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Serene H.-J. Choi and Timo A. Nieminen

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## **Improved social interaction by children with autism by training of peers**

Serene H.-J. Choi and Timo A. Nieminen

*The University of Queensland*

*S&T Consulting & Training*

### **Abstract**

Peer-mediated intervention is seen as promising to facilitate development of both social and cognitive skills in children with autism. However, peers have great difficulty in social interaction with children with autism, presumably diminishing the effect of the intervention. This difficulty does not lie with the children with autism alone—the inability of peers to understand social cues and behaviour of children with autism contributes. Therefore, we designed a peer training program to better enable the peers to interact.

Typically developing children acted as peer play partners for children with autism. Following initial play sessions to measure the pre-training levels of cognitive play and social interaction, half of the peers underwent the peer training program, and the effect of the training on cognitive play and social interaction were measured, with the untrained peers as controls. No improvement in social interaction was shown by the untrained peers—experience alone was not enough. Trained peers showed large, and statistically significant, improvements. Clearly, such a peer training program could be of great benefit in inclusive education as well as in peer-mediated intervention.

Apart from the observation that the program was effective and necessary, motivation of peers is an important, but difficult, issue. Finally, we note that the level of cognitive play shown by children with autism, which is often used as a measure of success of an intervention, appears to be an extremely unreliable metric of performance.

### **Introduction**

In view of the trend towards increased inclusion, the placement of children with autism into inclusive educational settings is likely to increase. An important benefit of such inclusive placement is the opportunity for the children with autism to socially interact with typically developing peers. However, such social interaction fails to result—physical proximity is insufficient (see, for example, the review by McConnell (2002)). The lack of social interaction is usually explained as a result of deficits of social skills in the children with autism. However,

social interaction is a reciprocal process, and it is reasonable to expect that the difficulty that children with autism experience in social interaction with typically developing children is partly due to the typically developing children being unable to recognize or understand social cues and responses used by the children with autism.

Accordingly, a training program to teach typically developing children how to interact with children with autism was developed. The training program focussed on disability awareness and play interaction skills that were modified from peer approach interventions. Fifteen specific play interaction skills were taught to the trained peers. Eleven play interaction skills were adopted from Pivotal Response Training (PRT) (Pierce & Schreibman, 1995) as follows: getting attention from the child with autism by touching and speaking, allowing the children with autism to choose play materials, paying attention and waiting, demonstrating play activities, including verbal statements, suggesting activities to children with autism, turn-taking, narration of play activity to children with autism, providing help to children with autism, sharing activity, explaining, and reinforcement of attempts to encourage and extend appropriate play behaviours and social skills in children with autism. Four additional play interaction skills were included: using eye contact, gesture, personal space, and asking for help.

The training consisted of watching videotapes, discussions, specific instruction, modelling, role-playing, feedback, worksheets, self-monitoring and feedback, and rewards. Videotapes that show general information about friendship, differences in people, and typical behaviours of children with autism were used to help the peers' understanding of play interaction with children with autism. Relevant segments of educational films were prepared to fit within the limited time of play training session. Discussion about play and social interaction was guided in a child player-centred manner. The discussion was supported and facilitated by simple questions focussed on the theme of each session. The topic of discussion was started with general friendship in typically developing children's lives, and expanded to special friendships with children with disabilities, especially children with autism. Also, it focused not only on the notion that what children with disabilities are not able to do *due to* their disabilities, but what children with disabilities are able to do *with* their disabilities.

The experimental test of this training program was the primary focus of the research described here. A modified subjects-as-their-own-controls design was used, with the same children with autism each playing with a trained peer and an untrained peer in dyads. This models a peer-mediated play intervention, and the difference in success between trained and untrained dyads allows the effectiveness of the peer training to be determined.

The levels of cognitive play and social interaction displayed by the children with autism were measured. The level of social interaction provides a direct measurement of the immediate success of the peer-mediated play intervention, and is the best available indicator of possible long-term benefit for the children with autism. While the level of cognitive play provides a more indirect measurement, it is widely used, using the Piaget–Smilansky categories (Piaget, 1962; Smilansky, 1968), as a measure of the effectiveness of various interventions.

