

Effects of Demand Complexity On Echolalia in Students with Autism

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ABSTRACT

Echolalia is a linguistic phenomenon common in individuals with Autism Spectrum Disorder. This study examined the relationship between demand complexity and immediate echolalia in 4 students with an autism diagnosis in a university-based academic setting. Mastered and novel antecedent verbal demands that required an intraverbal response were systematically alternated using a multielement design to test whether participants' immediate echolalia was socially mediated. Results showed that immediate echolalia was more likely to occur during complex novel intraverbal tasks than in any other condition. Implications for function-based treatment are discussed.

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TABLE OF CONTENTS

	PAGE
ABSTRACT	3
ACKNOWLEDGEMENTS	4
LIST OF FIGURES.....	5
I. INTRODUCTION	6
II. METHODS	21
Participants, Setting, and Data Collection	21
Procedure	23
III. RESULTS.....	25
IV. DISCUSSION	30
REFERENCES	34
APPENDICES	39

LIST OF FIGURES

Figure #1 “Percent of opportunity that Courtney engaged in immediate echolalia across all conditions”	pg. 26
Figure #2 “Percent of opportunity that Jasper engaged in immediate echolalia across all conditions”	pg. 27
Figure #3 “Percent of opportunity that Earl engaged in immediate echolalia across all conditions”	pg. 28
Figure #4 “Rate per minute that Earl engaged in vocal stereotypy across all conditions”	pg. 28
Figure #5 “Percent of opportunity that Katherine engaged in immediate echolalia across all sessions”	pg. 29
Figure #6 “Percent of opportunity that Katherine engaged with an “I don’t know” response across all sessions”	pg. 30

Introduction

Autism, or Autism Spectrum Disorder (ASD), is a spectrum of developmental disorders defined by deficits in social, linguistic, and behavioral domains. One of the universal impairments present amongst these core symptoms is in the pragmatic use of language. Regardless of where individuals with autism fall on the spectrum, each has a varying degree of pragmatic deficits, resulting in a lack of intuitive knowledge to use and understand language within social contexts (Walenski, Tager-Flusberg, & Ullman, 2006). Thus, even high functioning individuals with sophisticated linguistic ability have marked difficulty producing socially appropriate language. Language patterns in ASD have been characterized as being repetitive and stereotyped, excessively literal, and often containing immediate or delayed echolalia (lexically, prosodically, and syntactically faithful repetitions of antecedent utterances) (Walenski, et al., 2006).

Echolalia as “Language Play” in Regular Development

While echolalia and other forms of idiosyncratic language are highly characteristic of individuals with autism, it is also clear that they are present in younger, typically developing children. Studies that have investigated the communicative styles of children with normal language development have found forms of stereotyped language that seem at least similar to cases in autism. These forms of “language play” often involve children’s scripted dialogues, occurring by the ages of three to four years, where a child speaks aloud for multiple characters (Hale & Tager-Flusberg, 2005). Spoken language expressed as word play has been found to comprise more than twenty percent of total utterances in children younger

than age 5, and consists of various kinds of verbalized fantasy-play and nonsense words (Ely & McCabe, 1994). Previous studies of language play in kindergarten children have sought to categorize these nonsense utterances, many of which include echolalic and stereotyped components. Such categories include *sound play*, involving repetitive, rhythmic, and/or melodic phonation, and *original word play*, which involves repetition, imitation, neologisms, and alterations in prosody (Ely & McCabe, 1994). Most notably, it was found that the use of *traditional* language play involved scripted nursery rhymes and/or children's songs: children seem to repeatedly sing these songs to themselves, regardless of their contextual relevance to the current activity. While these categories seem similar to echolalia and stereotyped language produced by children with autism, there have been no efforts to examine how they relate to one another. It should also be noted that many of these types of utterances occur infrequently among typically developing children; they have been found to serve a non-communicative function, occurring predominantly in the absence of adults (Ely & McCabe, 1994; Wootton, 1999).

Although idiosyncratic language represents only a small element of typical children's developmental trajectory, the way in which these language characteristics are thought to function is of particular relevance to the study of language in autism. In their study of echolalia, Prizant and Duchan (1981) related autistic self-regulatory echoes to the "self-talk" that is common among typically developing children. They noted that this kind of personal dialogue and repetition is often used to enhance individuals' processing speed and ability: a person learning novel information, for example, might repeat aloud the components over and over in

order to facilitate retention and learning. However, conclusions in the Prizant and Duchan study were drawn from a sample that consisted of four children whose ages averaged to be approximately 6 years old. Consequently, these results are difficult to generalize to all children with autism, especially younger children.

