsible for the observed transfer to novel and sustained interactive play. It is suggested that a curriculum derive its strength especially through a consistent and widespread use of the multiple exemplar training to promote repertoires. Hence, this strategy might be the crucial vehicle for facilitating both transfer within the targeted area, facilitating collateral effects within related areas that are not targeted, and eventually to promote repertoire dependent progression towards more advanced repertoires. This assumption merits further research.

The present study contains some clear limitations that warrant mention. First, the rather limited number of participants makes it difficult to make clear inferences about the generality of the findings. Hence, replications are necessary. Second, since solitary play was merely assessed and not targeted directly, a clear-cut relationship between mastery of cooperative play and the occurrence of elaborate sequences of solitary functional play is not conclusive. Finally, the original study (Jahr, et al., 2000) used a non-concurrent multiple baseline design, and since the participants in the present study was drawn from that sample, the same possibility that external events might have coincided with the phase changes and thus produced the effects is relevant here.

In light of the qualifications just mentioned, the apparent change in solitary play, repeated across participants, along with the increase in response variability did coincide with mastery of cooperative play. When adding the corresponding performance between cooperative play and solitary play at both follow-up assessments for each participant, the evidence for a potential connection between the establishment of sustained cooperative play and improved elaborate functional play is strengthened.

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