## **Participants**

In total, nineteen children—five children with autism and fourteen typically developing peers—participated in this study.

The five children diagnosed with autism (whom we will designate CA1–5) were all boys, aged from three years and one month to six years and nine months at the time of their participation. These children with autism were recruited from two Special Education Developmental Units (which we will call SEDU-A and SEDU-B) and one Special Education School (SES) associated with SEDU-A. They were all Caucasian and from families where English was the only language spoken at home. All the five children with autism had been previously diagnosed by a local psychologist. Four of them (CA1, CA2, CA4, and CA5) attended their SEDU on a part-time basis for special educational services with other children with developmental delay. The other

boy with autism (CA3) was enrolled in the SES on a full-time basis with other students with special needs.

Fourteen typically developing peers (seven boys and seven girls, aged eight to nine years, designated P1 through to P14, with boys being the odd-numbered peers, and girls the even-numbered peers) were recruited from three grade three (year three) classes in two state primary schools (SPS-A and SPS-B). All of the children who acted as typically developing peers volunteered to take part in the study. Apart from one girl (P8) who was non-Caucasian of unknown background (possibly Maori or other Polynesian), all other peers were Caucasian. One boy (P7) had mild paraplegia.

Of these fourteen cross-aged peer players, ten acted as regular peer players (two for each child with autism). The other four students (P6, P7, P12, and P13) were substitute or reserve peers, to replace regular peers who were not present for a scheduled session or withdrew their participation. In the event, P13 did not participate in any of the play sessions. Assignment of peers was random.

These peers were randomly divided into two groups; one group was to receive training intended to enable them to interact more successfully with the children with autism, and the other was to remain untrained. Trained peers are identified by a prefixed "T", untrained peers by "U".

## **Experimental design**

In principle, it is quite straightforward to measure the effectiveness of a training program for typically developing children to improve their interaction with children with autism—simply compare the levels of social interaction shown by children with autism when playing with trained and untrained typically developing peers. In practice, however, inter-subject variability would require a large number of subjects before a statistically significant result could be established.

Therefore, a standard procedure is to make use of quasi-experimental methods, such as using a baseline/treatment design (AB design), where the subjects before treatment (in this case, before the training program) act as a control group. Since both the experimental group and the control group are made up of the same subjects, the effect of intersubject variability is virtually eliminated. This was the method adopted here, with typically developing children acting first as untrained peer play partners, undergoing training, and then acting as trained peer play partners.

However, and this is especially the case when testing the effect of a training program, any change could be due to the passage of time—improvement through practice, rather than through training. Since the trained peers cannot be untrained, it was not possible to use a baseline/treatment/reversal design (ABA design) to overcome this difficulty. It was then necessary to use a second group of peers who remained untrained to measure the amount of improvement that resulted from practice. In order to minimise the effect of variation among the children with autism, these untrained peers played with the same children with autism as the trained peers. Multiple-baseline designs can be used to distinguish between effects due to training and practice, but were ruled out by time limitations imposed by the participating schools.

This left open the possibility that improvement in social interaction with the untrained peers could have been due to learning by the children with autism, from the trained peers. Although it was realised that a strong crossover effect of this type, if it occurred, would make it impossible to achieve the primary goal—measurement of the effectiveness of the training program—such rapid learning of social skills by the children with autism was considered highly unlikely, and in any case, if it did occur would be an observation of such importance as to compensate for the failure to determine the effectiveness of the training program.

In order to be able to use statistical methods to determine the likelihood that any change seen due to the training was genuine, the social interaction and play behaviour of the children with autism, in play sessions with trained and untrained peers, was recorded over multiple sessions both before and after the training.

## Procedure

Play and interaction in both indoor and outdoor settings were measured in this study. These settings were simulated naturalistic settings, providing a high degree of both control and generalizability to real-life situations. Both indoor and outdoor settings were used since children in inclusive education could be expected to play together in both indoor and outdoor settings on a daily basis. Most similar studies were restricted to indoor settings only, presumably on the grounds of experimental practicality. Thus, it was possible that the outdoor settings might provide especially new and interesting results.

