THE EFFECTS OF PARENT-IMPLEMENTED RECIPROCAL IMITATION TRAINING ON AUTISM SPECTRUM DISORDERS

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ABSTRACT

A growing body of research indicates imitation is a skill that is significantly impaired in young children with autism spectrum disorders (ASD). Relationships between imitation skills and other social and communication skills, such as joint attention and play, have been discovered, leading early intervention service providers to focus on teaching imitation skills to young children with ASD in order to foster related skill development. Parent-implemented interventions can eliminate or reduce the need for outside service providers, which can reduce costs to families and have been shown to have positive effects on parent mental health. They can also yield similar benefits to therapist-implemented intervention when implemented with a high degree of fidelity. Parent-implemented Reciprocal Imitation Training (RIT) has been effective in increasing both object and gestural imitation skills in young children with ASD. This study aimed to replicate those findings. Three young children with ASD were exposed to parent-implemented RIT in two phases targeting object and gestural imitation, and all three increased their rates of both object and gestural imitation during the intervention.
DEDICATION

This paper is dedicated to my students.

Thank you for teaching me how to be patient, compassionate, and resilient.
ACKNOWLEDGMENTS

I would like to thank my advisor, Donald A. Hantula, Ph.D., for aiding in the development and analysis of this paper. I would also like to recognize Katherine Buckley for her assistance in data collection.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>DEDICATION</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
</tbody>
</table>

**CHAPTER**

1. IMITATION DEFICITS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS ................. 1
2. PARENT TRAINING                                                        ......................... 3
3. METHODS                                                               ................................. 5
   Participants                                                           ................................. 5
   Materials                                                              ................................. 7
   Setting                                                                ................................. 7
   Dependent Measures                                                     ................................. 7
   Inter-observer Agreement and Social Validity                           ................................. 8
4. EXPERIMENTAL DESIGN                                                   ................................. 9
   Procedures                                                            ................................. 9
5. RESULTS                                                               ................................. 11
   Social Validity                                                       ................................. 20
6. DISCUSSION                                                           ................................. 21

REFERENCES CITED                                                            ................................. 24
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correlations between parent and child behaviors</td>
<td>19</td>
</tr>
<tr>
<td>2. Parent questionnaire results</td>
<td>20</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rate of object and gestural imitation for Henry, Nathan, and Katie</td>
<td>13</td>
</tr>
<tr>
<td>2. Parent use of reciprocity strategies: contingent imitation and linguistic mapping</td>
<td>16</td>
</tr>
<tr>
<td>3. Parent use of object and gestural imitation training</td>
<td>18</td>
</tr>
</tbody>
</table>
CHAPTER 1

IMITATION DEFICITS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

Research indicating a relationship between non-verbal social-communication skills and later language development (e.g., Schertz & Odom, 2004; Schertz et al. 2013; Toth et al., 2006), has piqued interest in training parents to teach earlier emerging, non-verbal social-communication skills to their children (Meadan et al., 2009; Schertz & Odom, 2006). Imitation is one such skill that is significantly impaired in young children with autism spectrum disorder (ASD) (e.g., Williams et al., 2004). Some studies suggest that this deficit is significant even when compared to children with other developmental disorders (such as Fragile X Syndrome), and further, that certain imitative deficits may be specific to ASD (Stone, Ousley, & Littleford, 1997; Rogers et al., 2003; Edwards, 2014). However, a longitudinal study of children from 12-24 months showed only slight differences in the imitation skills of children with ASD and children with other developmental delays (Young et al., 2011).

Recent research suggests that this deficit may be due in part to the suppression of mirror neurons (Williams et al., 2001; Kana, Wadsworth, and Travers, 2011; and Perkins et al., 2010) in children with ASD. Mirror neurons typically show activity when performing certain types of goal directed tasks, including imitating the actions of others. Although not every study reports the same observation of mirror neurons suppression in individuals with ASD (Ruysschaert et al., 2014), there is enough evidence to support an increased focus in teaching skills affected by a suppression in mirror neurons to
individuals with ASD due to the harmless and cost-effective nature of these types of
interventions as previously noted.

