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Imitation Therapy for Young Children with Autism

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1. Introduction

This paper reviews the literature on the limitation skills of infants who were later diagnosed with autism and on the enhancing effect of adult imitation on the social behavior of children with autism. Nadel had previously used an adaptation of the still-face paradigm to demonstrate that children with autism showed more expectant behaviors such as looking and touching an adult stranger after being imitated by that stranger. Our studies are then reviewed showing that children with autism respond more to imitative than contingently responsive adults. After repeated imitation sessions the children showed more distal social behaviors (looking, vocalizing) and proximal social behaviors (moving close to and touching adult). In another study children approached more imitative and playful adults. And, children with autism were more imitative with an imitative adult than with their parents. In the final study reviewed the children showed more joint attention behaviors following imitation including referential looking, gaze following and imitation. This literature suggests, then, that children with autism show more social and imitative behavior when they are imitated, highlighting the importance of imitation as an effective therapy for these children.

2. Imitation in neonates and young infants

Imitation has been noted as early as the neonatal stage (Field, Greenberg, Woodson, Cohen & Garcia, 1984; Meltzoff & Moore, 1983). In these studies, newborns imitated tongue protrusions (Meltzoff & Moore, 1983) and the basic facial expressions of happy, sad, and surprised (Field et al, 1984). Later at around 3 months reciprocal imitation was noted in the face-to-face interactions between mothers and infants and fathers and infants (Field, 1977). Imitation has also been used as an "interaction coaching technique" to improve or "slow down" the intrusive or over-stimulating behaviors of mothers with their high-risk infants (Field, 1977). Several have suggested that reciprocal imitation and memory for imitation (deferred imitation) are the social bases for empathy and language development (see Meltzoff, 1990 & Nadel, 2006 for reviews).

3. Infants later diagnosed with autism rarely showed imitation

Infants who were later diagnosed with autism have shown notably different interaction behaviors (Dawson, Hill, Spencer, Galpert & Watson, 1990). They showed fewer smiles and less frequent eye contact. They were less likely to smile in response to their mother's smile, and their mothers were less likely to smile in response to them. Their pre-verbal behaviors were either delayed or failed to develop including engaging in synchronous imitation (Asendorpf & Baudonniere, 1993; Eckerman & Stein, 1990) and exhibiting deferred imitation (Heimann, Laberg & Nordoen, 2006). Children with autism have rarely shown imitative behavior (Roger & Williams, 2006; Williams, 2008). In one model, early imitation deficits were thought to interfere with social interaction which, in turn, affected language development (Rogers & Pennington, 1991).

4. Adult imitation enhances social behavior of children with autism

Several studies have documented the positive effects of adults imitating children in object play situations including non-autistic children (Field, 1977; Lubin and Field, 1981) and children with autism (Dawson and Adams, 1984; Dawson and Galpert, 1990). Typically, the imitation enhanced social responsiveness in the children. Other studies on imitation in children with autism showed that imitative interactions: 1) affected object manipulation (Tiegerman & Primavera, 1981); 2) decreased self-stimulating behaviors (Harris, Handleman & Fong, 1987); and 3) increased gaze behavior (Tiegerman & Primavera, 1984). Each of these studies linked these changes to secondary improvements in interpersonal interaction and affect expression. Others referenced an association between these social behaviors and the development of language (Dawson & Adams, 1984; Nadel, 2006). Studies conducted within the last decade supported these earlier findings (Escalona et al., 2002; Field, Field, Sanders & Nadel, 2001; Heiman, Laberg & Nordoen, 2006; Nadel, Croue, Kervella, Mattlinger, Canet, Hudelot et al., 2000). They demonstrated that children with autism ranging in age from 2 to 11 years improved their eye contact behaviors, increased positive affect, enhanced social responsiveness and decreased perseverative behaviors when an unfamiliar adult imitated them.

Studies by Dawson and Adams (1984) suggested that children with autism and a low level of imitative ability were more socially responsive, showed more eye contact, and played with toys in a less perseverative manner when the experimenter imitated their behavior. The authors suggested that imitation was beneficial to children with lower developmental ages because imitation is a "recognized exchange or connection between two persons and thereby creates a feeling of shared understanding between them" (Dawson & Adams, 1984; Nadel & Peze, 1993). In addition, adult interaction partners have been noted to become more sensitive to their child's cues when they are being imitative (Field, 1977).