In SPS-A, the indoor play setting was a space of approximately four by five metres which was partitioned off by desks and chairs from a larger function room. In the SEDU-B, the indoor play setting was a room of approximately four by four metres in size. The outdoor play settings at SEDU-B and SPS-A were similar in that both included a sandpit and an adequately-sized playground. The outdoor play setting at SEDU-B also had a play area used for playing with outdoor toys, distinct from the playground. The SEDU-B playground was also smaller, approximately half the size (but still of adequate size), and access was dependent on usage by other classes. For the indoor play sessions, four sets of play materials were chosen from those available at the SEDU attended by the children with autism and placed on the floor. For outdoor play sessions, some sandpit play materials were chosen from the two SEDU. In addition, playground facilities such as slides (and monkey bars at SPA-A) were used. Other outdoor play equipment such as a baseball set and a tenpin bowling set were set up in SEDU-B.

After an initial profiling and screening phase, indoor and outdoor play sessions, covering a pre-training phase, a peer training phase, and a post-training phase) were held two days per week for each dyad from late May to early November in 1999. Unfortunately, CA4's regular trained peer (TP10) withdrew after the peer training phase (and continued to participate in this study as a reserve trained peer). TP10 was replaced by TP12 as the regular trained peer player for CA4 during post-training phase. The data from these unmatched dyads (CA4-TP10 and CA4-TP12) were collected. Even though the data from these unmatched dyads could not provide conclusive evidence of improvement due to training (since improvement from CA4-TP10 before training to CA4-TP12 after training could be due to TP12 being more able to interact with CA4, independent of the training), it is still useful to note that the data for CA4 closely followed the trends seen in the other children with autism.

Each child with autism was alternatively paired with an untrained peer (untrained dyad) and trained peer (trained dyad). Counterbalancing was generally maintained to minimize the effect of the problem of same order implementation through alternating sequence of untrained and trained dyad as well as alternating sequence of indoor and outdoor setting. However, sometimes, one of the players was not available. Then, it was necessary to change the sequence again.

At the start of a play session, each dyad was told "It is play time together! You can play with these toys and have fun!" Each dyad had two play sessions, one indoor and one outdoor, on each day they played. Therefore, each child with autism participated in four play sessions, two with the trained peer, and two with the untrained peer, on each day they played (twice per week). Each session lasted for about six minutes—six minutes was the standard play session length, but variations did occur, as discussed below. Where the session exceeded six minutes in duration, data were only recorded for the first six minutes.

Early in the pre-training phase, the dyad was reminded during the play session once or twice about unused available play materials if they used only one item for more than half the time of the session (3 minutes). Occasionally, other teaching materials were nearby, having been prepared for other children by teaching staff. Then, the dyad was reminded which play materials were available in the play session.

When one child in the dyad did not want to keep playing in the session, the child was encouraged to continue playing. After one or two minutes, if the child still did not want to keep playing, the session was stopped. On the other hand, if both children in the dyad group wanted to keep playing longer than six minutes, they were told that they would have more opportunities to play together on other days (since the children had to return to regular school activities). If they still insisted on playing longer, they were allowed to play for about one or two minutes more. However, this extra play time was only requested a couple of times from the trained dyad of CA4 in the late post-training play phase.

Given that children with autism are especially vulnerable to disruption of their routines, if a regular peer was unable to attend the scheduled play session, one of the reserve trained or untrained peers was used as a substitute. This was important to minimise disruption for the children with autism. No notable disruption was observed as a consequence of the substitute peer play partner. Play sessions with substitute peers were not counted as play sessions for the regular dyad in data analysis, since the dyad was different. The play sessions with substitute peer were still all recorded, even though the data were not used in this study.