Schuler (1979) noted the important way that verbal imitation and scripting aids in the learning process of typically developing children. She noted that echoing tends to develop simultaneously with the development of vocabulary, and tends to be prevalent in typical children until age two and a half. In an effort to help reduce the “cognitive load” that may be associated with early sentence production, Schuler suggested that these strategies are used by both children with regular language development and children with autism; in other words, echolalia requires a lower response effort than contextually appropriate responses. Even bedtime monologues show consistent similarities in the echolalia produced amongst children with varying language development. These “monologues” occur just before the child is about to fall asleep and consist of a playful repetition of words or phrases that were heard throughout the day. Schuler’s discussion of bedtime monologues suggests a relationship between stereotyped language in children with autism and developmentally appropriate language in typical children. She did not comment, however, on possible reasons why this language characteristic disappears in typical children and fails to do so in children with autism. Further, the literature on scripting in typical children has failed to characterize how stereotyped language changes as children develop.

Piaget (1962) theorized that much of childhood play manipulates skills that are still in the process of being acquired. While it is clear that language play represents only an intermediate milestone in typical language development, it has been hypothesized that language play may be useful as a tool to master the structure of language itself (Ely & McCabe, 1994). Despite the overall differences between the development in typical children and in children with autism, the functional perspective of idiosyncratic language gained from research with typical children may help to advance our understanding of how this type of language may also be functional for individuals with autism.

Echolalia in Autism vs. Non-Autistic Disorders

Despite being a frequently documented characteristic of language in autism, echolalia has also been documented in numerous other types of populations. Specifically, forms of echolalia and stereotyped language have been noted in cases of blindness, other language impairments, as well as in various forms of dementia and psychiatric disorders (Bodfish, Simons, Parker & Lewis, 2000; Fay, 1974; Hale & Tager-Flusberg, 2005; Schuler, 1979; Wilkinson, 1998). There has also been some debate in the literature regarding the significance of echolalia as a primary language characteristic in autism. Hale and Tager-Flusberg (2005) noted that echoing is not a universal trait shared by everyone on the autistic spectrum, suggesting that, despite being a significant clinical attribute, echolalia should not be considered a defining characteristic of the disorder. However, other reports indicate that the high frequency and prevalence of this type of language is unique to ASD (Wilkinson, 1998). In order to better understand the behavioral and linguistic characteristics

that are unique to autism, Bodfish, Simons, Parker and Lewis (2000) compared the repetitive behaviors of individuals with autism and mental retardation with individuals diagnosed with mental retardation alone. They concluded that “stereotypy” (a category that included echolalia) occurred more frequently in people with autism and mental retardation than in those with MR alone (91% and 80%, respectively). Their study further concluded that stereotypy was the most often observed repetitive behavior in autism, occurring more often than compulsions. However, it was unclear from their analysis what percentage of children actually had stereotyped language.

Schuler (1979) compared differences in the quality of echolalia among disorders in which it was most commonly observed. Many of the echoes present in disorders such as Schizophrenia, Latah-reaction, Tourette Syndrome, midbrain lesions, and aphasia varied widely in terms of communicative intent, as well as in the degree of similarity to antecedent utterances. Schuler’s findings suggested, however, that autistic echoes were among the most complex, noting many different types (i.e. altered prosody, immediate, delayed echolalia, etc.) occurring in varying contexts, perhaps evidence of some underlying adaptive function.

Other studies noted similarities in echolalic production between autism and childhood blindness, which appeared to be nearly identical. The term “autistic-like echolalia” became a commonly used description when characterizing the echoes of blind children (Fay, 1974). Fay hypothesized that the underlying cause for these similarities in both populations was based in their shared visual impairments; the perceptual impairments experienced by individuals with autism were equated to

the total absence of vision experienced by the blind. Fay commented that the inability for both populations to perceive sensory stimuli “precludes the meaning of the world around them.” In a later comparison of speech characteristics between the two populations, Pring (2005) noted their behavioral similarities but acknowledged that any similarities are not necessarily indicative of similar functions.

Early Theories of Autistic Echolalia

In his first accounts of autism, Leo Kanner (1946) noted that each of the eight children in his study were unable to convey meaning to others, despite their ability to “speak.” This spoken language that he referred to, which was corroborated by the reports of patients’ parents, was repetition of a host of previously memorized routines, including nursery rhymes, prayers, lists of animals, rosters of presidents, the alphabet (both forwards and backwards), and even lullabies in a foreign language. Kanner’s interpretation of this type of spoken language was that was maintained by sensory consequences or non-social reinforcement. Rather, these echoic utterances were categorized as adding little semantic or conversational value or as being a meaningless and distorted memory exercise.

Prior to the 1980’s, there was considerable disagreement as to the clinical significance of this language feature in autism. Most of the early literature on autistic echolalia referred to it as being meaningless repetition, following Kanner’s interpretation. Clinicians with a psychodynamic orientation often characterized “psychotic” echolalia as a means of discharging aggressive, hostile, or erotic drives that were previously repressed by the child (Fay, 1969). Others felt that echolalia

represented a child's urge to sustain rather than reject social contact (Fay, 1969; Schuler, 1979). Historically, language symptoms were considered to be secondary characteristics of the disorder, and were erroneously believed to disappear as the child matures. Since there was no conceptual agreement about echolalia as a symptom, little was done to attempt to treat it. There were some early efforts to eliminate echolalia from children's behavioral repertoire (Schuler, 1979); however it is unclear how affective these early interventions were at reducing echolalia.

Gradually, accounts of autistic echolalia became focused on its function and communicative intent. Several articles in the early 1980's recognized the prevalence of this language characteristic in autism and attempted to detail functional differences between immediate and delayed echolalia (Prizant & Duchan, 1981; Prizant & Rydell, 1984). Immediate echolalia was examined in a naturalistic setting (at the child's home and school) to create the most comfortable social situation possible for the children who were participating (Prizant & Duchan, 1981). The authors categorized two types of immediate echoes produced by the children: (1) *Turn-taking* echoes, which they posited reflected the child's awareness and need to maintain social interaction, and (2) *Rehearsal* echoes, which were said to serve a cognitive processing function similar to "thinking out loud." Delayed echolalia was observed in a more structured setting, perhaps due to the complexities involved in reliably coding it (Prizant & Rydell, 1984). The authors viewed delayed echolalia as being represented in utterances that are beyond the child's demonstrated level of complexity, instances of pronoun reversal (i.e. when the child uses the pronoun "you" in place of the grammatically correct "I"), or in utterances that were

recognized as being memorized routines by individuals familiar with the child's language style. The authors concluded that the communicative intention and functionality of delayed echolalia falls on a continuum: at one end, *non-interactive echolalia*, where utterances seemed unfocused and self-stimulatory, and at the other, *interactive echolalia*, where children use echoes to socially engage with the co-participant. These findings are consistent with conclusions formed from a case study published over a decade later (Wootton, 1999). Wootton used observation of delayed echoes from his 11-year old subject with autism to suggest that some echoes are being used strategically in order to communicate with others in systematic ways. Wootton also commented that echoes seemed to be based, at least in part, on social context. Specifically, the production of echoic utterances were noted to be maintained by social consequences. Again, the benefits of these studies, which investigate how echolalia and stereotyped language may be beneficial to children with autism, are limited because no environmental manipulations were made to formally assess the function of the behavior.

A later study which was focused on the linguistic constraints of language examined how adult antecedent utterances impact the frequency and type of echoic responses produced by children with autism (Rydell & Mirenda, 1994). These adult utterances were first categorized in terms of the type of response they required from the child. *High constraint utterances* referred to directives, wh- and yes/no questions, as well as other types of prompts and attention-seeking attempts. Conversely, *low constraint utterances* were reflective questions (e.g., "how are you today?"), praise, and more general situation-based comments. The adult

participants in the study were either the subjects' classroom teachers or their speech pathologists, and all were well acquainted with the children involved. The design of the study was observational in nature: data on echolalia were collected while observing children with autism in a free play setting. The authors found that echoes comprised 35% to 73% of the entire corpus of each of the seven male subjects. They found that 74% of immediate echoes (defined as echoes which consist of (1) segmental (i.e. consonants and/or vowels) and/or suprasegmental (i.e., tone and/or prosody) similarities to prior adult utterances and (2) either rigid or selective echoing (e.g., echoing either all or part of an antecedent utterance) of the speaker within 2 turns of the original utterance) occurred after adult high constraint utterances. Further, the authors found that 63% of delayed echoes (defined as echoes with language that the child could not generate himself, or language that was identified by the adult participant as being part of a previously memorized routine) followed adult low constraint utterances. These results led the authors to infer a relationship between the level of constraint in adult utterances and the type of echolalia produced by individuals with autism. Ultimately, the authors' suggestion that context plays a significant role in the production of autistic echolalia was significant in advancing the understanding of such a common linguistic trait found in individuals with the disorder. Prior to this study, there was little consideration as to what factors significantly contributed to children's production of echolalia.

The current literature suggests that echolalia and other forms of vocal stereotypy can serve as linguistic tools used by individuals who are first acquiring

language (Ely & McCabe, 1994; Prizant & Duchan, 1981; Rydell & Mirenda, 1994). Although the presence of these characteristics has been noted in numerous clinical populations, research suggests that there may be a higher frequency of echolalia and stereotyped language present among people with autism (Wilkinson, 1998). Furthermore, echolalia has been noted to increase with the presentation of novel verbal stimuli, suggesting that echoic responding may be higher in social environments (Carr et al., 1975; Schreibman & Carr, 1978). