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Intersubjective Imitation in Children with Autism: The Relationship Between Intersubjectivity
with Joint Attention, Joint Engagement and Theory of Mind

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Education

by

Eric Hideyuki Ishijima

2012

ABSTRACT OF THE DISSERTATION

Intersubjective Imitation in Children with Autism: The Relationship Between Intersubjectivity
with Joint Attention, Joint Engagement and Theory of Mind

by

Eric Hideyuki Ishijima

Doctor of Philosophy in Education

University of California, Los Angeles, 2012

Professor Connie Kasari, Chair

This study aimed to explore the imitation abilities of children with autism that require intersubjective interaction with the person modeling the action. The relationships between these types of imitation with other developmental skills were also examined. Results showed that during the same time point, children that were better at intersubjective imitation tended to be better at joint attention, joint engagement and theory of mind. Joint engagement was also found to be a predictor of success with intersubjective imitation across time. The results also showed that receiving a treatment that focused on joint engagement increased the likelihood of doing better on intersubjective imitation tasks. The findings suggest that joint engagement may be a mediator between receiving joint engagement-based treatment predicting success with intersubjective imitation. Future studies should verify the potential mediator effect found in this study.

The dissertation of Eric Hideyuki Ishijima is approved.

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2012

DEDICATION

To Hatsuko Ishijima and David Watanabe. Thanks for being constant reminders to go as far as I can in life.

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- Locke, J., Ishijima, E. H., Kasari, C., & London, N. (2010). Loneliness, friendship quality, and the social networks of adolescents with high-functioning autism in an Inclusive school setting. *Journal of Research in Special Educational Needs*, 10(2), 74-81.
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Ishijima, E.H., Gulsrud, A., & Kasari, C. (March 2008). Increasing Spontaneous Imitation in Toddlers with Autism Spectrum Disorders, Poster presented at the Gatlinburg Conference, San Diego, CA.

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Locke, J., Ishijima, E.H., Stickles, K., Huynh, N., Gulsrud, A., Rotheram-Fuller, E., & Kasari, C. (March 2007). Teacher Perceptions of Social Competence in Elementary School-aged Children with Autism. Poster presented at the Gatlinburg Conference, Annapolis, MD

Introduction

Autism spectrum disorder (ASD) is a developmental disorder marked by social impairments (American Psychiatric Association, 2000). The core features of social impairment center on communication and imitation skills (Rogers & Williams, 2006). Studies show that, among people without ASD, there is a relationship between imitation with the social mind and with maintaining social relations (Chartrand & Bargh, 1999; Richardson, Marsh & Schmidt, 2005). Chartrand & Bargh studied people without ASD and found that participants unintentionally imitate people that they are interacting with. Moreover, the study showed that when participants' manners were imitated by confederates, they tended to feel that the interaction was "smoother" and liked the confederate more. Not only does imitation facilitate better interactions, it has also been found to increase prosocial behavior such as generosity and "helpfulness" by the person being imitated (van Baaren, Holland, Kawakami & Knippenberg, 2004). Therefore, because there is a relationship between these two skills, there needs to be an examination of children with ASD in terms of their social skills and imitation skills.

For more than 30 years, researchers have studied imitation in children with ASD (e.g. DeMyer et al., 1972; Rogers & Williams, 2006). Despite varying methodologies, the majority of the extant literature shows that imitation difficulties are associated with ASD (Hobson & Hobson, 2008; Martineau et al., 2010; Rogers et al., 2010; Smith & Bryson, 1998). For example, Rogers et al. looked at how well children with ASD could imitate a modeled action by an experimenter. In this study the authors were more concerned with comparing the physical attempt of the action and found that children with ASD performed worse than a matched comparison group that did not have ASD. Other studies such as Martineau et al. used an fMRI as children attempted to imitate the actions of the examiner. This study found that the neural system

that becomes activated when non-ASD participants imitate, the mirror neuron system (MNS), is significantly less active among participants with ASD. It has become increasingly clear that it is the interpersonal connection associated with autism that results in poorer performance on imitation tasks as compared to children with typical development (Meyer & Hobson, 2004; Rogers & Pennington, 1991).

Literature Review

Typical Development of Imitation

Imitation is a developmental skill that appears early in development. As early as three weeks of age infants independently attempt to imitate the facial expressions of the people around them, especially their caregivers (Kugiamutsakis, 1998; Meltzoff & Moore, 1977). Meltzoff (2007) purports that these moments of imitation provide the infants with mutual connectedness and shared social experiences. This reciprocal connectedness sets the foundation for developing other communicative actions and more complicated imitative skills. As infants become curious about the objects in their surrounding environments and interact with objects as well as with people, they begin to develop the ability to incorporate objects when imitating the actions of other people. Children as young as nine months of age have been shown to imitate actions directed toward objects that they have not been exposed to before (Meltzoff, 1988). Furthermore, children at this age were able to imitate those actions a week later (Meltzoff & Moore, 1998). In other words, children can retain and perform a mental representation of an action with an object that they saw another person perform previously. Therefore, within their first year of life, children not only use imitation to connect with people, but they also incorporate the use of objects and mental representations when imitating.

As children continue to develop other social, emotional and cognitive skills, they incorporate those into their repertoire of imitative skills. Between the ages of 12- to 15-months, children begin to impute the intention of other people based on their physical reactions following an action with an object. They also are able to imitate an experimenter's intended action on an object rather than simply copying the observed action (Bellagamba & Tomasello, 1999; Carpenter, Akhtar, & Tomasello, 1998). To illustrate this, a study had children observe an experimenter struggle to remove a ball from a stick. The experimenter then pretended to give up with an unsatisfied look on her face. Children of this age understood what the experimenter intended to do and imitated the action and the intended goal rather than just the exact action that they observed. Moreover, when 12 month-olds were presented an arbitrary action leading to a goal, children of this age emulated the intended result rather than the meaningless action (Carpenter, Call & Tomasello, 2005). In this study, experimenters modeled an unnecessary action like pushing a switch with her/his nose. Children of this age tended to laugh at the action, showing that they understood that the action itself was "silly" and unnecessary, and proceeded to push the button with their fingers. Therefore, by 12 months of age, children display their capability to observe a person's failed attempt and emotional reaction then imitate the intended action based on those observations.

By 18 months of age, typically developing children become proficient at incorporating other perspective-taking skills into their repertoire of imitation skills. This comes in the form of role-reversibility. Carpenter, Tomasello, & Striano (2005) showed that 18 month old children were able to correctly differentiate between actions being directed toward the model and toward the imitator. For example, when the experimenter slapped her own knee, children of 18-months of age slapped their own knees while children of 12-months of age tended to more often slap the

experimenter's knee. Therefore, in the typical development of imitation skills, children naturally move from imitating purely physical actions to actions that require manipulation of objects to actions that require understanding of other people's cognitions, thus carrying out actions from the model's cognitive and physical position.

During the toddler years, children use these imitative skills in social contexts. Toddlers imitate more when playing with older peers as compared to when they play with same aged peers (Howes & Farver, 1985; Rothstein & Howes, 1988). In this social context, the toddlers are able to imitate the slightly more developed children's play acts and use that ability to maintain their social interactions. Even as adults we imitate the mannerisms, facial expressions, and postures of the people that we interact with (Chartrand & Bargh, 1999). Imitating simple behaviors such as scratching one's chin can make the other person feel more comfortable and connected during the interaction. More interesting is the fact that we unintentionally imitate these simple actions. Perhaps as children when we imitate and are imitated by others, we feel deeper connections with those that we interact with and internalize an automatic tendency to imitate others during social interactions.

Imitation and Identification in ASD

In the past, research had shown an association between ASD and imitative deficit (e.g. Ohta, 1987; Sigman & Ungerer, 1984). However, as researchers examined imitative abilities with varying methods, it became apparent that a general imitative deficit for children with ASD was inconclusive. Whereas past studies have tended to find children with ASD perform worse than typically developing children in imitation tasks, more recent studies have found inconsistent findings. For example, although some recent studies have shown that children with ASD do not have a deficit in object-directed actions such as pulling apart a toy and then putting it back

together (Charman & Baron-Cohen, 1994; Hamilton, Brindley & Frith, 2007; Meyer & Hobson, 2004), fMRI studies (Kana, Wadsworth & Travers, 2011; Martineau et al., 2010) and facial imitation tasks (Rogers, Hepburn, Stackhouse, and Wehner, 2003) show a significant difference between children with ASD and children of typical development with children with ASD performing worse. The reasoning behind such contradictory findings is largely due to the inconsistencies in defining imitation.

More recent trends have shown that rather than a general imitative deficit, children with ASD consistently show a deficit with imitation skills that require a deeper social connection with the person modeling the action (Hobson & Lee, 1999). More specifically, children with ASD consistently show significant differences when perspective-taking is involved in the imitation task (Meyer & Hobson, 2004; Ohta, 1987; Smith & Bryson, 1998). Ohta (1987) found that when children with ASD observed a person waving toward them, instead of waving with their palms facing outward toward the other person, children with ASD waved to themselves. Similarly, Meyer and Hobson (2004) showed that children with ASD were less likely than children of typical development to imitate the self-other orientation quality of a modeled action. For example children either watched the experimenter roll the wheel toward herself or toward the child. They found that there were no significant differences between the two groups in terms of whether they imitated the action (e.g. roll the wheel). However, children with ASD were less likely to imitate the orientation of the action compared to children with typical development. Hobson and Hobson (2007) explained that the higher level imitation, such as self-other orientation imitation, required that the imitator alternate between their own subjective perspective to the subjective perspective of the other person and “identify” with the person modeling the action. In other words, the children were not taking into consideration how the

action would look from the experimenter's point of view. In his explanation the imitator "identified" with the other person and acted from a similar psychological state (e.g. pushing a box toward the other person rather than pushing the box in the same direction). According to Hobson, Lee and Hobson (2008) "identifying" has been described as a level of engagement with, and assimilation of, another person's attitudes. Hobson and Lee (1999) demonstrated that, compared to children without autism, children with autism were significantly worse at imitating the qualities of the action which they called 'style' (e.g. harsh versus gentle) even though they were able to imitate the goal-directed action. In their study, although both children with and without ASD were able to imitate the goal-directed action of making a sound by rubbing a stick against a wooden toy, only the children without ASD imitated the harshness of the stroke that was modeled by the experimenter. To add to this, children with ASD spent more time watching the object than the person demonstrating the action (Hobson and Hobson, 2007). Whereas typically developing children identified with the model by shifting attention between the model's gaze and the action on the object, children with ASD did not make the intersubjective connection with the model and only focused on the object and the action. Therefore, children with ASD understood the concept of imitation, yet because they became focused on the objects and the actions, they failed to fully take in the qualities of the action that were noticeable through the "shared" interaction (Hobson & Hobson, 2007; Tomasello & Rakoczy, 2003).

Tomasello and Carpenter (2007) explained that children embed the "sharedness" qualities within social interactions—understanding and comprehending the other person's perspective in terms of how they relate to their own perspectives. For instance, if child A directs child B's attention to an opaque container and says "I do not like that", child B may not know whether child A is referring to the container itself or the content inside of the container. However,

through the interpersonal process of “identifying”, child B would be able to take into consideration the context of the conversation from child A’s perspective and know exactly what she is referring to. However, without the ability to “identify” and shift between her own perspective and the perspective of child B, child A would have difficulty with following her attention. In this way, children with ASD performed poorly on imitating style (Hobson, 2007); because these children did not “identify” with the tester. The children were not thinking from the experimenters’ perspective which included a deliberate style of action or the way the action would look from the experimenter’s perspective and instead only imitated the end result of the action. In other words, *intersubjective imitation*, imitation of specific qualities of a modeled action that require intersubjectivity, reflects the difficulty in “identifying” with others.

Intersubjective Imitation and Joint Attention in ASD

The deficits with “identifying” may affect other skills that children with ASD have been shown to struggle with. Research has shown that children with ASD display less developed joint attention and engagement with other people (Mundy, Sigman, & Kasari, 1994; Adamson, Bakeman, Deckner, & Ronski, 2009). Joint attention and joint engagement, which involve a triadic interaction between two people and an object/event to which they share attention, may be the result of deficits with forming and maintaining interpersonal connection. Joint attention skills are defined as non-verbal social communication skills such as pointing and showing an object or event to another person (Kasari, Freeman, & Paparella, 2006). Many studies have found that children with ASD initiated these skills less frequently as compared to children of typical development (Mundy, Sigman, Ungerer, & Sherman, 1986; Stone, Coonrod, Turner, & Pozdol, 2004) even though they were just as likely to be able to respond to joint attention such as following another person’s gaze toward an object (Leekam, Lopez, & Moore, 2000).

In typical development, children were found to initiate points to share interest and attention with other people by 12 months of age (Liszkowski, Carpenter, Henning, Striano & Tomasello, 2004). Therefore, around the same time that children with typical development show the ability to imitate intention (Bellagamba, Camaioni, & Colonnese, 2006), they also show the ability to direct someone's attention to an object or event; both skills have been described as requiring the interpersonal process of "identifying" with the other person (Hobson & Hobson, 2007). Through a deeper social interaction, taking on the psychological stance of person B, person A would have been sensitive to the details necessary when trying to direct someone's attention. As with the example of the opaque container, rather than just imitating an action that resulted in a failed attempt, the imitator would have been required to take on the model's psychological stance resulting from the failed attempt and carry out the action according to the model's intention. Similarly, when people engage in joint attention such as directing someone's attention to an object by alternating eye contact to that person and the object of interest, they would have to be able to communicate to the person while being sensitive to when they have that person's attention and whether the intention of the communication was received successfully.

Intersubjective Imitation and Joint Engagement in ASD

Joint engagement may also be affected by deficits in intersubjectivity. Joint engagement is made up of states in which two people interact with each other and an object such as playing a board game as opposed to one person playing with a toy while another person observes (Adamson, Bakeman, & Deckner, 2004). Research has found that at about 9 to 15 months of age children with typical development begin to engage in supported joint engagement, to share attention between an object of interest and another person with active scaffolding by that other person (Bakeman & Adamson, 1984; Dunham & Moore, 1995). Then by 18 months of age, they

are able to coordinate actions on a common topic with communicative actions and well-timed glances at their partner's face (Bakeman & Adamson, 1984). During these coordinated engagement states, children actively recognize the other person as a social partner and talk to and play with that other person whereas in supported joint engagement the children are aware of the social partner but are less clear in the way they acknowledge them. Therefore, by the time a typical child is 2 years old, they are fluent at engaging with caregivers and directing their caregivers' attention to objects and events.

Joint engagement in children with ASD does not follow the same trajectory as children with typical development. By about 30 months of age, a significant gap develops between children with ASD and children with typical development in terms of the amount of time spent in coordinated joint engagement states (Adamson, Bakeman, Deckner, & Ronski, 2009). Adamson et al. found that even at 30 months of age when typical children have consolidated their ability to remain in coordinated joint engagement states, children with ASD were rarely observed to be in coordinated joint engagement with their caregivers. Moreover, children with ASD, at 30 months of age, spent significantly less time in coordinated joint engagement as compared to 18-month old typically developing children. These findings suggest that because children with ASD have difficulty intersubjectively interacting with their caregivers they did not actively try to integrate their caregivers into the play with the objects. Instead, similar to the findings of Kasari, Gulsrud, Wong, Kwon, and Locke (2010), children with ASD spent more time in states which did not require the back-and-forth of communicating intention and correcting the other person when the intention was miscommunicated; they tended to engage solely with objects or not engage with anything at all. However, the trend was not the same for supported joint engagement states. Children with ASD were found to spend similar amounts of time in supported joint engagement

states with their caregivers as compared to children with typical development. Even though supported joint engagement requires some interaction, perhaps here it was the caregivers “accommodating” to their children’s needs (Gallimore, Weisner, Bernheimer, & Guthrie, 1993; Gallimore, Weisner, Kaufman, & Bernheimer, 1989) by synchronizing their behaviors with their children’s to facilitate the deeper engagement states as witnessed in Siller and Sigman (2002). In other words, parents were “accommodating” to their children’s needs when interacting with them. The main difference between the engagement of children with typical development and ASD is that whereas children with typical development will initiate and maintain a higher level engagement, children with ASD need more support by the social partner to maintain interpersonal engagement. Hence, the difference between the two higher states that highlight the capabilities of children with ASD lies within the realm of intersubjectivity, or the ability to take into consideration the thoughts/perspective of another person.

Intersubjective Imitation and Theory of Mind in ASD

Young children are typically able to employ a theory of mind (ToM), or the ability to understand and reflect on the thoughts of others at about 4- to 5-years of age (Wellman, Cross and Watson, 2001). According to a meta-analysis by Wellman et al. (2001), children under 4 years of age consistently failed to keep separate their own thoughts from what they believed other people thought. In other words, children under 4 years tended to assume that other people thought the same thing as them even if they did not experience the same situations. Children between the ages of 4 to 5 years, on the other hand, were able to demonstrate their awareness that other people may not know the truth, even if they themselves know the truth, if both parties do not experience the same situation. Tomasello and Rakoczy (2003) explained that using a ToM requires the ability to combine the various precursors such as the understanding of other people’s

intentions and interpersonally connecting with other people. They explain that by the end of the first year of life, children understand that other people act intentionally. By 2 years of age, children show their awareness of the importance of attention. Through intersubjective interactions they begin to predict other people's attention (Tomasello & Haberl, 2002).

Tomasello and Haberl (2002) found children could identify with adults and could predict which toys they showed interest in when they acted surprised. Then at around 4- to 5-years of age children can combine the abilities to understand that other people have their own thoughts and that these thoughts are dependent on what they had attended to and experienced. The combination of these skills, including intersubjective interactions as one of its main components, allows children to successfully impute another person's thoughts even if they themselves know that the other person's thoughts are inaccurate.

Children with ASD, who have difficulty with intersubjectivity, have been studied frequently in terms of their ToM. Since Baron-Cohen, Leslie, and Frith's original study in 1985, many studies have found that children with ASD have difficulties on ToM tasks compared to children with typical development. In general, children with ASD tended to have difficulty separating their own thoughts from those of others. Beaumont and Newcombe (2006) demonstrated that these deficits in ToM were present even among adults with ASD. The most commonly used ToM tasks were the false-belief tasks (e.g. Sally-Anne). In the Sally-Anne task (Wimmer & Perner, 1983), the participant observed a doll named Sally put a marble in a box and walk away. Then without Sally knowing, Anne takes that same marble out of the box and puts it in another box. Sally comes back and the participant is asked where Sally will look for the marble. Paynter and Peterson (2010) compared 5- to 12-year old children with ASD to typically developing children matched on chronological, verbal and nonverbal mental age. Participants

were administered five separate false-belief tasks. The results showed that children with ASD performed significantly worse than the matched peers. Other studies have found that even among participants that were able to pass the false-belief ToM tasks, there was still a significant difference between participants with and without ASD when asked to explain their reasoning for their responses on the ToM tasks (Happe, 1994; Losh & Capps, 2003). Similar to the relationships between joint attention and joint engagement to the ability to interpersonally interact with other people, the same relationship may have caused children with ASD to do poorly on the false-belief tasks.