### **Data collection and analysis**

Indoor and outdoor play sessions of each dyad were recorded using a compact video camera, and then transferred to VHS videotapes and coding was performed using an editing machine which provided high-quality stills and accurate rewinding and fast-forwarding. The dyad data on videotapes were classified into two sets of behaviour categories: one measuring the cognitive play, and the other measuring the level of social interaction displayed by the child with autism as a function of time for each session. The behaviour data was recorded continuously, with onset times of each behaviour recorded to the nearest second.

The question of design and definition of the categories to be used for the classification merits further consideration. It can be noted that the widely-used and widely-accepted Piaget–Smilansky categories (Piaget, 1962; Smilansky, 1968) are an ideal choice for the measurement of the cognitive level of play, since these categories can be regarded as standard, and provide a basis for comparison with other studies. Unfortunately, the same cannot be said for social interaction. There appear to be no suitable standard categories for measuring social interaction with peers in children with autism. The six categories (unoccupied play, onlooker play, solitary play, parallel play, associative play, and cooperative play) established by Parten (1932) are widely used for the measurement of the social aspect of peer play in typically developing children, and have even been used in some studies of children with developmental delay or with autistic spectrum disorder—Parten's categories appear to be the closest that there is to a standard set of categories for the classification for peer play behaviour. However, Parten's categories do not seem to be sufficient to classify *meaningful* types or levels of social *interaction* of children with or without disabilities—Parten's categories do not allow the measurement of social interaction occurring without play. Even in play-centred settings, this is a serious limitation; while social interaction during play sessions will usually be part of play activities, non-play social interaction can occur, and must be measured. If play is not the primary activity of the children whose behaviour is being measured, this limitation makes Parten's categories fundamentally useless. This has been recently noted by Anderson, Moore, Godfrey and Fletcher-Flinn (2004) with some surprise, in view of the categories being in such wide use.

Therefore, it was necessary to design new categories to classify social interaction and play with peers in children with autism. This allowed for the hesitant, vague, uncertain, and brief social behaviours that can be expected. This was done in conjunction with the design of a binary key

for the classification of the observed behaviour (Choi, Nieminen, Bahr & Bahr, 2002). The key for the classification of social interaction, which can be read as an operational definition of the categories is:

1. Does the child with autism show non-negative response or initiation?
  - (a) Yes—go to 3
  - (b) No—go to 2
2. Does the child with autism show negative social behaviour?
  - (a) Yes—*Negative interaction*
  - (b) No—*No interaction*
3. Is the child with autism only responding to the peer (i.e. not initiating)?
  - (a) Yes—go to 6
  - (b) No—go to 4
4. Is there any non-negative response from the peer?
  - (a) Yes—go to 5
  - (b) No—*Unilateral*
5. Is there clear and reciprocal interaction?
  - (a) Yes—*Active-high*
  - (b) No—*Active-low*
6. Is there clear initiation by the peer and clear response by the child with autism?
  - (a) Yes—*Passive-high*
  - (b) No—*Passive-low*