5. Imitation in the still-face paradigm

Imitation effects on children with autism have also been studied in social play situations such as the adapted version of the still-face paradigm by Nadel and her colleagues (2000). In the original still-face paradigm, designed by Tronick et al, mothers were asked to interact naturally with their infants for 3 minutes, then to sit in a still-face fashion and not move for another 3 minutes, and finally to interact normally for 3 minutes (Tronick, Als, Adamson, Wise & Brazelton, 1978).

In the Nadel et al. (2000) adaptation, children with autism interacted with an unfamiliar adult for four phases, each lasting 3 minutes. In the first phase, the child walked into a room that was furnished with a sofa, a table, chairs and two sets of identical toys. An unfamiliar adult sat on the sofa with a still-face and a body like a statue and did not move for 3 minutes. In the second phase, the stranger imitated everything the child did including the child's autistic-like behaviors, social and toy play behaviors, using toys that were identical to those the child used. The third phase consisted of a second still-face similar to the first one, and the fourth phase was a spontaneous interaction.

Although Nadel et al. (2000) had some concern about the negative effects or at least the potential confusion created by the still-face behavior in contrast to the more social behavior during the imitative segment, they showed that out of the six social behaviors coded (looking at person, positive facial expressions, negative facial expressions, positive social gestures, close proximity, and touching), as many as five occurred more often during the second still-face after the imitative segment compared with the first still-face. These included looking at the adult, negative facial expressions, positive social gestures, close proximity and touching. During that segment the children, according to the Nadel et al. study (2000), displayed significantly more expectant behaviors such as looking at or touching the strangers.

The results of the Nadel et al. (2000) study showed that the children's distal social behaviors (looking and social gestures) and proximal social behaviors (close proximity and touching) occurred significantly more often during the second still-face session than the first still-face session. Thus, the children displayed significantly more expectant behaviors such as looking-at or touching the stranger after the imitation session. The increases in proximity-seeking and touching behaviors were viewed as positive changes because they seemed to indicate attempts on the part of the children to initiate interactions, a rare event for children with autism. It is not clear why the imitative behavior on the part of the adult was so effective, although normal children at the early preschool developmental age have also been noted to be particularly responsive to imitations of their own behaviors (Lubin & Field, 1981).

6. Imitation compared with contingently responsive interactions

A shortcoming of the Nadel et al. (2000) study was that it could not be determined whether the imitation per se or simply the interaction being contingently responsive led to their results. Thus, we attempted to replicate the Nadel et al. (2000) study but to compare the effects of the adult being imitative versus simply being contingently responsive in their interaction behavior (Escalona et al., 2000). Using the same paradigm, similarly positive effects of imitation were observed (Escalona, Field, Lundy & Nadel, 2000), this time when imitation sessions were compared with contingently responsive sessions. In this study, twenty children with autism (mean age, 5 years) were recruited for the study from a school for children with autism. The children were randomly assigned to an imitation (N=10) or contingently responsive (N= 10) interaction group based on a stratification table for gender and developmental and chronological age. The sessions consisted of four phases, with each phase lasting 3 minutes. In the first phase, the child walked into a room that was furnished with a sofa, a table, chairs, and two sets of identical toys. An adult was in the room sitting very still like a statue (first still-face condition). In the second phase, the adult either imitated the child or was contingently responsive to the child. In the third phase, the adult

sat still again (second still-face condition), and in the fourth phase, the adult engaged in a spontaneous interaction.

The results suggested that during the third phase (the second still-face condition), the children in the imitation group spent less time in gross motor activity and more time being close to the adult and touching the adult, as if attempting to initiate an interaction. The contingency condition appeared to be a more effective way to facilitate a distal social behavior (attention), whereas the imitative condition was a more effective way to facilitate a proximal social behavior (touching). These results highlighted the effectiveness of imitation versus the use of simply contingent responsive behavior.

In at least the two studies just described, increases in social initiation and responsiveness were noted, including increased physical proximity and touching by the children with autism immediately following the imitation by the adult (Escalona et al., 2000; Nadel et al., 2000). The children also showed significantly more negative facial expressions toward the adult during the second still face phase, perhaps suggesting that they may be expressing their disappointment that the adult was no longer imitating them.

