COMPARING CONTINGENT VOCAL IMITATION AND CONTINGENT VOCAL RESPONSES TO INCREASE VERBAL COMMUNICATION IN YOUNG CHILDREN DIAGNOSED WITH AUTISUM SPECTRUM DISORDER

A Thesis

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ABSTRACT

Individuals diagnosed with Autism Spectrum Disorder (ASD) have difficulties in forming functional communication. The purpose of this study was to replicate Ishizuka and Yamamoto (2016) to determine which intervention, contingent vocal imitation or contingent vocal responses, produced the highest level of vocalizations of young children diagnosed with ASD in a play-based setting. For the contingent vocal response treatment phase, the experimenter vocally responded to each child vocalization with a response that was topographically different than the child's response. For the contingent vocal imitation treatment phase, the experimenter vocally imitated the child's vocalization with a topographically identical response. Two children diagnosed with ASD, ages 41 and 57 months, participated in this study. An alternating treatment design was used to compare the effects of each treatment on increasing child vocalizations. . Results indicated that contingent vocal imitation resulted in a higher number of child vocal imitations for both children. Results also indicated that contingent vocal responses and contingent vocal imitation produced comparable levels of overall vocalizations, which replicated the findings of Ishizuka and Yamamoto (2016).

Keywords: Autism spectrum disorder, verbal communication, imitation, early intervention

DEDICATION

I would like to dedicate the findings of my research to all families of children diagnosed with ASD. I would also like to dedicate my research to all those working in the field of Applied Behavior Analysis, and those who work with any child that has a diagnosis of ASD or other diagnosis of an intellectual developmental disability. Thank you for all that you do for each child and family.

ACKNOWLEDGMENTS

I would like to share my appreciation and thanks to Dr. Matt Tincani. Thank you for all of your guidance, your advisement, and your commitment in assisting me throughout the process of the publication of my thesis. Words cannot express how grateful I am for your consistent and prompt feedback. Your dedication to your work, and to your students is inspiring.

I would also like to thank all of those who have provided me with their mentorship throughout my entire career in Applied Behavior analysis including Temple University Staff, Michigan State University Staff, and all those who have inspired me in growing in the field of ABA.

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LITERATURE REVIEW

Autism Spectrum Disorder (ASD) has been estimated to affect 1 in every 59 children in the United States, according to the Centers for Disease Control and Prevention (Baio, et al., 2014). Having a diagnosis of ASD can include lacking communication skills, deficits in social skills, difficulty relating to others, restricted and repetitive behaviors, excesses in maladaptive behaviors, speech delay, hyposensitivity, hyper-sensitivity, and having an overall lack of independence in their daily living (Schreibman et al., 2015; Tager-Flushberg, et al. 2005). Specifically, children diagnosed with ASD often lag behind their typically developing peers in developing expressive language due to a lack of social reciprocity while also showing non-responsiveness with conversational exchanges (Rutter, et al. 1992;Young,1991).

Applied behavior analysis (ABA) is an evidence-based intervention which incorporates the science of understanding how human behavior is affected by environmental changes (Schreibman, et al., 2015). ABA is used to decrease maladaptive behaviors, while increasing desired behaviors including communication skills, social skills, play skills, academic skills, attending skills, and fine and gross motor skills (Smith, 2010; Tager-Flushburg, et al. 2005). Prescribed hours will vary depending on the need of each child. These hours may vary from 20 to 40 hours per week (Smith). This depends on the individual, their diagnosis, and their needs. ABA helps prevent inappropriate behaviors from forming and instead provides replacement behaviors consisting of desired and appropriate behaviors to increase daily living skills.

Early Intervention

Early intervention has dramatically changed in the last 30 years by providing ABA services to young children. Children diagnosed with ASD between birth to four years of age are at the early intervention phase (Baio et al., 2018). Most children are not diagnosed until the ages of three and a half years to five years of age, which means may children diagnosed with ASD are missing out on receiving early intervention treatment (Baio). The early intervention phase is the most critical phase since the most efficient and remarkable progress will occur in children who are first diagnosed between this age range including: increasing communicational, motor, and socio-emotional skills, as well as reducing barriers to learning (Vietze & Lax., 2020). There are many interventions that incorporate ABA for the early intervention age range. These interventions include naturalistic environmental teaching (NET), naturalistic developmental behavioral intervention (NDBI), early intensive behavioral intervention (EIBI), and Discrete Trial Training (DTT) (Kuhl et al. 2003; Yurovsky et al. 2013; Smith, 2001).

Some ABA therapeutic techniques occur in the child's natural environment, such as NET and NDBI (Ingersoll, 2008; Kuhl et al., 2003; Yurovsky et al., 2013). In contrast, DTT, developed by Ivar Lovaas (Smith, 2001), applies ABA techniques in a more structured setting. Regardless of which technique is being used to apply ABA services, all share an essential characteristic. That is, implementing ABA at an early age, with a focus on developmentally based learning targets, as well as facilitating the acquisition of language and social skills (Schreibman et al. 2015). Having the ability to communicate decreases maladaptive and undesired behaviors by replacing these behaviors with appropriate and desired behaviors via functional communication (Tiger, et al. 2008). Having greater access to early intervention

significantly increases verbal communication in young children diagnosed with ASD, prevent vocal communication gains later in life (Tager-Flushburg, et al. 2005).

Vocal Imitation

Imitation, which is a form of learning, is an important skill. It is especially important for a child who is diagnosed with ASD, since modeling vocalizations of others requires having the ability to imitate these words (Ingersoll., 2010b). In a neurotypically developed child, imitation is developed in early infancy, and this skill increases an infant's acquisition of communication, language, joint-attention, and play. Children diagnosed with ASD often have deficiencies in imitation, highlighting the need for interventions to promote imitation skills (Ingersoll & Schreibman., 2006; Williams et al., 2004;). Vocal imitation is when a child can repeat words or sounds that they hear. This could include full words, approximate words, and vocal sounds. For example, a young child with ASD hears an adult say "no", so the child immediately imitates what they just heard and say "no." Gross-Lousi et al. (2000) found that mothers who implemented infant vocal constant-vowel vocalization produced 14% more vocalizations in comparison to mothers who only imitated a vowel like vocalization of their infants. Imitation is extremely important for language acquisition and in forming communication behavior like increasing vocabulary and using appropriate language (Ingersoll, 2008). Continuous vocal imitation occurs when the child's vocal sounds, including full words or approximate words, are continually vocally imitated by another person. For example, if while a child is engaging in play activity and says "red" or any other word or word approximation, the adult will immediately imitate the child by saying "red" or whatever word they just heard.