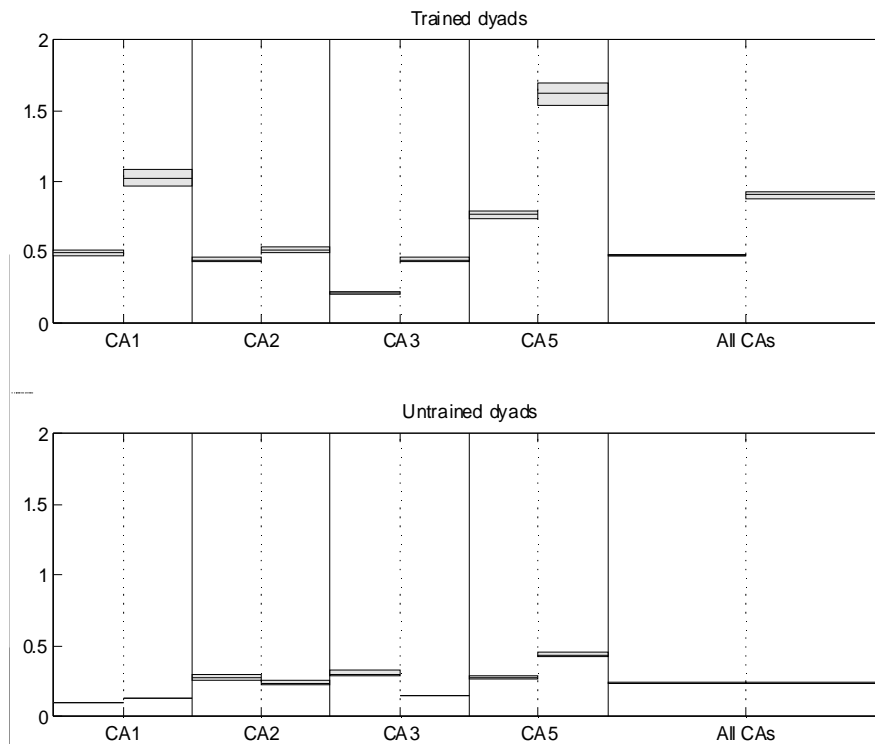
## Results

In general, the observed behaviour in children with autism showed much variation over the sessions, for both cognitive and social categories. This is to be expected—it would be highly unusual if the children with autism displayed identical behaviour in each session, given that children with autism have sufficient cognitive abilities to engage in a wide range of behaviours, despite general intellectual deficits (Pelios, MacDuff, & Axelrod, 2003; Field, Lasko, Mundy, Henteleff, et al., 1997). It is possible that children with autism might well show greater variation in their behaviour than typically developing children due to frequent and unpredictable shifts in attentiveness between on-task and off-task (Pelios, MacDuff, & Axelrod, 2003; Field, Lasko, Mundy, Henteleff, et al., 1997). In addition, the play sessions in this study were conducted over a period of six months, so extraneous confounding factors at home and school beyond experimental control may well influence the behaviour of not only the children with autism but also peer players. The play sessions were conducted in naturalistic settings at the participating SPSs and SEDUs, without artificial constraints that might restrict the range of behaviour. All of these factors might have contributed to the observed large variation in behaviour.

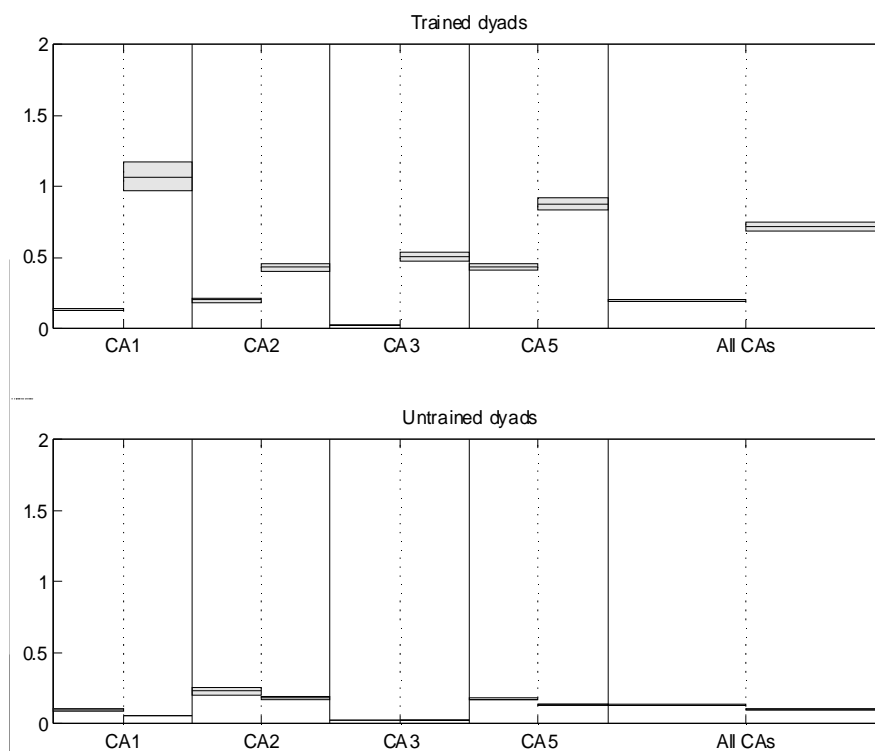
While the observed behaviour was quite variable, this session-to-session variation is actually of little importance—what is most important are the overall level of social interaction and the overall level of cognitive play behaviour. In particular, the use of overall scores is useful for the small sample size in this study to obtain greater statistical power. In this study, it is the difference in the level of social interaction and cognitive play behaviour between the pre-training and post-training play sessions that is crucial. The fraction of each session occupied by each category of social and cognitive behaviour was converted into an overall score using weights assigned to each category. The categorical data, session-by-session data, and raw data are available from the authors, if desired.