In the Escalona et al (2002) study, we randomly assigned children to groups. Thus we controlled for the possibility of imitation merely being a contingently reinforcing response by establishing a control group where half of the twenty subjects were responded to contingently without imitation. The results of this study showed that imitation produced a larger effect than merely responding contingently without imitation.

These results also suggest that the child's proximal behaviors may be increased by the adult's imitation and contingent responsivity. Decreased distance from the adult occurred for both groups during the second still-face segment after the imitation and contingently responsive interactions, suggesting that the children were initiating moves toward the adult. Imitation, however, yielded additional improvements, including less motor activity, suggesting that imitation may have made the child more aware of the adult and thus diverted his or her attention from motor activity when the adult stopped imitating the child during the second still-face segment. Although both groups reduced their distance from the adult, the increase in touching the adult by the children was significantly greater for the imitation group and is consistent with data reported in the prototype for this study by Nadel et al. (2000).

According to Nadel et al. (2000), children with autism develop social expectancies during the imitation condition. The children showed these expectancies in both the Nadel et al. (2000) study and the Escalona et al. (2002) study by not only reducing their distance from the adult but also by touching the adult more frequently. They also showed a greater advantage for social interaction relative to the contingent responsivity group by reducing motor activity and vocal stereotypies, as indicated by no decrease in silence. Although the silence category also included no discernible sound, which could also include preverbal vocalizations, this makes this finding difficult to interpret inasmuch as increases in stereotypic speech may be less desirable while increases in other vocalizations may be more desirable, especially if they occur at the same time the children are increasing their attention to an adult.

We suggested in the conclusions of the Escalona et al. (2002) study that a future study might determine the specific ways in which the adult differs during the contingent responsivity and imitation conditions. A larger sample would also enable a comparison between those children who initiated contact by touching the adult after imitation and the other approximately half of the children who did not. The anecdotally reported frequency of

social touch aversion in children with autism (Baranek, 1999) highlights the importance of finding interventions such as imitation to enhance the proximity and touch initiations noted in the children with autism in this study. The fact that imitation was more effective in reducing gross motor behavior and increasing the children's social contact behavior (touching) than the contingently responsive interaction highlights the special nature of imitation. It is not only being immediately responsive, as in being contingently responsive, that is important, but it is also responding with the same form of behavior that is effective. The data from these studies as well as those from other studies (Dawson & Adams, 1984; Nadel & Peze, 1993) suggest that imitation by adults may be an effective intervention with young nonverbal children with autism.

7. Children with autism display more social behaviors after repeated imitation sessions

In the next study we explored the effects of repeated sessions of imitation (Field et al., 2001). Twenty children were recruited from a school for children with autism to attend three

	Sessions		
	1	2	3
Stereotypies	1.6 (2.1)	1.5 (1.9)	0.9 (1.7)
Inactivity	19.3 ^d (21.2)	1.7(20.7)	5.7 ^c (19.0)
Playing alone	65.7 ^a (67.1)	54.1 (61.2)	50.9 ^a (60.3)
Accepting object	0.0 ^d (0.7)	3.0 (1.2)	0.0 (0.9)
Playing with object	60.3 ^d (54.9)	90.6 (62.3)	80.8 ^b (71.5)
Looking at adult	4.5 ^d (3.9)	20.0 (7.8)	15.7 ^c (9.3)
Mirror play	1.0 (2.1)	6.5 (4.2)	10.7 ^a (5.8)
Smiling/laughing	0.1 ^d (0.4) ^a	8.9 (3.2)	4.3 (2.7)
Vocalizing	5.0 ^b (6.7)	11.0 (7.2)	7.3 (5.8)
Proximal to adult	0.7 (0.5)	0.7 (0.9)	3.3 ^b (1.7)
Sitting next to adult	0.1 (0.4)	1.0 (0.5)	7.1 ^b (0.8)
Touching adult	0.0 (0.0)	0.0 (0.0)	6.2 ^d (1.2)
Imitation recognition	0.0 ^d (0.0)	6.8 (0.0)	7.0 ^d (0.0)
Reciprocal play	0.0 ^d (0.2) ^a	6.7 (3.1)	7.1 ^d (3.2) ^a

Superscripts in column 1 reflect significant differences between sessions 1 and 2. Superscripts in column 3 reflect significant differences between sessions 1 and 3.

^a $p < 0.05$. ^b $p < 0.01$. ^c $p < 0.005$. ^d $p < 0.001$.

Table 1. Mean percentage time that behaviors occurred during spontaneous play following repeated imitation sessions (contingently responsive play sessions in parentheses). (Adapted from Field et al., 2001).

sessions during which an adult either imitated all of the children's behaviors or simply played with the child. By the second session the children in the imitation group were showing distal social behaviors toward the adult a greater proportion of time including (see table 1): (1) looking; (2) vocalizing; (3) smiling; and (4) engaging in reciprocal play. During the third session, the children in the imitation group spent a greater proportion of time showing proximal social behaviors toward the adult including: (1) being close to the adult; (2) sitting next to the adult; and (3) touching the adult.

These results suggest that both distal and proximal social behaviors may be increased in children with autism by repeated sessions of the adult imitating the child's behaviors. Solitary behaviors including inactivity and playing alone had decreased by the second session and accepting and playing with objects had increased. Distal social behaviors of looking at the adult, smiling and vocalizing toward the adult occurred more often, and reciprocal play and recognizing imitation had also increased by the second session. By the third session the time that proximal social behaviors occurred had increased including mirror play, being close to the adult, sitting next to the adult and touching the adult. Consistent with the suggestions of Dawson and Adams (1984), Nadel and Field (2001) recently reported data showing that only those children with autism who recognized they were being imitated actually increased their social behavior.

Imitation by an adult requires total attentiveness and responsiveness to the child for the child's behaviors to be matched. As in mother-infant interactions featuring imitation (Field, 1977), the adult-child time together becomes more playful and reciprocal. In the better interactions of children with autism (i.e. those where the children approach, are close to and touch the adult more), the adult has been noted to be more playful (Nadel et al., 2007). A larger sample would enable a comparison between those children who approach and touch the adult following imitation and those (approximately half of the children) who do not (Escalona et al., 2002). Those who approach and touch may experience less social touch aversion, frequently reported in children with autism (Baranek, 1999), and have more intimate relationships.

8. Children with autism approach more imitative and playful adults

In a subsequent study, the videotapes from the Escalona et al. (2002) study were recoded for children's approach behaviors and for adult behaviors to assess the adult's imitative behavior and to determine what other adult behaviors were associated with the children's approach behaviors (Nadel et al., 2007). The videotapes were first coded for the children's approach behaviors. The children from the high-approach sessions were labeled the high-approach group, and those with low-incidence approach behavior were labeled the low-approach group. The interactions were then coded for the adults' behaviors. Children with autism were selected to be in high-approach and low-approach groups based on a median split of their proximity-seeking behavior with adults (looking at, approaching and touching adults) during videotaped interactions. The same videotapes of those two sets of interactions were then coded and analyzed for the adult partners' behaviors. The adult interaction partner of high approach children showed more looking at the child, smiling at the child, moving toward the child, inviting the child to play, imitating the child in play and being playful (see table 2).

The results suggested that the high-approach group interaction sessions or those in which children with autism showed more approach behaviors were characterized by more interesting behavior in the adults, including more frequent smiling, sound effects, imitative behavior and playfulness. The greater incidence of adult imitative behavior during those high-approach interactions may have been a carryover effect from the imitative phase of the

Adult Behavior	High approach	Low approach	<i>t</i> value	<i>p</i> value
Looking at child	52.5 (29.2)	63.9 (20.8)	1.01	N.S.
Smiling at child	11.1 (10.6)	4.0 (2.4)	-2.81	0.001
Moving toward child	29.7 (24.4)	21.8 (13.0)	-0.90	N.S.
Relaxed body tone	72.0 (39.7)	20.0 (18.5)	-3.73	0.001
Adult making sounds	3.5 (3.2)	0.0 (0.2)	-3.46	0.01
Inviting child to play	47.6 (29.5)	28.5 (22.4)	-1.63	0.05
Imitating child in play	3.8 (6.8)	0.7 (1.8)	-1.44	0.05
Being playful	72.0 (39.7)	20.4 (18.5)	-3.73	0.01

Table 2. Mean (standard deviation) percentage of time adult behaviors occurred in high-approach and low-approach interactions. (Adapted from Nadel et al., 2008).