Present Study

There is ample evidence in the literature that indirectly links the relationships between imitation, joint attention, joint engagement, and ToM. Hobson (2008) and Tomasello & Rakoczy (2003) give support to the theory that the link between these skills lies within the ability to interpersonally connect with other people and identify with them. Since these skills are intricately linked with shared social skills, a core deficit of children with ASD, the aforementioned skills are less likely to be developed in children with ASD. However, no studies to date examine the relationships of intersubjectivity/interpersonal connections with joint attention, joint engagement, and ToM in children with ASD. Moreover, there has not been a study that examines whether skills such as joint attention and joint engagement early in development can affect the ability to interpersonally connect with others later on.

The present study examines these relationships among a single group of children with ASD over a 5-year period. It is important to examine the relationships between these skills over a significant period of time for two important reasons. If imitation that requires intersubjectivity, *intersubjective imitation*, is related to joint attention, joint engagement, and ToM among a single

group of children with ASD, it would strengthen the current theories about their relationship. Because this study looks at all of these skills in a single group of children rather than multiple studies that only examine the relationships between two or three of the skills among different groups of children with ASD, it addresses the concern that these relationships are based on differences in methodologies and participants between studies. Second, by examining the relationships of joint attention and joint engagement with intersubjective imitation and ToM at later ages, this study can provide information about the effects of interventions on the development of children with ASD. By understanding the skills that affect the intersubjective/interpersonal connections necessary for social interactions, we can approach social skills training of children with ASD by building a stronger foundation.

Research Question 1: Are children with ASD between 8 and 10 years of age able to imitate others' style and orientation (intersubjective imitation)? What are the associations of intersubjective imitation and child characteristics (e.g. chronological age and verbal mental age)? What are the associations of intersubjective imitation with ToM, joint attention and joint engagement with others?

Hypothesis1: In general, children with ASD will have difficulty imitating the style and orientation of the actions even when they are able to imitate the end result of an action on an object.

Hypothesis 2: Similar to the typical development of imitative skills it is expected that there will be a positive association between mental age and children's ability in intersubjective imitation.

Hypothesis 3: Since intersubjective imitation is a measurement of the ability to interact with and metacognitively analyzing other's thoughts and behaviors, children that do better at intersubjective imitation will also be better at false-belief tasks.

Hypothesis 4: The ability to imitate style and orientation of an action requires that a child flexibly alternate attention between the model doing the action and the object being acted upon. These two abilities are also integral to joint engagement, therefore it is expected that the more the child is able to intersubjectively imitate, the more time that child will be in higher joint engagement states with their caregiver.

Hypothesis 5: Since joint attention requires a more intersubjective interaction between two people, It is expected that children that imitate style and orientation will tend to initiate more joint attention skills.

Research Question 2: What is the association between early joint engagement and joint attention with the caregiver and imitation of style four years later?

Hypothesis 6: Young children that spend more time in higher engagement states will be better at imitating the style and orientation of the actions by a model four years later.

Hypothesis 7: Responding to joint attention skills gives children the opportunity to follow the attention of other people which can help children develop the ability to identify and take on other people's psychological perspectives. Therefore, it is expected that the children that follow joint attention skills more often will be better at intersubjectively imitating.

Research Question 3: For children with ASD, does receiving a treatment that uses joint engagement as a tool predict intersubjective imitation skills 4 years later?

Hypothesis 8: Compared to control group participants, children that receive a treatment that emphasizes joint engagement will be better at intersubjective imitation skills later.

Method

Participants

The present study is based on the 4 year follow-up assessments of participants in a randomized controlled treatment study (Kasari, Freeman, & Paparella, 2006). In the original study participants were randomized into a joint attention treatment, symbolic play treatment or a control group. For this study, only participants that met specific language requirements at the 4 year follow-up assessment time point were included.

Active Participants. The original Kasari et al. (2006) included 58 children with ASD between 3 to 4 years of age. Informed consents were obtained for all participants with the supervision of the UCLA Institutional Review Board procedures and regulations before the initiation of any screening assessments. All participants had autism, as confirmed by the Autism Diagnostic Interview—Revised (ADI-R) and the Autism Diagnostic Observation Schedule (ADOS), had no seizure disorders or additional medical diagnoses, and were under the age of 5 years. They were mostly boys ($n = 46$), Caucasian ($n = 37$) and had mothers that completed college ($n = 43$).

6 months and 12 months Follow-up. After the post-intervention phase Kasari, Paparella, Freeman, and Jahromi (2008) conducted a 6 months and 12 months follow-up to the original treatment study. During the 6 months post-intervention phase, 56 of the original 58 children participated. Of the two participants that did not participate in the follow-up, one participant made no significant progress on the Reynell Receptive and Expressive Language scores from

pre- to post-intervention while the other child made significant progress between pre- to post-intervention. For the 12 months post-intervention follow-up, 3 additional children did not participate. Two of these children made no progress on the Reynell Expressive and Receptive Language scores from post-intervention to 6 months follow-up while the third child made progress.

4 year Follow-up. The current analyses included 39 participants from the original treatment study. Although 40 participants came for the first day of the follow-up assessments, one of the participants never returned for the second day which included the Imitation Task. Participants were between 7.83 – 10.08 years with a mean age of 8.81 years. The sample is predominantly male (31 males and 8 females) Caucasian (26 Caucasian, 1 Hispanic, 1 Black, 5 Asian, 5 other and 1 undisclosed) children.

Measures

Caregiver-Child Interaction. This assessment was repeated at all five time points (Entry, Exit, 6-month follow-up, 12-month follow-up and 4 year follow-up). Each caregiver was videotaped during a 15 minute interaction with her/his child using a standard set of toys. The standard set of toys included dolls, dishes, truck, puzzle, and blocks. The caregiver was asked to play with her/his child in the same way that they would interact at home. The video was later coded for the percentage of time during the interaction in which the parent and child were jointly engaged and interactive around objects (Bakeman & Adamson, 1984). The variables of interest here included unengaged, person-engaged, object-engaged, supported joint engagement, and coordinated joint engagement. The overall ICC coefficient between 2 independent coders blind to group status was .78, range .65–.95 on 20% of randomly selected participants.