To determine whether or not the difference between the behaviour in the pre-training and post-training sessions is statistically significant, the mean behaviour and the standard error in the mean were calculated; this allows, firstly, a simple visual comparison of pre-training and post-training behaviour on graphs presenting the data, and secondly, testing of the statistical significance of the change from the pre-training to the post-training behaviour by determining the 95% confidence intervals for the differences in the means. This is done for both the total cognitive play scores and social interaction scores, and for each cognitive and social category for each dyad.

On figures 1 and 2, the means and the interval specified by the standard error are shown by the grey bars—the bar itself shows the interval specified by the mean and standard error, and the line through the centre shows the mean. If the pre-training and post-training gray bars overlap, then there is no statistically significant difference. If the vertical separation between the bars is large compared to their widths, then the difference is clearly statistically significant.

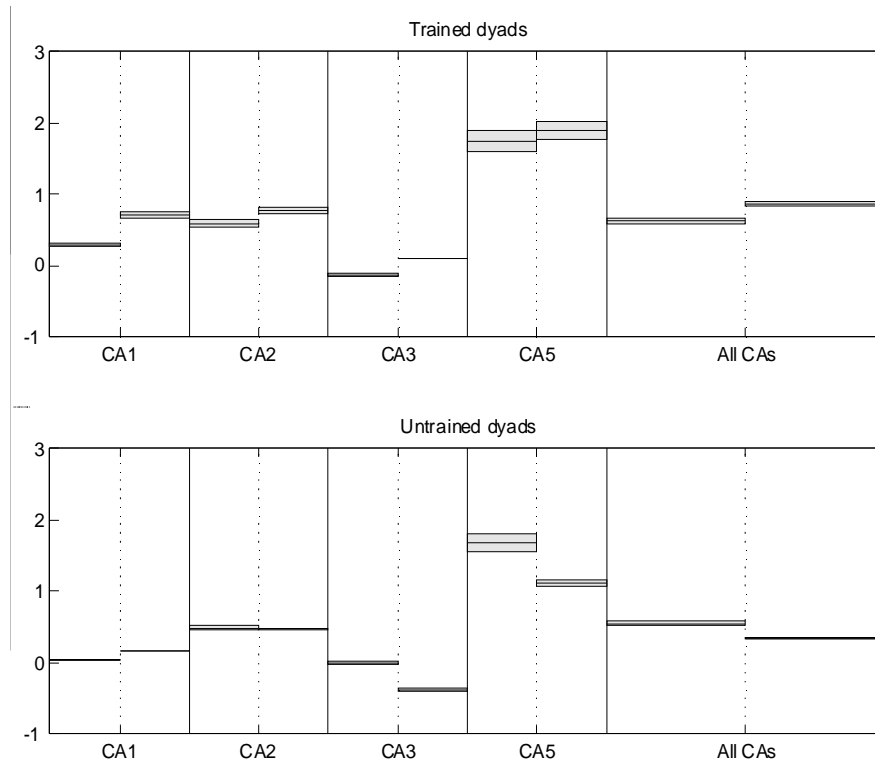


**Figure 1**  
Social interaction behaviour—indoor setting.

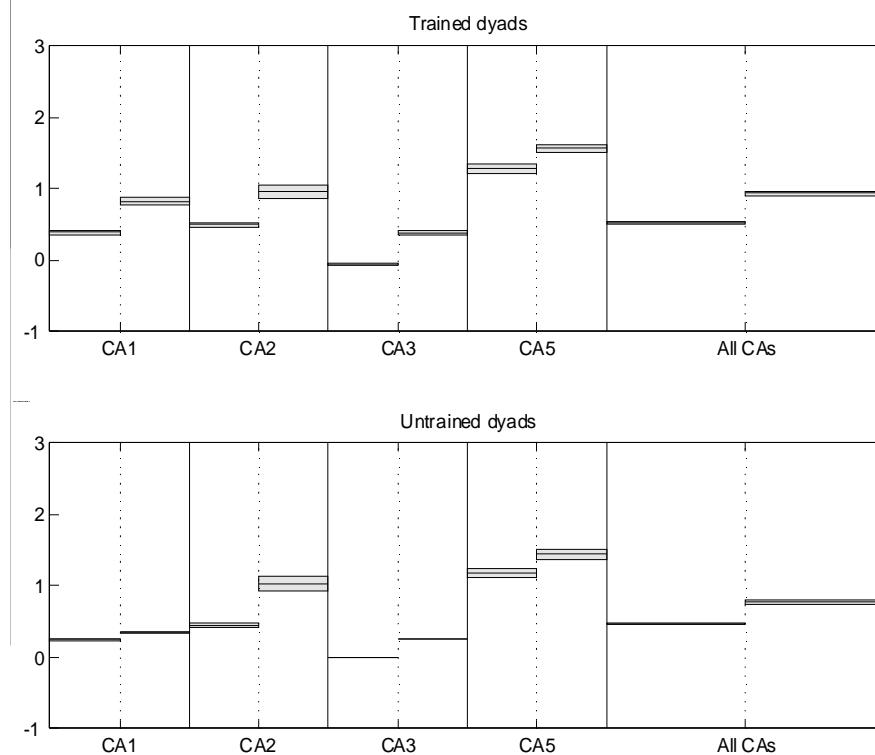


**Figure 2**  
Social interaction behaviour—outdoor setting.

In figures 1 and 2, it can be clearly seen that there was a large and statistically significant increase in the level of social interaction in the trained dyads after training, while there was no change in the untrained dyads. This shows that the training program was both effective, since the improvement was large, and necessary, since there was no improvement in the absence of training.



**Figure 3**  
Cognitive play behaviour—indoor setting.



**Figure 4**  
Cognitive play behaviour—outdoor setting.