Imitation plays a significant role in the development of complex cognitive and
social skills. Research in children with ASD demonstrates a correlation between imitation
skills and a) language (Stone & Yoder, 2001; Thurm et al., 2007), b) play (Stone, Ousley,
& Littleford, 1997), and c) joint attention (Carpenter, Pennington, & Rogers, 2002). In a
longitudinal study, imitation of body movements was correlated with expressive
language skills both concurrently and one year later, and imitation of actions with
objects was concurrently correlated with play skills (Stone, Ousley, & Littleford, 1997).
These types of concurrent and predictive relationships led researchers to suggest targeting
imitation skills in young children with ASD in order to supplement the development of
their social communication (Carpenter et al., 2002).
CHAPTER 2

PARENT TRAINING

A growing body of literature has demonstrated the benefits of parent-implemented interventions for children with ASD (Barton et al., 2013; Patterson, Smith, & Mirenda, 2012; Meadan et al., 2009). Parent training is socially valid for multiple reasons. From a practical standpoint, parent training is extremely cost effective, as it can reduce the need for direct services once parents are better able to implement behavior interventions independently of therapists. Besides reducing costs, parent training offers significant benefits for the child and family in terms of skill acquisition and maintenance and parental mental health (Tonge et al., 2006). Parent training can lead to gains in the language and social communication skills of children with ASD (Kaiser, Hancock, & Nietfeld, 2000; Roberts & Kaiser, 2011; McConachie & Diggle, 2007). In one study, parent-implemented intervention resulted in better generalization and maintenance of skills than therapist-implemented intervention (Koegel et al., 1982) and one metanalysis showed that skill acquisition in some areas occurred at higher rates following parent-implemented intervention, while therapist-implemented intervention resulted in better acquisition of other skills (Roberts & Kaiser, 2011). Although more research needs to be done comparing parent-implemented intervention to therapist-implemented intervention, these findings suggest that it is at least possible to achieve similar rates of skill acquisition through parent-implemented intervention. This is especially true when interventions are implemented with fidelity (Barton et al., 2013). In order for this to occur, not only is effective and thorough training of parents necessary, but treatment integrity in the implementation of the intervention by parents must be present.
Reciprocal imitation training (RIT) is a naturalistic behavioral intervention that teaches imitation to children with ASD within a social-communicative context. An adult pairs a child's play actions with a verbal marker and imitate them in order to encourage reciprocity. Approximately every minute, the adult models an action related to the child's play. If the child does not imitate the action, the adult prompts the child to complete the action, and then provides praise. Previous research has demonstrated that RIT is effective for teaching both object (Ingersoll & Schreibman, 2006) and gestural imitation (Ingersoll, Lewis, & Kroman, 2007). In these studies, imitation skills generalized to novel settings, materials, and therapists and maintained over time.

When parents of young children with ASD were taught to use RIT strategies with their children, the children demonstrated increases in their object imitation and one child increased his gestural imitation (Ingersoll & Gergans, 2007). Gestural imitation was only targeted for one child in this study, since the other children received lower scores on the Motor Imitation Scale (MIS) at intake. Therefore it is not known whether parent-implemented RIT would have increased gestural imitation in the other children had it been targeted.

In addition to adding to the research regarding RIT as an effective intervention for increasing imitation skills in children with ASD, this study aimed to provide insight on whether children's gestural imitation can be enhanced using a parent-implemented RIT program regardless of their initial scores on the MIS.
CHAPTER 3

METHODS

Participants

All participants were recruited via word of mouth from local service providers. The inclusion criteria for this study were as follows: the children must have been preschool or kindergarten aged students receiving Applied Behavior Analysis services, diagnosed with ASD, presented with deficits in imitation skills, and had imitation goals in their Individualized Education Programs (IEP). Their parents must not have received any prior training in RIT. Three young children with ASD and their parents participated in this study. All three children were diagnosed with ASD by an outside professional, and all exhibited imitation and communication deficits.