Early Social Communication Scales (ESCS; Seibert, Hogan & Mundy, 1982). This assessment was repeated at all four time points (entry, exit, 6 months, and 12 months). The child and tester sat facing each other at a table with a set of toys in view but out of reach of the child (Seibert, Hogan, & Mundy, 1982). Toys included several small wind-up and hand-operated mechanical toys, a hat, comb, glasses, ball, car, balloon, and book. The child was presented with three trials of the mechanical toy, three trials of the hand-operated toys, and two trials of a social interaction game (i.e., singing a song with a tickle). The procedure was videotaped and later scored by coders who were independent of the intervention and assessment staff and blind to child group assignment. The coders overlapped coding on 20% of the sample, and reliability was estimated using two-way mixed effects model (consistency definition)—single rater ICC value.

These coefficients are reported after each variable below. The major variables of interest for this study included frequency of both initiations and responses of JA behaviors. Initiations included coordinated looking (.77), distal pointing (.80), proximal pointing (.78), and showing (.79). Responses included responding to experimenter points (.81) and gaze (.83). The average ICC for initiations was .79, and for responses the average ICC was .82.

JAMES (Kasari, Paparella, Freeman & Jahromi, 2008). This assessment replaced the ESCS for the 4 year follow-up to measure joint attention skills with toys that were more age-appropriate as compared to the ESCS. The aim of this assessment was to facilitate opportunities where a child may initiate communication with the tester (Kasari, Paparella, Freeman, and Jahromi (2008). The child sat across from the tester at the table with a set of toys in view of the child but out of reach. Materials included 2 racing cars, Mr. Potato Head, noisy toy, plastic jar with a desirable object inside, book, silly hat, big glasses and 3 pictures on the walls. This semi-structured assessment gave the child multiple opportunities for non-verbal communications for

requesting and sharing purposes. The tester operated the noisy toy and race cars and then waited for the child's reaction. Similarly, the tester demonstrated putting on the silly hat and big glasses and waited for the child's reaction. The Mr. Potato Head and the body parts, without the mouth, were placed in the middle of the table. The book and pictures on the walls were to assess how well the child responded when the tester pointed to objects. The procedure was videotaped and later scored by coders blind to the children's group assignment.

These coefficients are reported after each variable below. The major variables of interest for this study included frequency of both initiations and responses of JA behaviors. Initiations included coordinated looking (.99), point (.60) and showing (.88). Responses included responding to experimenter points (1.00). The average ICC for initiations was .82, and for responses the average ICC was 1.00.

Imitation Task (Hobson & Lee, 1999). This assessment was only used during the 4 year follow-up phase. The purpose of this task was to examine the performance of copying goal-directed actions and imitating the style with which actions are executed (Hobson and Lee, 1999). During the pre-test phase of this assessment the child was given either the toy bird or the stick and rack. The experimenter said, "play with it" and gave the child two minutes to play with the toy. After the two minutes the child was given the next toy with the same instruction. Upon completion of the pre-test, the child was presented with either toy with one of two styles of actions modeled by the experimenter. For the chick toy, the experimenter activated the toy by pushing it on the head with either her two long fingers or the ball of her hand. For the pipe and rack toy, the experimenter put the rack under her chin like a violin and strummed the rack by either lightly grazing the top of the rack or pushing down on the rack with the pipe. The styles

modeled by the experimenter were randomly assigned and the order of the toy presented was counterbalanced.

The imitation task was videotaped and later coded by researchers blind to the purpose of the study. For all three tasks, the coders scored for whether the child imitated the end result of the modeled act, the style of the modeled act (using fingers versus palm to push a button or rubbing a pipe on a wooden rack in a harsh versus gentle motion), and the orientation of the modeled act (e.g. strummed the stick away from themselves versus strummed the stick toward themselves).

Coders independently double-coded 20% of the sample and the reliability was estimated using two-way mixed effects model—single rater intraclass correlation coefficient (ICC) value. ICC values for imitating the end result of the modeled act (1.0), style of the child's action (1.0), style of the experimenter's action (1.0), orientation (.83) were all calculated using SPSS version 20.

Sally-Anne Theory of Mind Task (Wimmer & Perner, 1983). This assessment was only used during the 4 year follow-up phase. The purpose of this measure was to see how well children can impute the mental states of others through a false-belief task. Children were asked to impute the belief of one character, whose thought was inaccurate. A confirmation question followed to make sure that children were really interpreting the character as having an inaccurate thought separate from their own since the children themselves observed what actually happened. Experimenter and child were seated across from each other. Sally and Anne were placed next to each other by the tester in front of the child. The tester then confirmed that the child understood the names of the dolls. Then Sally placed a marble into her basket. After Sally left Anne removed the marble from the basket and put it into her box. Sally then returned and the child was

asked where Sally would find her marble. Next, the child was asked the actual location of the marble. Finally, the child was asked where Sally had originally put the marble at the beginning. The entire procedure was then repeated with the exception of the marble being moved to the tester's pocket from Sally's basket by Anne.

The variables of interest in this assessment included how the child answered the false-belief questions and how they responded to the "actual location" questions. A correct answer on the Theory of Mind task was given only if the child was able to pass both the false-belief question and the "actual location" questions. The overall ICC coefficient between two coders blind to group status was 1.0 on 20% of the randomly selected participants.

Differential Abilities Scale (DAS: Elliot, 1990). This assessment was only used during the 4 year follow-up phase. This assessment was used as the cognitive and achievements test. Subscales include verbal mental age, non-verbal mental age, and spatial mental age. Verbal mental age was made up of items that measured children's receptive language and their expressively labeling skills. Non-verbal mental age included items that measured children's ability to match pictures and completing patterns of abstract figures. Spatial mental age was made up of items that measured visual-perceptual matching, especially of spatial orientation, and fine motor coordination in copying shapes.

Procedure

Active Treatment. Participants were recruited from, and attended, the Early Childhood Partial Hospitalization Program, an early intervention program (EIP), at UCLA. The EIP is an Applied Behavior Analysis (ABA) based partial hospitalization program consisting of 30 hours of treatment per week (see Kasari et al. 2006 for greater detail). In accordance with the institutional review board requirements, children were randomized upon admission to the EIP

but before completing assessments for the study. Due to the pre-intervention protocol, 7 of 65 children that were randomized were later dropped for not meeting eligibility criteria on the ADI-R, ADOS, or having an additional genetic syndrome or seizure. Pretreatment assessments also included Early Social Communication Scale (ESCS), and Caregiver-Child Interaction. After completing pretreatment assessments, the remaining 58 children began treatment. The same assessments were completed during post-intervention, 6 months follow-up, and 12 months follow-up. During the 4 years follow-up the ESCS was replaced by the JAMES (Kasari, Paparella, Freeman, and Jahromi, 2008), which is the ESCS modified for older children. The Sally-Anne Theory of Mind task (Wimmer & Perner, 1983) and the Imitation task (Hobson & Lee, 1999) were also added at the 4 year follow-up.