The cognitive play behaviour, shown in figures 3 and 4, on the other hand, followed a remarkably different pattern. In indoor settings, there were statistically significant but small changes—a small increase in trained dyads, and a small decrease in untrained dyads. In outdoor settings, there was a statistically significant moderate increase that was *almost equal* for both groups. This indicates that the children with autism rapidly learned how to make appropriate use of the outdoor play equipment, possibly from being taught by the trained peers, in which case this would be a carryover effect, or by experience over the play sessions. Since the change appeared to be rapid, the former seems to be the more likely. This may imply that social difficulty, rather than cognitive delay, is the primary deficit in children with autism.

## Conclusions

In total, the data presented above show a very clear trend—children with autism in trained dyads showed a large and significant improvement in social interaction in both indoor and outdoor play settings. Their cognitive play was also underwent a statistically significant increase, although the relative increase in cognitive play was smaller than the increase in social interaction. Untrained dyads, in contrast, showed no statistically significant change in the level social interaction. Cognitive play in indoor settings significantly decreased.

Therefore, it can be concluded that the peer training program used in this study is clearly effective. In particular, peer training is necessary to promote positive and higher level social interaction in children with autism.

It can be further concluded that it is highly desirable to measure the level of social interaction as directly as possible when evaluating the success of an intervention program intended to enhance social interaction. An indirect attempt to measure social interaction via the commonly-used Piaget–Smilansky cognitive play categories may not closely reflect that which it is intended to measure. Furthermore, some caution needs to be exercised even in the case where a measurement of cognitive *ability* is intended, since rapid and dramatic changes in the level of cognitive play displayed *during a short measurement session* can occur even with no background improvement in cognitive ability.

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