Providing continuous vocalization allows the child to understand the concept of imitation and increases their overall communication skills by increasing their vocal imitation (Ingersoll & Schreibman, 2006). Once this has been established, the child's verbal repertoire may increase. If the child is unable to imitate any sounds or words, however, it is possible they might not have the ability to and, if this is the case, an alternative form of communication such as sign language, or the Picture Exchange Communication System (PECS), may be implemented (Bondy & Frost, 1994). Since there are many different types of augmentative alternative communication (AAC) devices to be considered, acquisition rates, audience training, and preferences should be heavily considered prior to implementing an alternative form of communication devices (Tincani, 2004).

Imitation is a very important skill that allows children to learn new skills. Imitation skills play a critical role in language and communication acquisition, as well as social interaction skills. This is extremely important in children who are diagnosed with ASD since they face limitations and deficits in social skills when compared to typically developing peers. Imitation includes language and communication, play, joint attention, as well as vocal and motor imitation. Research shows that children who are diagnosed with ASD have a delay in imitation; therefore, interventions to promote imitation in this population are critical (Ingersoll, 2008).

Contingent Imitation Versus Contingent Responses

As discussed, contingent vocal imitation occurs when another person vocally imitates the vocal sounds, full words, or approximate words a child says (Gadzag & Warren, 2000). For example, a child says "truck" and an adult responds by saying "truck." This is done to increase the child's overall vocalizations. Pelaez, Virues-Ortega, and Gewirtz (2011) found that implementing contingent maternal vocal imitation acted as a reinforcement for infant vocalizations and increased infants' overall frequency of vocalizations.

In contrast, contingent vocal response, a common procedure in many ABA therapy programs, occurs when another person provides non-imitative verbal responses contingent on a child's vocal sounds, approximate words, or full words. An example of this is when a child says "bubbles" and an adult responds by saying "wow, so many!" Mothers who respond to their children's language have been shown to advance their children's language development in the early phases of life (Bornstein, et al. 2008; Tamis-LeMonda, et al. 2001). Paternal responsiveness is considered to influence a child's language development in both atypical, and neurotypical children (Tamis-LeMonda, et al. 2014; Haebig, et al. 2013; McDuffie & Yoder, 2010; Siller & Sigman, 2002). Children who had a limited verbal repertoire, with very few words, benefited the most from the implementation of vocal responses in increasing their vocalization language repertoire (Marion, et al. 2019).

Ishizuka and Yamamoto (2016) compared the effects of contingent vocal imitation and contingent responses as an intervention a using within-subject multi-element design. They evaluated the relative effects of each intervention on increasing verbal interaction with children diagnosed with ASD within an experimental setting. Although both interventions used in this study resulted in increasing the participant's overall vocalizations, they specifically found that providing contingent imitation facilitated the child's vocal imitation. The findings indicated that contingent vocal imitation was a more effective intervention to facilitate the emergence of child vocalizations. However, they conducted their study in an experimental setting having only a table and chair. Each participant in their study was required to sit in the chair across from the experimenter at a table. Picture cards were incorporated into each session, while few toys were incorporated into sessions. Preferred activities in naturalistic setting were not incorporated into any aspect of the study. In contrast, implementing an intervention during preferred activities in a

natural environment can potentially promote generalization of skills, which would allow both interventions to be more effective (Yurovsky et al. 2013; Ingersoll & Schreibman, 2006).

Similar to Ishizuka and Yamamoto (2016), the aim of this study was to evaluate the relative effects of contingent vocal responses and contingent imitation on vocalizations of young children diagnosed with ASD. Since a limitation of the previous study was that it was conducted in a non-therapeutic experimental setting, this study occurred in a natural setting while the child is engaging in play activities in a playroom with access to preferred items and activities. Specifically, the following research questions will be addressed:

1. What are the relative effects of contingent vocal imitation and contingent vocal responses on vocal imitation of children with ASD?
2. What are the relative effects of contingent vocal imitation and contingent vocal responses on spontaneous vocal responses of children with ASD?
3. What are the relative effects of contingent vocal imitation and contingent vocal responses on overall vocal responses of children with ASD?

METHOD

Participants and Settings

Two participants were recruited at a clinic that provides ABA therapeutic services to children diagnosed with ASD, located in Dearborn, Michigan. Inclusion criteria for this study were as follows. Each participant must have had a diagnosis of, ASD and between the ages of two to five years of age and must have qualified to receive ABA services due to the severity of the diagnosis, while also having the ability to engage in vocalizations. Vocalization abilities were assessed by using the Verbal Behavior Milestones Assessment and Placements Program (VBMAPP) (Sundberg, 2008). The VB-MAPP is a skill assessment administered to individuals diagnosed with ASD or other language delays. It is an assessment that specifically contains 16 separate measurements of language and related skills, including child vocalizations. The VB-MAPP involves three levels: level 1, level 2, and level 3. Level 1 focuses on skills of children between the ages of 0 to 18 months of age, Level 2 focuses on children 18 to 30 months of age, and Level 3 focuses on children from the ages of 30 to 48 months. To participate in the study, a child must have attained at least a Level 1 score in the skill domains of spontaneous vocal behavior or echoics. This was done to ensure that each participant in the study had the ability to engage in spontaneous vocal behaviors whether that included babbling sounds, approximate words, or full words. The VB-MAPP assessment was on file for each participant, already completed by Patterns Behavioral Services, the service provider agency of each child' applied behavior analysis therapeutic services.

Informed consent for these children to participate in this study was obtained from each of their parents, using a consent form, per the university IRB. Jaka was a three-year-five-month-old middle eastern male, diagnosed with ASD who received ABA services in the home setting. He

was receiving ABA therapeutic services for a full year. Although he was unable to repeat any three words, he had the ability to approximately repeat one word, and sometimes two-word phrases. Jaka required prompting to respond to open ended questions such as “What do you want?”, and greetings. Jaka scored a 4 out of 5 possible points in the vocalization’s domain of the VB-MAPP; a 4 out of 10 possible points in the echoic domain; a 3 out of 10 possible points in the imitation skill.

Haal was a four-year-nine-month old middle eastern male, diagnosed with ASD who receives services in the clinical setting. Haal was receiving ABA services for 6 months in the clinical setting. Prior to the outbreak of Coronavirus, Haal was receiving services for a full year. Haal was able to echo some one-word phrases, in approximations including the following: “purple”, “toy”, “eat”, “blue”, “baba”, and “bye”. Haal was unbale to respond to open ended questions. Haal was able to respond to greetings such as “hi” or “bye” in approximation that an unfamiliar adult would be able to understand his vocalizations. Haal scored a 3 out of 5 possible points in the vocalization’s domain of the VB-MAPP; a 3 out of 10 possible points in the echoic domain; a 0.5 out of 10 possible points in the imitation skill.