Results

Imitation style and orientation at 4 year follow up

Descriptive statistics were examined for the imitative abilities of the children with ASD at their 4 year follow-up assessments. As summarized in Table 1, 87.2% of participants were able to imitate the End Result of the action on both trials while only 35.9% and 56.4% were able to imitate Orientation and Style on both trials respectively. Also, whereas every participant was able to imitate the End Result on at least one trial, 20.5% and 10.3% were not able to imitate Orientation and Style on a single trial respectively.

Pearson's correlations between Intersubjective Imitation with chronological age, cognitive assessments, ToM, joint attention skills and joint engagement at the 4 year follow-up were calculated using SPSS version 20 (Table 2). There was no significant relationship between Intersubjective Imitation and chronological age.

There was a significant, positive relationship between Intersubjective Imitation and the verbal score on the Differential Abilities Scale $r(28) = .41, p = .025$. Intersubjective Imitation was not related to nonverbal or spatial scores on the DAS.

As shown in Table 3, there was a significant, positive correlation between Intersubjective Imitation and ToM $r(30) = .51, p = .003$, coordinated joint looks $r(34) = .38, p = .019$, and percentage of time in a joint engagement state $r(35) = .41, p = .031$.

Prediction from early assessments to later assessments

Ordinal regression analysis was used to examine the relationships between Intersubjective Imitation measured at the 4 year follow-up with joint attention and joint engagement of earlier time points. As shown in Table 4, joint engagement at pre-treatment was not predictive ($p = 0.13$) of Intersubjective Imitation at the follow-up although, as shown in Table 5, joint engagement at the end of the treatment phase was a predictor ($p = 0.02$) of Intersubjective Imitation; for every 1% increase in joint engagement we expect a 6% increase in score on Intersubjective Imitation. The joint attention skill of pointing followed the same pattern. At the pre-treatment phase pointing was not a significant predictor of Intersubjective Imitation ($p = .26$) although it became a predictor of Intersubjective Imitation at post-treatment ($p = 0.04$); for every 1 unit increase in frequency of joint attention point, we expect a 12% decrease in score on Intersubjective Imitation.

Treatment effects of joint attention

An ordinal regression was used to explore whether receiving the treatment predicted better Intersubjective Imitation at the 4 year follow-up. As shown in Table 6, receiving treatment was a significant predictor of Intersubjective Imitation ($p = 0.041$); receiving treatment increased

the odds of having higher Intersubjective Imitation by 4.14 times compared to participants in the control group.

Next a t-test was used to examine if the treatment affected the change in joint engagement. The analysis showed that treatment status had significantly affected the amount of change in joint engagement between pre-treatment and post-treatment $t(39) = 2.175$, $p = 0.036$. Finally a t-test showed that children with ASD who spent more time in higher engagement states were in the treatment group at post-treatment $t(39) = 2.212$, $p = 0.033$.

Discussion

There were three primary goals of this study. One was to describe the Intersubjective Imitation of children with ASD at age 8 and to examine the association of intersubjective imitation and children's skill in joint attention, joint engagement and theory of mind. A second goal was to determine if earlier abilities in joint attention and joint engagement were associated with intersubjective imitation, and finally to test whether involvement in a targeted intervention on joint engagement predicted better intersubjective imitation. The results of this study yielded important information on both concurrent and predictive associations of core developmental skills of children with ASD and their development of intersubjective imitation.

First, in this study children with ASD showed very little difficulty imitating the object-direction action while struggling with imitating style and orientation consistent with previous reports (Hobson & Lee, 1999; Meyer & Hobson, 2004). This struggle appears rooted in their difficulty with interacting with people on a deeper intersubjective level. Spontaneous initiations of joint attention (specifically coordinated joint looks), joint engagement with their caregiver and performing better on a ToM task were all associated with the child's ability to imitate style and

orientation. These data yield support for the importance of sustained joint engagement with others. Children that are able to remain in joint engagement states for longer periods of time are naturally given more opportunities to practice alternating between their own perspectives and the perspectives of the person that they are interacting with. Even when the child is being supported in a joint engagement state, the child is being exposed to the other person's perspective as they play as compared to interactions where the other person just watches the child play with the toy. Indeed, there was a positive association between ToM, putting themselves in another person's perspective, and Intersubjective Imitation. In both the ToM task and Intersubjective Imitation, the child needs to take on someone else's perspective and compare it with their own perspectives. Thus, three skills that children with ASD struggle with, engagement, ToM and joint attention (Adamson, Bakeman, Deckner, & Ronski, 2009; Stone, Coonrod, Turner, & Pozdol, 2004; Paynter and Peterson, 2010) are related to Intersubjective Imitation.

Second, earlier skills measured at age 3-4 years of age predicted how well children performed on the intersubjective imitation task at age 8. None of the correlations between pre-treatment joint attention and Intersubjective Imitation were significant. Only post-treatment behaviors appeared associated with later imitation. Post-treatment joint engagement and joint attention points were predictive of Intersubjective Imitation at the 4-year follow-up. While more joint engagement had a positive effect on imitation, *fewer* points post-treatment were associated with more imitation. It may be that at some point in development, pointing may become less critical to later developmental skills, and that by the post-treatment testing, many children used joint attention language rather than nonverbal pointing gestures. Similarly lower level joint attention skills such as coordinated joint looks did not significantly predict Intersubjective Imitation despite the concurrent correlation at age 8. Again, language may be supplanting some

of these associations, although coordinated joint looks may be important at any one time point for improving performance on a task that requires attention to self and other.

Third, children who received one of the experimental treatments exhibited more joint engagement with their caregivers at the end of treatment compared to control group children. Joint engagement at post treatment was predictive of later Intersubjective Imitation. Although the sample size was too small to yield definitive data, the suggestion is that increasing joint engagement between children and others yields better performance on the Intersubjective imitation task. Therefore, being in treatment increases the likelihood of being in joint engagement states for longer periods of time, which increases the likelihood of being better at Intersubjective Imitation. Future studies using larger samples of children should directly test this hypothesis.