At intake, students were administered the MIS (MIS: Stone, Ousley, & Littleford 1997) to determine initial object and gestural imitation skills during a structured assessment. This assessment is comprised of 16 imitation targets: 8 which use objects, such as banging a spoon on the table, and 8 which utilize gestures, such as waving. Each action is modeled for the child, followed by the prompt, "You try it." The child receives a score of 0 for failing to imitate the action, 1 for an emerging response, such as partial imitation, or 2 for a correct response. In a validation study of the MIS, children with ASD scored a mean of 45% of the total possible points on the object imitation portion of the MIS and 16.3% on the gestural imitation portion. Children in a developmentally delayed group scored a mean of 70.6% of the total possible points on the object imitation portion, and 38.1% of the gestural imitation portion. Children in a normally developing group
scored a mean of 69.4% of the total possible points on the object imitation portion, and 25.6% on the gestural imitation portion (Stone, Ousley, & Littleford 1997; Stone 2015).

Henry was 6 years old. On the MIS, he scored 25% for object imitation and 29.2% for gestural imitation. He vocalized single words and short phrases to communicate his wants and needs. He lived at home with his parents and younger brother, and received supplemental autistic support services at his elementary school. His mother had received a Doctor of Law degree and a Master of Arts. She worked part-time from home for the duration of the study, and had received no parent training prior to this study.

Nathan was 3 years, 3 months old. On the MIS, he received a score of 29.2% for object imitation and 12.5% for gestural imitation. He communicated his wants and needs using single words, short phrases, or by pointing to desires items. He lived at home with his parents and older sister, and attended an early intervention preschool classroom five days per week. His mother was a stay-at-home parent at intake, and began working outside of the home midway through the study. Her highest level of education was undergraduate, and she previously received some parent training through Early Intervention services.

Katie was 3 years, 11 months old. She used a combination of picture exchange, sign, and pointing to objects to communicate her wants and needs. On the MIS, Katie scored 29.2% for object imitation and 25% for gestural imitation. Katie lived at home with her parents and younger sister, and attended an ASD preschool classroom five days per week. Her father, who participated in this study, was a stay-at-home parent for the
duration of the study. His highest level of education was a Bachelor of the Arts degree, and he had previously received some parent training in the areas of occupational therapy, speech, and communication through picture exchange.

Written consent was obtained from the parents, and assent was assumed by the children's willingness to begin each session.

Materials

Parent-child dyads were provided with five sets of similar toys for each session, and toys were rotated periodically. A variety of toys were used, including, but not limited to spring toys, dolls, noisemakers, and animal figures. Toys were not presented in any particular order. A digital video camera held by the principal investigator was used to record each play session.

Setting

All baseline and treatment sessions were conducted in the children's homes. Katie and Nathan played at a table with their parents, and Henry and his mother played on the floor.

Dependent Measures

All sessions were video recorded and scored later. Data were collected on both the behavior of the parent and the child. Parents were scored on their use of RIT strategies. The following parent behaviors were scored using a frequency count: modeling, prompting, and reinforcement. Contingent imitation and linguistic mapping were scored in 30 second partial intervals. A frequency count
was used to score children's object and gestural imitation. All frequency data were converted to rate per minute by dividing the number of behaviors observed by the number of minutes.

Inter-observer Agreement and Social Validity

Reliability data were collected during all sessions prior to phase changes and six randomly selected videos, for 15% of the videos. An independent observer was trained in RIT strategies and data collection methods. Pearson's $r$ was used to calculate reliability for all behaviors. The correlation for object imitation was $r = .99$, gestural imitation was $r = .97$, contingent imitation was $r = .98$, linguistic mapping was $r = .98$, object imitation training was $r = .98$, and gestural imitation training was $r = .99$. All correlations were significant at $p < .01$. Parents were asked to complete a social validity questionnaire (Ingersoll & Gergans 2007) at the completion of the study in order to evaluate their opinions of the effectiveness of the intervention.
CHAPTER 4

EXPERIMENTAL DESIGN

A multiple-baseline design was conducted across participants and behaviors (object and gestural imitation). Differing baseline lengths were chosen based on the stability of the data. During treatment, parents received training in RIT consisting of a general overview of strategies followed by modeling, role play, and feedback. An RIT manual was provided to the parents and used in the trainings (Ingersoll 2014).