All study sessions occurred either in the child’s home setting or in the clinic, depending on where the child received ABA services. For Jaka, this occurred in his home setting. For Haal, this occurred in the clinical setting at Patterns Behavioral Services.

Materials

General materials used included: a timer, a pencil, data sheets, an item checklist, and a fidelity checklist. Please see the Appendix, Appendix A. for an example of the data sheet used throughout the study. Additionally, a variety of preferred items were available to the participants

during each session. These were written on an item checklist during the first session, which was used during the remaining sessions to ensure that all the same items were present. During the first session the experimenter chose a minimum of 30 to 40 items per participant to provide them with access to a large variety of toys during each session. Items were chosen based on availability and input from each participant's therapist who reported to the experimenter their most recent preferred they accessed during their therapy sessions. Preferred items were different for each participant based on availability and their preferences, although there was some overlap of items between the two participants.

A total of 35 items were used for the first participant, Jaka. These items were slime, elephant animal toy, tiger animal toy, mini elephant animal toy, monkey animal toy, seal animal toy, shark animal toy, zebra animal toy, hippo animal toy, moose animal toy, dinosaur animal toy, large doll house, slide, car, stretchy toy, visual sensory bottle toy, three mini balls, three squishy balls, light up spin toy, anima face toy, brain squishy toy, squishy string toy, two finger puppet toys, squishy cloud toy, stuffed moose, block, three squishy bug toys, pink penguin squishy toy, blue penguin squishy toy, white squishy dog toy, brown squishy dog toy, chicken squishy toy, lion squishy toy, hippo squishy toy, dinosaur squishy toy, egg carton toy, and ABC letter magnets. The items for the second participant, Haal, totaled 33, which included: car truck, bank car, mini guitar, maracas, mini piano, large yoga ball, bead maze toy, mini drum, xylophone, mini oven toy, a small car, ball bouncer toy, pig, squishy toy, dragon, toy popper, boat, orange bouncy ball, purple bouncy ball, rainbow bouncy ball, spikey ball, ABC toy, mini cart toy, red ball pit ball, orange ball pit ball, pink ball pit ball, purple ball pit ball, blue ball pit ball, green ball pit ball, yellow ball pit ball, and three mini cars.

Dependent Measures

Two dependent measures were scored: (a) the number of participant vocal imitations, and (b) the number of participant spontaneous vocalizations. Vocal imitations were defined as when the participant engaged in any vocal imitation within 5 sec of the experimenter. This included vocally imitating the vocal sounds, words, or approximate words the experimenter made. If the participant vocally imitated the experimenter, who had originally imitated the participant, this counted as two occurrences of child vocal imitation, and so on. For example, if the child spontaneously said, "eat," the experimenter echoed "eat," the child echoed, "eat," the experimenter again echoed, "eat," and the child echoed the experimenter once again by saying"eat", this would have been scored as a total of one participant spontaneous vocalization, two participant vocal imitations, and two experimenter vocal imitations.

Spontaneous vocalizations were defined as vocalizations which occurred naturally without any instructional antecedents. This included any sounds, full words, or approximate words. Examples included "eeehhh", "aaa", "toy", and "too". Vocalizations that followed an instructional demand from another person were not considered spontaneous. For example, saying to the participant, "Say cat," was considered a demand, and thus any subsequent vocalization would not have been recorded. However, if the participant saw a cat and said "cat" or "ca" without a demand, this was recorded as a spontaneous vocalization, since the participant engaged in the vocalization independently without anyone issuing a demand. Additionally, if the child engaged in a vocalization in response to the experimenter that was not imitative or in response to a demand, this was recorded as a spontaneous vocalization. For example, if the participant vocalized, "yeh", the experimenter responded "yellow", and the participant responded, "wow, yellow", the participant's second response was considered a spontaneous vocalization and not a

vocal imitation, since the response consisted of a word that the experimenter did not initially say, "wow".

Experimental Design

This study used an alternating treatment design using the following two interventions: contingent vocal imitation and contingent vocal responses. The order in which the intervention was presented to each participant in the first session was randomized. This was done using a coin flip. Following the first session, the intervention was alternated every other session. The ensured a counterbalanced presentation of both interventions.

General Procedure

The study took place over 18 days for Haal, and 7 days for Jaka. The timeline depended upon the stability of the data, as well as the availability of each participant. Two to four sessions were conducted per day. At the beginning of each session, the experimenter laid out each participant's preferred items on the floor, so the participant was able to gain access to each of the items during the session. Then, a timer was set to 10 minutes. As soon as the timer went off and the last scheduled session occurred for the day, the experimenter put away all the items. During each session, the experimenter was always sitting beside the participant, within arm's length of them. The experimenter engaged with play activities with the participant throughout the entire 10-min duration of each session. This included bringing toys to the participant or placing them in proximity of toys they were playing with. If the participant was not engaging with any toys, the experimenter would put toys in front of or near them. This was done to maintain interaction with the child, as well as to entice them to engage with both the toys and the experimenter.

The first participant, Jakka, received ABA services in their home setting. Therefore, each session occurred in the participant's home. The participant's therapist was present for 75% of the scheduled sessions. The therapist was asked to collect IOA data during this time, while sitting five feet away from both the participant and the experimenter. All other objects in the room, other than toys, were put away and out of reach.

The second participant in this study, Haal, received ABA services in the clinical setting. Therefore, his sessions were held in an empty room that was arranged to look like a playroom by incorporating toys throughout the room. The second observer was present for 10% of the scheduled sessions in the session room sitting five feet away from the participant and experimenter recording IOA.

Contingent Vocal Imitation

During the contingent vocal imitation intervention, the experimenter imitated each occurrence of the participant's spontaneous vocalizations within 5 seconds. In other words, when the child engaged in any vocalization, including sounds, word approximations, and full words, the experimenter immediately repeated what had been already vocalized by the child within 5 seconds. For example, if the child said "ahhha", the experimenter repeated "ahhha." If the child vocally imitated the experimenter imitating them, the experimenter would have then again vocally imitated the child. This may have repeated as many times as the child imitated the experimenter. If the child responded to the experimenter by engaging in any of the following behaviors: breathing loudly, gasping, laughing, burping, sneezing, coughing, crying, or clearing throat, the experimenter would not have engaged in any vocal imitations as these behaviors did not count as any of the target behaviors.

Contingent Vocal Responses

During the implementation of contingent vocal response, the experimenter provided a non-imitative vocal response after each occurrence of the participant's vocalizations within 5 seconds. For example: if the child said "car", the experimenter would have responded: "yes, it is red", or "yay", the child then may have responded by saying "reh", and the experimenter then said, "big car" within 5 seconds. If the child was breathing loudly, gasping, laughing, burping, sneezing, coughing, crying, or clearing throat, the experimenter would not have engaged in any vocal responses, as these were not considered participant vocalizations.

Fidelity of both interventions was documented using a frequency count of: (a) experimenter vocal imitations, and (b) experimenter vocal responses. These were measured to ensure the experimenter was following the stated intervention procedures in both intervention conditions. Self-monitoring checklists were implemented by the experimenter for 100% of the sessions. In addition to this, a second observer completed these checklists for 11% of the sessions. Experimenter vocal imitation was only scored during the implementation of the contingent vocal imitation condition. Experimenter vocal imitation occurred when the experimenter contingently vocally imitated the participant within five seconds of the participant's vocalization. Experimenter contingent vocal responses occurred when the experimenter responded to each of the participant's vocalizations within five seconds. Experimenter contingent vocal responses only occurred throughout the implementation of contingent vocal responses. Procedural fidelity was calculated by adding participant vocalizations and diving this by the experimenter vocal responses depending on the treatment phase. The average procedural fidelity rate for Jaka averaged a 98.5% (94.6%-100%). The average procedural fidelity rate for Haal averaged 99.4% (93.3%-100%).

IOA

Two therapists who provided ABA services to each of the participant's case were recruited to collect IOA data. Since each participant had a different therapist working on their case, a total of two observers were recruited and trained to collect IOA data per participant. Prior to collecting IOA data, the experimenter reviewed the definitions and examples of each target behavior with the second observer. Then, the second observer was trained during a minimum of five practice sessions until they reached at least 90 percent agreement with the primary observer. The practice sessions were comprised of video clips and practice sessions each totaling 30 to 120 seconds. Any specific information regarding the purpose of the study was withheld from both secondary observers to minimize risk that potentially could have caused bias when collecting IOA.

Interobserver agreement data collection occurred during 38.8% of the sessions. The primary interobserver collected IOA for a total of 75% of Jaka's sessions. The secondary interobserver collected data for a total of 10% of Haal's sessions. IOA was calculated by using the total count method, in which the smaller frequency of behavior was divided by the larger frequency of behavior and multiplied by 100. Jaka's IOA averaged 97.7% (92 -100%), and Haal's IOA averaged 98% (96 -100%).

Fidelity of Implementation

During each experimental session, a self-monitoring checklist with a total of 10 questions was used to establish the correct implementation of each condition phase by the experimenter. See Appendix D. The checklist was also completed by a trained second observer for 11% of the sessions. Interobserver agreement averaged a 100% agreement on the fidelity data. The overall

implementation of steps in the checklist for both participants averaged 96.42%. Fidelity of implementation averaged 98.21% (85.71-100%) for Jaka, and 95% (71.42-100%) for Haal.

RESULTS

The results for Jaka are displayed in Figures 1, 2, and 3. Figure 1 shows the frequency of Jaka's vocal imitations in the contingent vocal imitation and contingent vocal response conditions. Jaka displayed an average of 10.5 occurrences of vocal imitation (range, 2-28) responses in the contingent imitation condition, and an average of 1.6 vocal imitations (range, 0-4) responses in the contingent vocal response condition. Visual analysis of Figure 1 shows that Jaka imitated more frequently in the vocal imitation condition.

Figure 1.

Jaka's frequency of vocal imitation in the contingent vocal imitation and contingent vocal responses conditions.

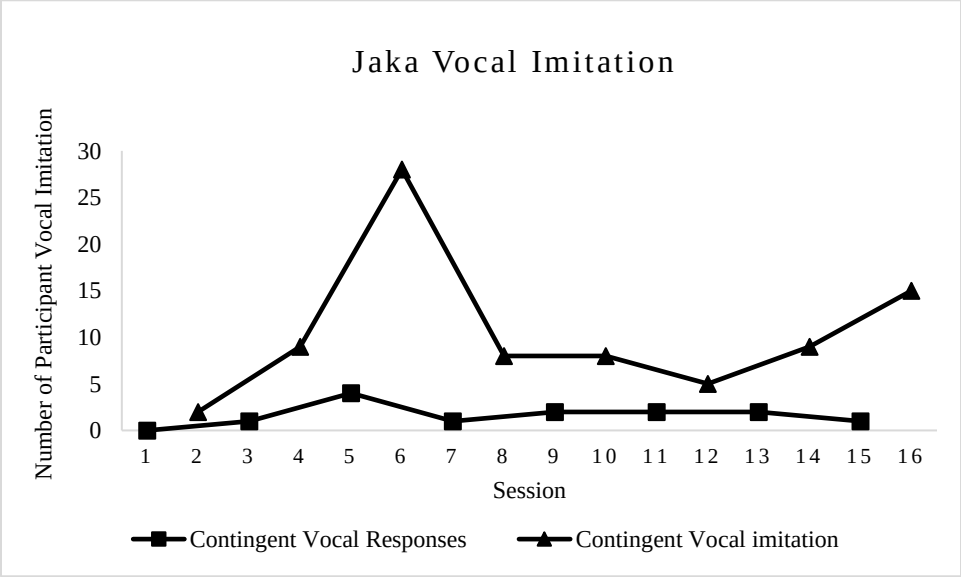


Figure 2 shows the frequency of Jaka's spontaneous vocal responses in both the contingent vocal imitation and contingent vocal response conditions. Jaka displayed an average

of 66.2 occurrences of spontaneous vocalizations (range, 40-87) responses in the contingent vocal imitation phase, and an average of 64.2 spontaneous vocalizations (range, 54-73) in the contingent vocal response phase. Visual analysis of Figure 2 shows that the frequency of Jaka's spontaneous vocalizations were at similar levels during both conditions.

Figure 2.

Jaka's spontaneous vocal responses in the contingent vocal imitation and contingent vocal responses conditions.

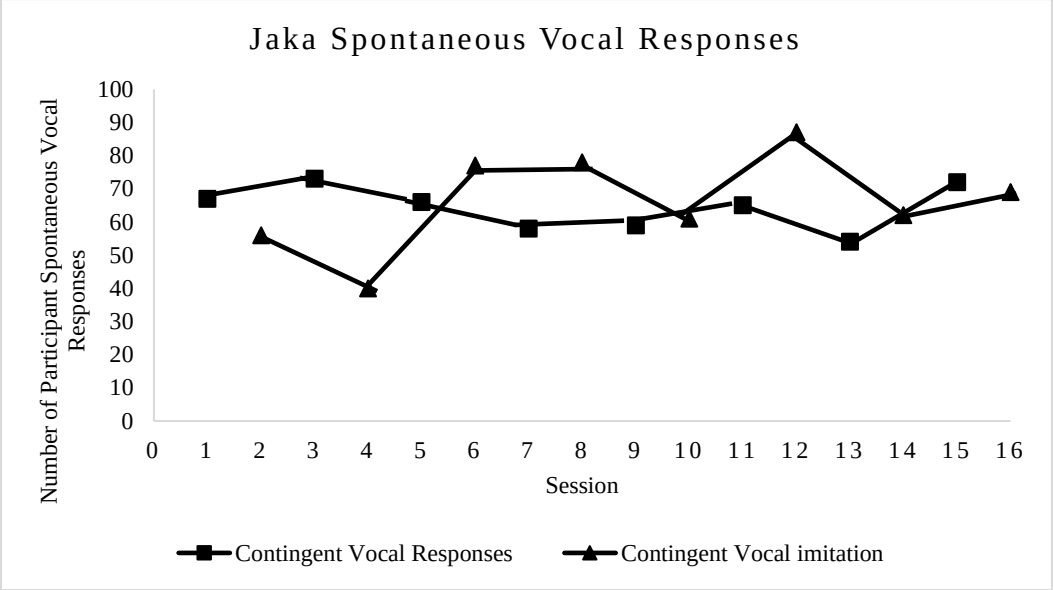
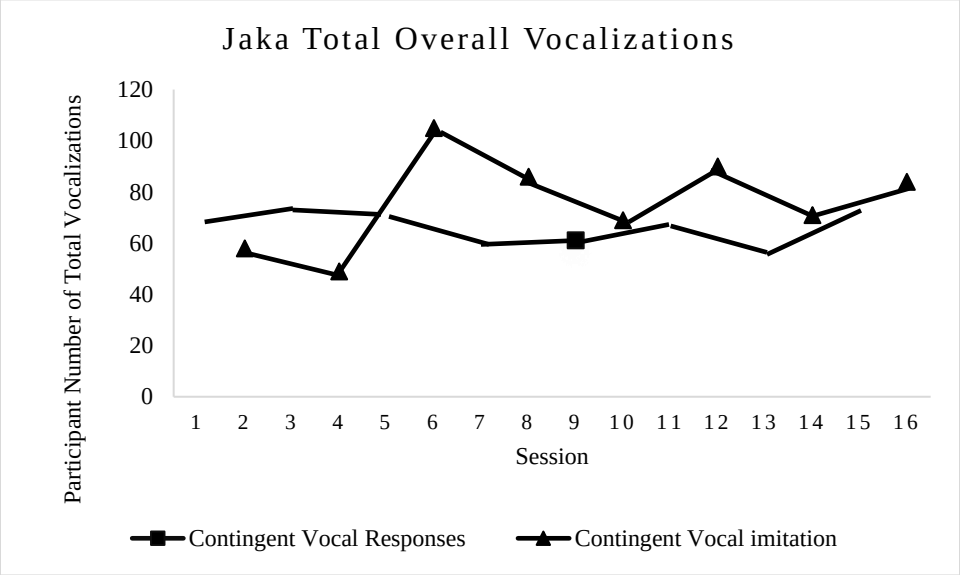


Figure 3 shows the frequency of Jaka's overall vocalizations in the contingent vocal imitation and contingent vocal response conditions. Jaka displayed a total average of 76.7 overall vocalizations (range, 49-105) throughout the contingent vocal imitation phase, while displaying an average of 76.1 total overall vocalizations (range, 56-72) throughout the contingent vocal response phase. The visual analysis of Figure 3 shows that throughout the implementation of both condition phases, Jaka's overall vocalizations occurred at a similar level.

Figure 3.

Jaka's overall vocalizations in the contingent vocal imitation and contingent vocal responses conditions



The results for Haal are displayed in Figures 4, 5, and 6. Figure 4 shows the frequency of Haal's vocal imitations in the contingent imitation and contingent response conditions. Haal displayed an average of 4.3 occurrences of vocal imitation (range, 1-10) responses in the contingent imitation condition, and an average of 0.30 occurrences of vocal imitation (range, 0-1) responses in the contingent vocal response condition. Visual analysis of Figure 4 shows that Haal imitated more frequently in the vocal imitation condition than in the contingent vocal response condition.

Figure 4.

Haal's frequency of vocal imitation in the contingent vocal imitation and contingent vocal response conditions

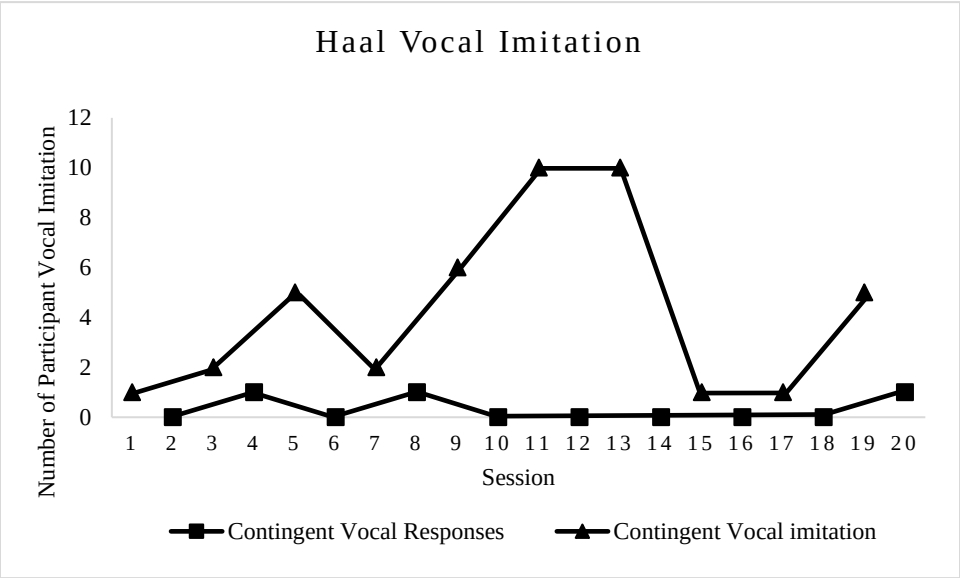


Figure 5 represents a visual analysis of Haal's spontaneous vocalization's throughout both the contingent vocal imitation and contingent vocal response phase. Haal displayed an average of 26.8 occurrences of spontaneous vocalization (range, 11-48) responses in the contingent vocal imitation phase, and an average of 19.8 spontaneous vocalizations (range, 2-38) in the contingent vocal response phase. Visual analysis of Figure 5 shows that throughout the implementation of both condition phases, both interventions resulted in a similar amount of Haal's spontaneous vocalizations.

Figure 5.

Haal's spontaneous vocal responses in the contingent vocal imitation and contingent vocal responses conditions.

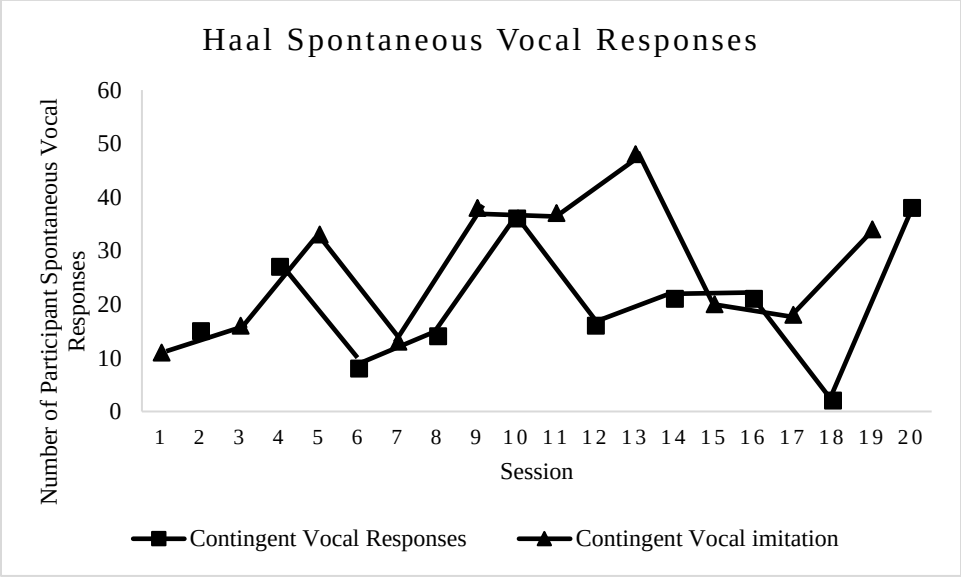
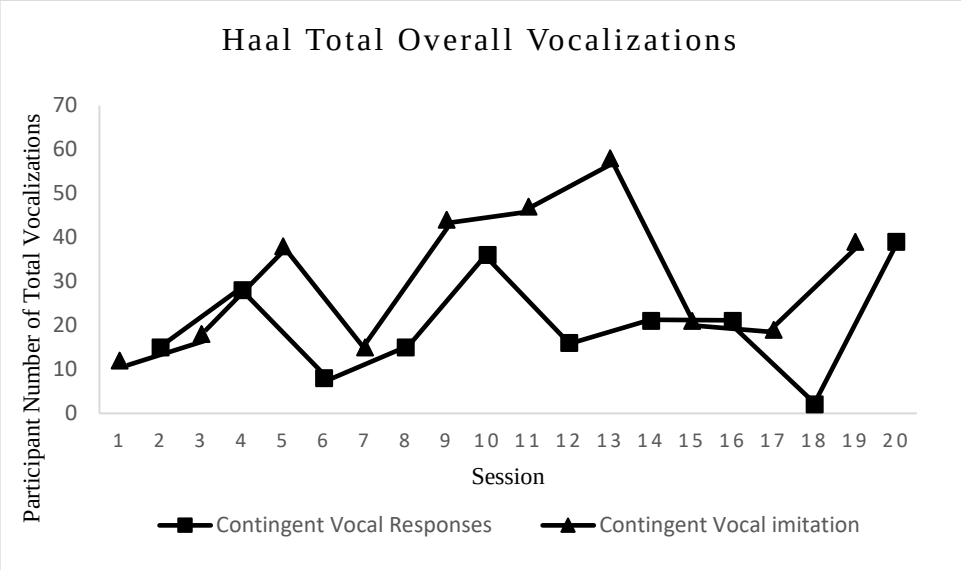


Figure 6 represents the frequency of Haal's overall vocalizations, including both the participant's vocal imitation and spontaneous vocalizations throughout both treatment phases. Haal displayed a total average of 38.9 overall vocalizations (range, 2-39) throughout the contingent vocal imitation phase, while displaying a total of 25.1 overall vocalizations (range, 12-58) throughout the contingent vocal response phase. Visual analysis of figure 6 shows that when both condition phases are compared, Haal engaged in a higher amount of overall vocalizations throughout the implementation of the contingent vocal imitation phase.

Figure 6.

Haal's overall vocalizations in the contingent vocal imitation and contingent vocal responses conditions


Haal Total Overall Vocalizations
Participant Number of Total Vocalizations
70
60
50
40
30
20
10
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Session
Contingent Vocal Responses
Contingent Vocal imitation

DISCUSSION

Between both participants, 16 to 20 sessions were implemented. For Jaka, a total of 16 sessions were conducted over 7 days utilizing alternating treatments between implementing contingent vocal responses and implementing contingent vocal imitation. Sessions were conducted during the participant's ABA therapeutic services. For Haal, a total of 20 sessions were conducted over 18 days. Sessions were scheduled based off the participant and their parent's availability. The participant's needs including lunch time, dinner time, and/or bathroom breaks were incorporated between sessions. Sometimes causing greater break periods between sessions. A minimum of two sessions were incorporated per day, with a maximum of four sessions. Each treatment phase was implemented for the same number of times per day. If contingent vocal responses had been implemented twice, then contingent vocal imitation was implemented for the same number of times throughout that day to prevent inconsistency.

Jaka's sessions one through four were implemented on the same day, towards the end of his ABA session. The first two sessions were implemented back-to-back, with only two mins of time lapse between both sessions. Session 3 and session 4 occurred after the participant had eaten his scheduled dinner. A total of 44 mins elapsed between session three and session four. The next four sessions occurred the next day. Sessions five and six occurred in the morning, with only 4 mins between the two sessions. The participant then took a break to eat his breakfast and go outside with his family for a total time of 99 minutes. Sessions seven and eight occurred back-to-back with only one minute of time elapse between the sessions. The next four sessions occurred after the participant's three-day weekend. Sessions nice and ten occurred back-to-back with only one minute of time lapse between the two sessions. Since the participant was receiving more than a 30-minute break between the first two sessions and last two sessions, session 11 occurred after

two hours. Session 12 then occurred with only one minute of time lapse from session 11. The last four sessions then occurred on the following day. Session 13 and session 1 4were implemented back-to-back with only a one-minute time lapse. Session 15 occurred 2 hours and 12 minutes after the previous scheduled session. Jaka's final session occurred 23 minutes after the previous session, due to the client's lunch break.

For the second participant, Haal, the first 6 sessions occurred in the afternoon towards the end of his ABA therapeutic services. Sessions 7 through 20 occurred in the morning between the first three hours of his ABA therapeutic services. There was a total of one min time elapse between session one and two. Session 3 and 4 occurred four days after the first two sessions, due to the weekend. A time elapse of one min occurred between sessions 3 and 4. Session 5 and 6 were conducted two days later. Between sessions 5 and 6, a total of one min elapsed between the two sessions. Sessions 7 and 8 occurred on the following day. Once again, there was a one min time elapse between these two sessions. Sessions 9 and 10 occurred after the weekend, two days after the previous session. Between sessions 9 and 10, there was a one min time elapse. Sessions 11 and 12 occurred on the following day. Between sessions 11 and 12, there was once again a one min time elapse between these sessions. Sessions 13 and 14 occurred the following day with one min time elapse between the two sessions. It was then the participant's lunch time. A total of 40 mins elapsed between session 14 and 15. Sessions 15 and 16 occurred on the same day as the previous two sessions. Only one min elapsed between these two sessions. Sessions 17 and 18 then occurred on the following day, with only one min of time elapse. Sessions 19 and 20 then occurred four days after the previous two sessions. Between sessions 19 and 20, there was only a one min time elapse between the two sessions.

The purpose of the study was to compare the effects of contingent vocal imitation versus contingent vocal responses on the vocalizations of two young children diagnosed with ASD. Specifically, the following research questions were addressed: 1) What are the relative effects of contingent vocal responses and contingent vocal imitation on vocal imitation of children with ASD? 2) What are the relative effects of contingent vocal responses and contingent vocal imitation on spontaneous vocal responses of children with ASD? 3) What are the relative effects of contingent vocal responses and contingent vocal imitation on overall vocal responses of children with ASD?

Research Question 1

This study found that vocal imitation in children diagnoses with ASD occurred at higher levels during the contingent vocal imitation condition compared to the contingent vocal response condition. Jaka averaged 10.5 vocal imitations during the contingent vocal imitation condition compared to just 0.3 vocal imitations during the contingent vocal response condition. This represents a higher rate of 1333.3% of Haal's vocal imitation during the contingent vocal imitation condition. These results show that the implementation of contingent vocal imitation produced higher levels of child vocal imitation than contingent responses, similar to the results of Ishizuka and Yamamoto (2016). They also found that contingent vocal imitation produced higher levels of child vocal imitation.

One possible reason why the contingent vocal imitation condition resulted in a higher amount of each participants' vocal imitations is that the vocalizations repeated by the adult were already in the child's verbal repertoire. Therefore, when the adult repeated these words back to the child, the child was more likely to imitate them. In contrast, during the contingent vocal response condition, the adult responded to the child with utterances that may not have been in the

child's verbal repertoire. For example, if the child said, "Ball," and the adult said "Nice job!", if the child had never before said "Nice job", they would be unlikely to imitate this phrase. Similarly, if the child lacked the ability to imitate two-word phrases, this would inhibit their ability to imitate an adult's two-word phrases in the contingent response condition. However, if the child said "Ball" and the adult said, "Ball", the child would be more likely to imitate the adult by repeating "Ball", as this word was already in their repertoire. Therefore, similar to Ishizuka and Yamamoto, these results suggest that contingent vocal imitation is a superior strategy for promoting child vocal imitation.

Research Question 2

This study also sought to evaluate the relative effects of contingent vocal responses and contingent vocal imitation on spontaneous vocal responses of children with ASD. Results showed that implementation of both treatments resulted in a similar outcome in spontaneous vocalizations. Jaka averaged 66.2 spontaneous vocalizations throughout implementation of contingent vocal imitation, compared to 64.2 spontaneous vocalizations throughout implementation of contingent vocal responses. This represents a higher frequency of only 3.11% spontaneous vocal responses in the contingent vocal imitation condition. Similarly, Haal's spontaneous vocalizations averaged 26.8 during contingent vocal imitation, in comparison to 19.8 during contingent vocal responses. Haal's spontaneous vocal responses were 35.3% higher during contingent vocal imitation.

It is not clear why the two conditions yielded more similar levels of spontaneous vocal responding compared to vocal imitation. Given that neither participant had substantial verbal repertoires prior to the study; it seems they were more readily able to imitate another person's vocalizations than to engage in spontaneous vocalizations. Still, the data suggest that while the

contingent vocal imitation condition did not produce higher levels of spontaneous vocal responding, it also did not inhibit spontaneous vocal responding since levels of spontaneous vocal responses were similar across both conditions.

Research Question 3

Finally, the third research question addressed the effects of contingent vocal responses and contingent vocal imitation on overall vocal responses of children with ASD. Similar to the results found in the study by Ishizuka and Yamamoto (2016), the participant's overall vocal responses occurred at a higher rate throughout the implementation of adult vocal imitation compared to the implementation of adult contingent vocal responses. Jaka displayed an average of 76.7 overall vocalizations throughout the contingent vocal imitation condition, in comparison to an average of 76.1 overall vocalizations in the contingent vocal responses condition. Jaka's total overall vocalizations occurred 0.82% higher throughout the contingent vocal imitation treatment phase. Haal displayed an average of 38.9 total overall vocalizations throughout the contingent vocal imitation condition, in comparison to an average of 25.1 total vocalizations throughout the contingent vocal response condition. Haal's total overall vocalizations occurred at a higher rate of 54.98% with contingent vocal imitation compared to contingent vocal responses. The results show that for one participant, Jaka, total overall vocalizations were similar throughout both treatment phases. However, for the second participant, Haal, the implementation of contingent vocal imitation of total overall vocalizations occurred at a higher amount. Given that total overall vocalizations were a combination of vocal imitations and spontaneous vocalizations, Haal's larger number of overall vocal responses is likely a function of his substantially higher levels of vocal imitation in the vocal imitation condition. Regardless, if the procedures are evaluated purely from the perspective of which produced the most overall

vocalizations, it appears that contingent imitation condition was superior for Haal, but more equivocal for Jaka.

Limitations and Future Research

There are several limitations to this study. This study was conducted within 20 to 35 days, with 16 sessions for Jaka and 20 sessions for Haal. Despite differences in vocal imitation observed between the two conditions, the participants' data were variable and there were small and inconsistent differences observed in overall vocalizations between the two conditions, though Haal's overall vocal responses were higher with contingent vocal imitation. If a greater number of sessions were run in each condition, this would have permitted more definitive conclusions about the relative effectiveness of each intervention. Therefore, increasing the number of sessions per participant is suggested for future research. Future research should also consider implementing sessions throughout the same time of day every day with a consistent amount of time elapse between sessions, and a consistent number of sessions implemented per day. Future researchers should consider incorporating a larger number of participants to increase the external validity of the results, also by incorporating a variety of child demographics including gender, ethnicity, and location. Finally, Haal was sick throughout the implementation of sessions 17 and 18 engaging in the following behaviors throughout both sessions: sneezing, coughing, wiping nose with fingers. This could have affected the participant's behavior, including the data on the dependent variables. Additionally, collecting data on the topography of the participant's vocal imitation is recommended for future research. This would enable researchers to gauge participants' levels of vocabulary development as well as their overall levels of vocal output.

Haal's overall vocal responses were higher with contingent vocal imitation. If a greater number of sessions were run in each condition, this would have permitted more definitive conclusions about the relative effectiveness of each intervention. Therefore, increasing the number of sessions per participant is suggested for future researchers. Additionally, future researchers should consider incorporating a larger number of participants to increase the external validity of the results, also by incorporating a variety of child demographics including gender, ethnicity, and location. Finally, Haal was sick throughout the implementation of sessions 17 and 18 engaging in the following behaviors throughout both sessions: sneezing, coughing, wiping nose with fingers. This could have affected the participant's behavior, including the data on the dependent variables.

Additionally, the study did not include a baseline condition. Since there was no baseline, there was no way to tell if implementation of either treatment condition increased participants vocal imitation, spontaneous vocal responses, and overall vocal responses relative to no intervention. Therefore, only limited conclusions about the relative effectiveness of either intervention can be drawn from the study. Future research should include baseline data prior to implementing the intervention phases to compare the participant's behavior prior to receiving treatment.

Finally, throughout both treatment phases, child non-verbal imitation was observed in response to the experimenter's non-verbal behaviors, including imitating adult motor responses, such as pointing to toy, shaking the toy, and other motor movement involving the toys in the study. However, non-verbal imitation was not measured. Previous research has shown that incorporating reciprocal imitation training (RIT) in children with ASD is effective in promoting a greater variety of behavior changes, such as improving social interaction and decreasing self-

stimulatory behaviors (Ingersoll et al., 2013). Therefore, future research should include recording data on other behaviors, including non-verbal imitation, to determine the relative effects of both conditions on these behaviors.

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APPENDICES

APPENDIX A. DATA SHEET FOR THE IMPLEMENTATION OF CONTINGENT VOCAL IMITATION

Participant behaviors to record using a frequency count:

1. Participant vocalizations: Participant spontaneous vocalizations includes any vocal sound the participant makes including vocal sounds, approximate words, and full words.

2. Participant vocal imitations (echoic): Any vocal imitation the participant makes within 5 seconds of the experimenter, this includes vocally imitating the experimenter including approximately imitating the vocal sounds, words, or approximate words the experimenter made.
   e.g. Experimenter: "Arrrr"→ Child: "Arrr"; (E): "cat"→ (C): "cah"; (E): "Look, toy"→ (C): "Loo"; (E): "Wow, nice bubbles"→ (C): "wow, bubbles"

Experimenter behaviors to record using a frequency count:

1. Experimenter vocal imitations (echoic): Any vocal imitation the experimenter makes within 5 seconds of the child, this includes vocally imitating the experimenter including approximately imitating the vocal sounds, words, or approximate words the experimenter made.

e.g. Child: "blue"→ Experimenter: "blue"; (C): "ca"→ (E): "ca"; (C): "A"→ (E): "A"

Participant Spontaneous Vocalizations w/out vocal imitation	**Participant Vocal Imitation**	**Experimenter Vocal Imitation**
Session #: *Session Date:* *Session Time:* *Notes:*		

Note. This figure shows the data collection sheet used per session.

APPENDIX B. DATA SHEET FOR THE IMPLEMENTATION OF CONTINGENT VOCAL RESPONSES

Participant behaviors to record using a frequency count:

1. Participant spontaneous vocalizations: Participant spontaneous vocalizations includes any vocal sound the participant makes including vocal sounds, approximate words, and full words.

2. Participant vocal imitations (echoic): Any vocal imitation the participant makes within 5 seconds of the experimenter, this includes vocally imitating the experimenter including approximately imitating the vocal sounds, words, or approximate words the experimenter made.
   e.g. Experimenter: "Arrrr"→ Child: "Arrr"; (E): "cat"→ (C): "cah"; (E): "Look, toy"→ (C): "Loo"; (E): "Wow, nice bubbles"→ (C): "wow, bubbles"

Experimenter behaviors to record using a frequency count:

1. Experimenter vocal responses: Any vocal response the experimenter makes within 5 seconds of the child. During this time the Experimenter will NOT vocally imitate the child.

e.g. Child: "blue"→ Experimenter: "that's a color"; (C): "yay"→ (E): "wow"; (C): ""→ (E): "blue"

Participant Spontaneous Vocalizations w/out vocal imitation	**Participant Vocal Imitation**	**Experimenter Vocal Responses**
Session #: *Session Date:* *Session Time:* *Notes:*		

Note. This figure shows the data collection sheet used per session.

APPENDIX C. ITEM CHECKLIST

Item checklist used per participant during the initial session.

Item Checklist:

Please make a list of the toys and activities used below. This is to be used only during the first sessions. After each session that occurs after that, you must check off to make sure these items are present.

Participant: _____

Items/activities used

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
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10. _____
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50. _____

APPENDIX D. FIDELITY CHECKLIST

Fidelity questionnaire incorporated throughout each session.

Fidelity Checklist:

1. Was the timer set to 10 minutes?

   Yes No

2. Were the same items from session one present?

   Yes No

3. Did the session occur for a total duration of 10 minutes?

   Yes No

4. Was data only taken during the 10-minute session?

   Yes No

5. Was the researcher the only one in the room?

   Yes No

   - If not, who else was in the room?

     _____

6. If someone else was present in the room, did they engage in vocalization?

   Yes No

7. If this treatment phase consisted of implementing contingent vocal responses, did the experimenter implement a vocal response each time the child engaged in vocalization?

   Yes No Not Applicable

8. If this treatment phase consisted of implementing contingent vocal imitation, did the experimenter vocally imitate each time the child engaged in vocalization?

   Yes No Not Applicable

9. Did the experimenter engage in any other vocalization besides the treatment during this phase?

   Yes No

10. Was IOA data taken during this session?

    Yes No