The treatment used in Kasari, Freeman, & Paparella (2006) builds joint engagement with the child using toys before embedding the skills to be taught during that session (e.g. symbolic play skills). The practice of building and maintaining engagement allows the child to take part in opportunities to put themselves in the subjective perspective of the interventionist. These opportunities allow children to learn how to be more flexible in alternating between their own perspectives and the perspective of the tester, especially when transitioning between observing an action and reproducing the action. Thus, although the treatment did not specifically target imitation skills, it helped the children develop a skill that had downstream effects in developing other skills (e.g., language; Kasari et al, 2008).

Limitations

As previously mentioned, the Intersubjective Imitation task was only administered at the 4-year follow-up assessment so more rigorous statistical analyses could not be done to strengthen

the theories proposed by this study. For example, the data indicate that children who received treatment are more likely to do better on Intersubjective Imitation and children who spent more time in joint engagement states more likely do better on Intersubjective Imitation but it cannot be stated directly that these predictors are causing changes in Intersubjective Imitation with the same confidence as compared to a study that has a pre-treatment and post-treatment measurement of Intersubjective Imitation.

Another limitation is that the Intersubjective Imitation task consisted of only 2 different tasks, each with 2 variations in styles. Perhaps an Intersubjective Imitation task with multiple tasks could show a more detailed picture about the strengths and limitations of the Intersubjective Imitation abilities of children with ASD. Finally, future studies need to take additional steps to maintain a longitudinal sample of children thus increasing power to detect differences.

Future studies

Future studies should use this imitation task at pre-treatment and post-treatment to measure changes in Intersubjective Imitation. The Intersubjective Imitation task should also include more tasks so that it can be more sensitive to the possible changes that take place with this measure. This would allow for more stringent analyses to test the theories proposed in this study. Specifically, it would be interesting to see whether engagement serves as a mediator of the relationship between treatment and Intersubjective Imitation. Although t-tests were used to indirectly show that treatment increased engagement which then affected Intersubjective Imitation, without having a measurement of change in Intersubjective Imitation a true mediator model cannot be tested. However, based on the data that were available, additionally testing of the model with larger samples of children is warranted.

Another suggestion for a future study is to measure other skills related to social interaction. For example, because the results show that children with higher scores on the language section of a developmental assessment were also better at Intersubjective Imitation, it would be interesting to see how the change in Intersubjective Imitation may be affecting language. It may also be interesting to explore whether Intersubjective Imitation relates to social interaction with peers. Since peer interactions are related to other skills that require intersubjectivity, it would be interesting to see how this skill is affecting other difficulties that children with ASD face on a day to day basis.

Table 1
Responses to types of imitations

<i>Scores on Imitation of Style, Orientation and End Result</i>		
Score	N	Percent (%)
Style		
0	4	10.3
1	13	33.3
2	22	56.4
Orientation		
0	8	20.5
1	17	43.6
2	14	35.9
End Result		
0	0	0
1	5	12.8
2	34	87.2

Table 2

<i>Bivariate Correlations with Intersubjective Imitation at 4 year Follow-up Assessments</i>				
	Chronological Age	DAS Verbal	DAS Nonverbal	DAS Spatial
Intersubjective Imitation	0.04	0.40*	0.12	-0.01

* $p \leq 0.05$

Table 3

Bivariate Correlations with Intersubjective Imitation at 4 year Follow-up Assessments

	ToM	Joint Engagement	Coordinated Joint Look	Point	Show	Follow Point
Intersubjective Imitation	-0.49**	.41*	.38*	0.23	-0.16	-

** $p \leq 0.01$ * $p \leq 0.05$

Table 4

Pre-treatment to 4 year Follow-up Intersubjective Imitation Ordinal Regression

		Estimate	Odds Ratio	Std. Error	Sig.
Location	Coordinated Look	-0.005	1.01	0.042	0.907
	Point	-0.042	1.04	0.038	0.263
	Show	-0.933	2.54	0.687	0.175
	Give	-0.977	2.66	1.469	0.506
	Response to JA	0.051	1.05	0.055	0.351
	Joint Engagement	0.024	1.02	0.016	0.129

Table 5

Post-treatment to 4 year Follow-up Intersubjective Imitation Ordinal Regression

		Estimate	Odds Ratio	Std. Error	Sig.
Location	Coordinated Look	-0.098	1.10	0.051	0.055
	Point	-0.13	1.14	0.062	0.036
	Show	0.28	1.32	0.208	0.178
	Give	-0.776	2.17	1.227	0.527
	Response to JA	0.166	1.18	0.092	0.072
	Joint Engagement	0.058	1.06	0.026	0.022

Table 6

Ordinal Regression of Treatment vs Control

		Estimate	Odds Ratio	Std. Error	Sig.
Location	Treatment	1.421	4.14	0.696	0.041

Appendix A: Coding for Imitation Task based on Hobson & Lee (1999)

Object	Characteristics of imitation		Description
Wooden Rack and Stick	Style	Harsh	While pressing the stick down on the rack, pushing the stick across the rack making a grating jarring sound
		Soft	While gently pressing the stick down on the rack, sweeping the stick across the top of the rack to making a softer sound
	Orientation	Toward self	Pushing/sweeping the stick across the top of the rack from the farther side toward her/his own chin.
		Away from self	Pushing/sweeping the stick across the top of the rack from the side closer to her/himself .
Toy chick	Style	2 longest fingers	Operate the toy chick by pushing the head of the chick with two longest fingers.
		Palm	Operate the toy chick by pushing the head of the chick with the ball of the hand.
	Orientation	Away from self	When operating the toy chick, the child's fingers point away from her/himself.
		Toward self	When operating the toy chick, the child's fingers point toward her/himself.

Appendix B: Coding for Early Social Communication Scale (Seibert, Hogan & Mundy, 1982)

Joint Attention Skill		Definition	Example
Initiates Joint Attention Skills	Coordinated Joint Look	Child looks to toy, then tester, and back to the toy. Or the child looks to the tester, then toy, and back to the tester. There can be no more than 3 seconds between looking at the object and tester.	In reaction to a toy car crashing into a wall the child becomes excited and looks at the toy, then makes eye contact with the tester, then back to the toy car as to reference the object of her excitement.
	Showing	Child holds out the toy toward the tester so that the tester can see it but does not give the toy.	After a child puts in the final puzzle piece, she holds up the completed puzzle toward the tester to show her accomplishment.
	Gives to Share	Child deliberately gives the toy to the tester for sharing purposes. Child must give purely to share, e.g. for adult to look at a toy or for adult to take a turn with a toy. It does not get coded as “gives to share” if the child is giving the toy to the tester because s/he needs help. It also does not get coded as “gives to share” if the child just throws or thrusts the toy in the direction of the tester.	Child gives the tester a shape for a shape sorter each time after her own turn so that the tester can also take turns.
	Proximal Point	Child points to an object within 4 inches of object purely to share interest with the adult. Child’s finger does not need to be touching object.	Child and tester look at a book together. The child points and labels a picture in the book.
	Distal Point	Child points to an object which is more than 4 inches away from pointing finger purely to share interest with the adult. Child does not want adult to act on the toy.	A toy across the room unexpectedly starts to flash so the child points to it with concern.
Responsive Joint Attention Skills	Following Proximal Point	After adult points (to object within 4 inches of pointing finger), child responds with an attentional focus. The child’s eye-gaze shifts to focus on the object that the adult is pointing to	Tester points to a picture in a book and the child looks at that picture.
	Following Distal Point	Child follows adult distal point (at least 4 inches away from object). The child’s eye-gaze shifts to focus on the object that the adult is pointing to.	Tester points to a picture on the wall and the child looks toward that picture.

Appendix C: Coding for JAMES (Kasari, Paparella, Freeman & Jahromi, 2008)

Joint Attention Skill		Definition	Example
Initiates Joint Attention Skills	Coordinated Joint Look	Child looks to toy, then tester, and back to the toy. Or the child looks to the tester, then toy, and back to the tester. There can be no more than 3 seconds between looking at the object and tester.	In reaction to a toy car crashing into a wall the child becomes excited and looks at the toy, then makes eye contact with the tester, then back to the toy car as to reference the object of her excitement.
	Showing	Child holds out the toy toward the tester so that the tester can see it but does not give the toy.	After a child puts in the final puzzle piece, she holds up the completed puzzle toward the tester to show her accomplishment.
	Gives to Share	Child deliberately gives the toy to the tester for sharing purposes. Child must give purely to share, e.g. for adult to look at a toy or for adult to take a turn with a toy. It does not get coded as “gives to share” if the child is giving the toy to the tester because s/he needs help. It also does not get coded as “gives to share” if the child just throws or thrusts the toy in the direction of the tester.	Child gives the tester a shape for a shape sorter each time after her own turn so that the tester can also take turns.
	Proximal Point	Child points to an object within 4 inches of object purely to share interest with the adult. Child’s finger does not need to be touching object.	Child and tester look at a book together. The child points and labels a picture in the book.
	Distal Point	Child points to an object which is more than 4 inches away from pointing finger purely to share interest with the adult. Child does not want adult to act on the toy.	A toy across the room unexpectedly starts to flash so the child points to it with concern.
Responsive Joint Attention Skills	Following Proximal Point	After adult points (to object within 4 inches of pointing finger), child responds with an attentional focus. The child’s eye-gaze shifts to focus on the object that the adult is pointing to	Tester points to a picture in a book and the child looks at that picture.
	Following Distal Point	Child follows adult distal point (at least 4 inches away from object). The child’s eye-gaze shifts to focus on the object that the adult is pointing to.	Tester points to a picture on the wall and the child looks toward that picture.

Appendix D: Caregiver-Child Interaction (Adamson et al., 2004)

Engagement State		Description	Example
Unengaged/Other engagement	Unengaged	Child is not playing with a toy or person. Child is not even looking at what the other person is doing.	Child is lying on the floor and staring at the ceiling.
	Onlooking	Child is watching another person but not engaging the person or the object that the person is using.	Child watches another person push a car.
	Person-Engaged	Child is interacting with a person only. No object is involved.	Child plays pat-a-cake with her mom.
Object Engaged		Child is actively playing with an object. Child does not pay any attention to any person.	Child is playing with a shape sorter next to her mom but does not share any of the pieces with her nor does she respond with her mom talks to her.
Joint Engagement	Supported Joint Engagement	Child is actively playing with another person with the same object although the child does not actively acknowledge the other person. However, the child must show some awareness of that other person.	Child and her dad push a toy truck toward each other. Although the child does not make eye contact with her dad, she puts out her hands in anticipation when it is dad's turn to push the truck back to her.
	Coordinated Joint Engagement	Child is actively playing with another person with the same object and consistently acknowledges the other person. The child coordinates her/his attention to both the other person and the object.	Child and her dad push a toy truck toward each other. The child repeatedly says "ready set go" and looks to dad then back to the truck.

Appendix E: Sally-Anne Theory of Mind Task (Wimmer & Perner, 1983)

Variable	Response	Description
Where does Sally Look? (Trial 1)	Basket (correct)	Because Sally originally put the marble in the basket, the correct response would be for the child to say that Sally will look in the basket.
	Incorrect	If the child responds that Sally would look in the box or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with a location of where Sally would look for the marble, the response would be counted as unrelated.
Where is the marble really? (Trial 1)	Box (correct)	To confirm that the child understands that there is a difference between what Sally thinks and the truth, this item is included. Because Anne moved the marble from the basket to the box, the correct response would be for the child to say that the marble is in the box.
	Incorrect	If the child responds that the marble is really in the basket or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with the actual location of the marble, the response would be counted as unrelated.
Where was the marble in the beginning? (Trial 1)	Basket (correct)	To confirm that the child understands that the marble was moved, this item is included. Because Sally originally put marble in the basket, the correct response would be basket.
	Incorrect	If the child responds that the marble was initially placed in the box or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with the actual location of the marble, the response would be counted as unrelated.
Where does Sally Look? (Trial 2)	Basket (correct)	Because Sally originally put the marble in the basket, the correct response would be for the child to say that Sally will look in the basket.
	Incorrect	If the child responds that Sally would look in the pocket or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with where Sally would look for the marble, it would be counted as unrelated.

Where is the marble really? (Trial 2)	Pocket (correct)	To confirm that the child understands that there is a difference between what Sally thinks and the truth, this item is included. Because the marble was moved to the tester's pocket, the correct response would be for the child to say that the marble is in the pocket.
	Incorrect	If the child responds that the marble is really in the basket or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with the actual location of the marble, the response would be counted as unrelated.
Where was the marble in the beginning? (Trial 2)	Basket (correct)	To confirm that the child understands that the marble was moved, this item is included. Because Sally originally put marble in the basket, the correct response would be basket.
	Incorrect	If the child responds that the marble was initially placed in the pocket or any other place in the room, the response would be considered incorrect.
	Unrelated	If the child responds with something that does not have to do with the actual location of the marble, the response would be counted as unrelated.

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