session inasmuch as more of the high-approach interactions occurred following the imitation sessions. More frequent approach behaviors by the child during the spontaneous interactions may relate to the imitative and more playful behavior during those interactions. Consistent with the Nadel *et al.* (2000) suggestion that children with autism can develop social expectancies around socially expressive adults, which then manifest themselves in more approach behaviors such as looking at or touching the adult. The more playful adult may help the child with autism relate to that adult and form more social expectancies, the more playful adult may also be a more interesting playmate and more flexible, allowing the children with autism more freedom to initiate. The child being allowed to initiate seems to be effective in eliciting social contact. A second confound of this study, in addition to the chance finding that more imitation occurred prior to the high-approach sessions, is that more of the high approach sessions featured an adult who was more experienced playing with children with autism. This adult may have learned through interactions with these children that imitation and playfulness are effective behaviors.

Several behavioral techniques have been investigated for increasing imitative behavior in children with autism including discrete trial training, use of stereotypic behaviors to increase play skills, pivotal response training, differential reinforcement of appropriate behavior, *in vivo* modeling and play scripts, video modeling and reciprocal imitation training (Stahmer, Ingersoll, & Carter, 2003). In a study teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach, the children with autism increased their imitation skills and generalized these skills to novel environments (Ingersoll & Schreibman, 2006). In addition, the children increased other social-communicative behaviors, including language, pretend play and joint attention.

9. Children with autism are more imitative with an imitative adult than their parents

The purposes of our next study were: (1) to determine how much imitative behavior parents show during play interactions with their autistic children as compared to a researcher who was deliberately imitative of the children during a play interaction; and (2) to determine how the more imitative researcher affected the child's social and imitative behavior. Children with autism (mean age = 6 years) were videotaped first interacting with a parent and then with an unfamiliar researcher who imitated the child's behaviors. The researcher showed more imitative and playful behaviors than the parents. In turn, the children showed more imitative behavior when playing with the imitative researcher than with their parents (see table 3 & 4).

	Interaction		
	Mother	Researcher	p
Adult			
Imitating child	2.60 (5.33)	39.33 (14.48)	0.000
Playful with child	50.33 (22.28)	59.67 (15.81)	0.05
Child			
Smiling at adult	6.20 (8.10)	9.27 (10.96)	0.1
Touching adult	15.93(23.98)	5.13 (7.53)	0.04
Imitating adult	7.20 (9.17)	17.33 (16.70)	0.02
Recognizing being imitated by adult	1.47 (4.91)	2.13 (4.47)	0.25

Note: These behaviors are not mutually exclusive nor would they comprise 100% of the individual's interaction behavior.

Table 3. Mean percent time that interaction behaviors occurred in mothers, researchers and children with autism. (Adapted from Field et al., 2010).

	Interaction		
	Father	Researcher	p
Adult			
Imitating child	.00 (.00)	39.33 (14.48)	0.002
Playful with child	33.40 (13.43)	59.67 (15.81)	0.02
Child			
Smiling at adult	2.80 (2.95)	9.27 (10.96)	0.17
Touching adult	21.40 (32.24)	5.13 (7.53)	0.05
Imitating adult	.80 (9.09)	17.33 (16.70)	0.05
Recognizing being imitated by adult	.00 (.00)	2.13 (4.47)	0.37

Note: These behaviors are not mutually exclusive nor would they comprise 100% of the individual's interaction behavior.

Table 4. Mean percent time that interaction behaviors occurred in fathers, researchers and children with autism. (Adapted from Field et al., 2010).

The low levels of imitation among these children with autism (from 7% to 8% time with the parents to 17% time with the researcher) are consistent with the literature suggesting impaired imitation in these children (Malvy et al., 1997; Rogers et al., 2003). Imitation deficits are a risk factor for later development given their relationship to mental age (Roeyers et al., 1998). The children's very infrequent signs of recognizing being imitated in this study may be another risk factor. However, the paradigm used in this study, like that of our other studies (Escalona et al., 2002; Field et al., 2001; Nadel et al., 2000) suggests that

children can display social imitation (Nadel & Peze, 1993), and particularly when an adult is being imitative. This is highlighted by the comparisons between the researcher who was more imitative of the children than the mothers or fathers were. The children, in turn, were more imitative with the more imitative researcher than with their parents.

The reciprocal play and game-like turn-taking during the bouts of imitation could be elicited specifically by the imitative behavior of the adult. Comparisons between sessions that are imitative and those using contingently responsive behavior have suggested that imitative behavior of the adult may be more effective in eliciting imitative behavior of the child (Escalona et al., 2002). The effects of the researcher's more frequent imitative behavior on the imitative behavior of the child, however, were confounded by the researcher also showing more frequent playful behavior. Playful behavior by adults has also been notably effective in eliciting social behavior in children with autism in a recent study (Nadel, Field, Escalona, & Lundy, 2007). The relatively high levels of playful behavior in the parents (33–50% time) and the simultaneously low levels of imitative behavior by the children during play with their parents suggest that the adults' playful behavior is less instrumental than the adults' imitative behavior in eliciting the children's imitative behavior.

These data highlight the effectiveness of adult imitative behavior and suggest that therapists/teachers might model imitative behavior for parents. Since imitation is a process by which most young children learn new skills, the social and cognitive skills of children with autism might also be enhanced by imitation modeling of this kind.

10. Imitation and joint attention

A study on imitation and communication involved the recoding of videotapes from the Field et al (2001) study (Field et al., 2001). This included two randomized groups. During the intervention phase, one group of 10 children was imitated by the unfamiliar adult. This constituted the imitation (IM) group. In the other group, the adult interacted in a non-imitative, yet, contingently responsive manner. For this group, the adult was instructed not to imitate the child. Joint attention behaviors were observed in accordance with the definition offered by Carpenter, Pennington, and Rogers (2002). These researchers referred to joint attention as a cluster of behaviors such as referential looking, gaze following, imitation, and gestures such as showing, reaching, and pointing. The young children with autism (4–6 years of age) who were imitated were expected to show a greater percent of time showing joint attention behaviors compared to the children in the group that simply received contingent responsiveness, including referential looking, gaze following, imitation, and gestures such as showing, reaching, and pointing sessions.

The percent time the children engaged in joint attention behaviors as demonstrated by referential looking, gaze following, imitation, and gesturing was recorded during two phases of two sessions (during the intervention phase and the spontaneous interaction phase and the first and third sessions). The imitation group showed greater referential looking, gaze following and imitation behaviors (see table 5). Imitating the child's behaviors was significantly related to the increase in percent time the child engaged in three of the four joint attention behaviors by the children including referential looking, gaze following and imitation (see table 6). Adult imitation was not, however, significantly related to the percent time the child spent gesturing.

Joint Attention Behaviors				
	Referential Looking	Gaze Following	Imitation	Gestures
Adult Imitates	30.25	67.25	24.00	23.65
Adult does not imitate	10.68	39.63	2.55	19.40

Table 5. Comparison between groups of the mean percentage time joint behaviors occurred. (Adapted from Ezell & Field, 2011). The groups significantly differ on all behaviors except gestures.

Joint Attention Behaviors					
N=20	Adult Imitates	Referential Looking	Gaze Following	Child Imitates	Gestures
Adult Imitates	-	.567(**)	.466 (*)	.429 (*)	.056
Referential Looking		-	.409	.290	.319
Gaze Following			-	.809 (**)	-.036
Child Imitates				-	-.142
Gestures					-

Table 6. Correlations between mean percentage time of imitation and joint attention behaviors. (Adapted from Ezell & Field, 2011).

11. Summary

This paper reviews the literature on the imitation skills of infants who were later diagnosed with autism and on the enhancing effect of adult imitation on the social behavior of children with autism. Nadel had previously used an adaptation of the still-face paradigm in to demonstrate that children with autism showed more expectant behaviors such as looking and touching an adult stranger after being imitated by that stranger. Our studies are then reviewed showing that children with autism respond more to imitative than contingently responsive adults. After repeated imitation sessions the children showed more distal social behaviors (looking, vocalizing) and proximal social behaviors (moving close to and touching adult). In another study children approached more imitative and playful adults. And, children with autism were more imitative with an imitative adult than with their parents. In the final study reviewed the children showed more joint attention behaviors following imitation including referential looking, gaze following and imitation. This literature suggests, then, that children with autism show more social and imitative behavior when they are imitated, highlighting the importance of imitation as an effective therapy for these children.

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Autism spectrum disorders are a major topic for research. The causes are now thought to be largely genetic although the genes involved are only slowly being traced. The effects of ASD are often devastating and families and schools have to adapt to provide the best for people with ASD to attain their potential. This book describes some of the interventions and modifications that can benefit people with ASD.

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