Procedures

During the baseline phase, parents were asked to play with their children as they normally would. The play sessions were video recorded for 10 minutes.

During the initial treatment session, each parent was given a manual outlining the strategies used in RIT. The intervention consisted of two phases. During Phase I, parents were taught RIT skills targeting reciprocity, such as imitating their children's play actions, in the first session, and strategies targeting object imitation, such as modeling novel actions with toys, in the second session that took place two weeks later. Parents were instructed to imitate their child's play and provide a running commentary. For example, if the child rolled a toy car across the table, the parent would also roll his/her car and say, "we're driving." Parents were trained to model an action approximately every minute, and pair it with a verbal marker. This action could be modeled up to three times in order to give the child an opportunity to observe the action and respond to it. If the child did not spontaneously imitate the action, parents were instructed to provide a verbal prompt, such as, "you try it." If the child did not respond to the verbal prompt, parents
were to physically prompt the child to complete the action. Once the child completed the action, the parent was to provide reinforcement (e.g. "You did it!"). Parent trainings in the remaining sessions in Phase I reviewed these strategies. Trainings in Phase II consisted of teaching RIT strategies for increasing gestural imitation, such as modeling gestures relevant to their children's play. For example, if a child was playing with a dinosaur toy, the parent might cover his/her face and say, "It's scary!" Just as in Phase I, if the child did not imitate the action, parents were taught to prompt the child to complete the action and then provide praise.

During both Phase I and Phase II of the intervention, sessions consisted of a 20-minute parent training, followed by 10 minutes of the parent playing with his/her child. Parent trainings consisted of review of strategies, modeling, role-play, and feedback.
CHAPTER 5
RESULTS

Figure 1 displays the results for the children's object and gestural imitation. Henry did not engage in object or gestural imitation during baseline. Both object and gestural imitation increased with the onset of treatment in Phase I, during which parents were taught reciprocity strategies and object imitation training, but gestural imitation was inconsistent at a mean of .03 (SD = .07) responses per minute, and eventually dropped back to 0. Object imitation, by contrast, increased and remained stable at a mean of .14 (SD = .12) responses per minute. Henry's gestural imitation peaked at 1 response per minute with the onset of Phase II, during which parents were taught gestural imitation training skills, while object imitation began at 0. After the initial session in this phase, both object and gestural imitation stabilized at levels above baseline responding with a mean of .15 (SD = .11) responses per minute for object imitation and .45 (SD = .32) responses per minute for gestural imitation.

During baseline, Nathan imitated a mean of .23 (SD = .08) actions with objects per minute. He did not imitate any gestures during baseline. Nathan's object imitation increased with the onset of Phase I to a mean of .64 responses per minute (SD = .16), while his rate of gestural imitation remained at zero. With the onset of Phase II, Nathan's rate of object imitation decreased to a mean of .25 responses per minute (SD = .11), while his rate of gestural imitation increased to a mean of .19 responses per minute (SD = .12). While responding in Phase II was less stable than Phase I, rates of both object and gestural imitation remained higher than baseline levels.
During baseline, Katie imitated a mean of .22 (SD = .10) actions with objects per minute. She did not imitate any gestures during baseline. Katie's rate of object imitation increased with the onset of Phase I to a mean of .38 responses per minute (SD = .16), and remained on an increasing trend throughout the phase. While she did imitate some gestures during Phase I, her use of gestural imitation was inconsistent during this phase at a mean of .03 (SD = .08) responses per minute. During Phase II, however, Katie's rate of gestural imitation increased steadily and remained stable at levels above baseline at a mean of .28 (SD = .17). While her rate of object imitation decreased when gestural imitation increased, object imitation remained stable at levels above baseline throughout Phase II at a mean of .3 responses per minute (SD = .06).
Figure 1. Rate of object and gestural imitation for Henry, Nathan, and Katie

Figure 2 depicts parent use of reciprocity strategies: contingent imitation and linguistic mapping. During baseline, none of the parents used reciprocity strategies with consistency. Henry's mother utilized contingent imitation 3.3% of intervals on average (SD = .05) and linguistic mapping 10% of intervals on average (SD = .04). Nathan's mother utilized contingent imitation 15% of intervals on average (SD = .12) and linguistic mapping 33.8% of intervals on average (SD = .12). Katie's father utilized contingent imitation 3% of intervals on average (SD = .02) and linguistic mapping 21% of intervals on average (SD = .08). During Phase I of treatment, Nathan's mother and Katie's father greatly increased their implementation of these strategies. Nathan's mother utilized contingent imitation 91.4% of intervals on average (SD = .06) and linguistic mapping 80.7% of intervals on average (SD = .19). Katie's father utilized contingent imitation 76% of intervals on average (SD = .12) and linguistic mapping 72.1% of intervals on average (SD = .15). While Henry's mother also increased her usage of these strategies during Phase I, her implementation was more variable at an average of 35.3% of intervals (SD = .25) for contingent imitation and 38.4% of intervals (SD = .25) for linguistic mapping. Her usage of these strategies increased but remained variable during Phase II, at an average of 53.8% of intervals (SD = .23) for both contingent imitation and linguistic mapping. Nathan's mother used fewer reciprocity strategies in Phase II than in Phase I, but her utilization of strategies remained higher, at 75% of intervals (SD = .09) on average for contingent imitation and 71.9% of intervals (SD = .13) for linguistic mapping, than her baseline levels. Katie's father's use of reciprocity strategies further
increased during Phase II to an average of 91.7% of intervals (SD = .04) for contingent imitation and 86.7% of intervals (SD = .04) for linguistic mapping.
Figure 2. Parent use of reciprocity strategies: contingent imitation and linguistic mapping

Figure 3 depicts parents' use of object and gestural imitation training. None of the parents utilized gestural imitation training during baseline. During Phase I of treatment, all three of the parents increased their use of object imitation training. Henry's mother and Katie's father used some gestural imitation training during Phase I, but it was not consistent. Henry's mother averaged .45 responses per minute (SD = .15) for object imitation training and .03 responses per minute (SD = .09) for gestural imitation training. Katie's father averaged .71 responses per minute (SD = .12) for object imitation training and .02 responses per minute (SD = .07) for gestural imitation training. Nathan's mother averaged .66 responses per minute (SD = .29) for object imitation, but did not use any gestural imitation training during Phase I. During Phase II, all three parents increased their usage of gestural imitation training while decreasing their usage of object imitation training. Henry's mother averaged .35 responses per minute (SD = .21) for object imitation training and .53 responses per minute (SD = .45) for gestural imitation training. Katie's father averaged .38 responses per minute (SD = .04) for object imitation training and .45 responses per minute (SD = .13) for gestural imitation training. Nathan's mother averaged .31 responses per minute (SD = .09) for object imitation training and .45 responses per minute (SD = .11) for gestural imitation training.
Figure 3. Parent use of object and gestural imitation training

Table 1 reports Pearson's $r$ correlations between parent and child performance. There were several large correlations between parents' utilization of object and gestural imitation training and their child's object and gestural imitation. For Katie and her father, gestural imitation and gestural imitation training were highly correlated at $r = .92$. Gestural imitation and gestural imitation training were also highly correlated for Henry and his mother at $r = .98$. For Nathan and his mother, both object imitation and object imitation training and gestural imitation and gestural imitation training were highly correlated at $r = .9$ and $r = .86$ respectively. Object imitation was negatively correlated with gestural imitation training for all three children. Gestural imitation training was also negatively correlated with object imitation across all three participants.

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<tr>
<th></th>
<th>Nathan</th>
<th>Henry</th>
<th>Katie</th>
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<tbody>
<tr>
<td></td>
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<td>Gestural Imitation</td>
<td>Object Imitation</td>
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<tr>
<td>Gestural Imitation Training</td>
<td>-0.45</td>
<td>0.86</td>
<td>-0.14</td>
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Table 1. Correlations between parent and child behaviors
Social Validity

Parents were asked to complete a questionnaire (Ingersoll & Gergans 2007) at the completion of the study in order to evaluate their opinions of the effectiveness of the intervention, and their mean responses are displayed in table 2. Overall, parents agreed that the intervention was both effective and easy to implement. They also reported that they used the intervention at home independently of research sessions, and that they would recommend the intervention to others. Parents had the most neutral reaction to whether their child enjoyed the intervention, which may have been due to the children being in varied moods across sessions.

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<td>Child's social engagement improved</td>
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<td>Parent used intervention at home on regular basis</td>
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<td>Parent would recommend intervention to others</td>
<td>7</td>
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1 = Strongly disagree, 4 = neither agree nor disagree, 7 = strongly agree
Table 2. Parent questionnaire results
CHAPTER 6

DISCUSSION

The purpose of this research was to further evaluate the effectiveness of parent-implemented RIT in increasing the object and gestural imitation skills of children with ASD. Studies have shown RIT to be effective in increasing object (Ingersoll & Schreibman, 2006) and gestural (Ingersoll, Lewis, & Kroman, 2007) imitation skills in children with ASD when implemented by therapists. Ingersoll and Gergans (2007) demonstrated that parent-implemented RIT can also effectively increase object and gestural imitation skills in children with ASD, although only one child in their study was included in the phase targeting gestural imitation. Gestural imitation was not targeted for the remaining two children, who scored poorly on the gesture portion of the MIS, which made it impossible to determine whether parent-implemented RIT would have increased gestural imitation skills in these children.

The findings of the present study suggest that parent-implemented RIT can, in fact, increase gestural imitation skills in children with ASD despite their scores on the gesture portion of the MIS. All three children significantly increased their rate of gestural imitation during Phase II of the intervention, when gestural imitation training skills were taught to their parents. Two of the children, Henry and Katie, even slightly increased their rates of gestural imitation during Phase I of the intervention, before gestural imitation training skills had been taught to their parents. As was the case in previous studies (Ingersoll & Schreibman, 2006; Ingersoll and Gergans 2007), rates of object
imitation also increased during the intervention phases. This was true for all three of the participants.

Linguistic mapping was not strongly correlated with object or gestural imitation for any of the three participants, and contingent imitation was not correlated with gestural imitation for any of the participants. It was correlated with object imitation for Nathan, but not for Henry or Katie. While it is possible that contingent imitation and linguistic mapping are necessary parts of RIT's treatment package, future research should be conducted to assess the effectiveness of object and gestural imitation training as stand-alone interventions for increasing object and gestural imitation skills in children with ASD.

Object imitation was negatively correlated with gestural imitation training for all three children. This was due to the fact that parent object imitation training was the discriminative stimulus for child object imitation, making it a stimulus delta for gestural imitation, since the two behaviors could not occur simultaneously. For the same reason, gestural imitation training was a stimulus delta for object imitation, and the two behaviors were negatively correlated across all three participants.

One limitation of this study was that the data collection procedures were not sensitive to parent over-prompting, which affected their children's ability to respond independently. Future research should include data collection on this additional parent behavior in order to account for correspondingly low rates of imitation in their children. In order to further assess increases in imitation skills as a result of RIT, future research should include an additional MIS assessment at the conclusion of the study in order to
compare scores to those received at intake. Future research should also assess the effects of ordering treatment phases based on MIS sub-section scores, since Henry received a higher score on the gesture portion of the MIS but object imitation was targeted first for all of the children. Another limitation of this study was the setting. Since sessions took place in the participants' homes, it was difficult to control for external stimuli such as noise, siblings, and pets which may have caused distraction and affected responding.

In conclusion, the findings of this study are consistent with previous research suggesting that parent-implemented interventions can be effective in increasing social-communicative skills in children with ASD (Meadan et al., 2009; Kaiser, Hancock, & Nietfeld, 2000; McConachie & Diggle, 2007; Ingersoll & Schreibman, 2006; Ingersoll, Lewis, & Kroman, 2007; Ingersoll & Gergans, 2007), and more specifically, that parent-implemented RIT can be effective in increasing both object and gestural imitation in children with ASD, regardless of their initial scores on the MIS. Research regarding these procedures should continue to be conducted.
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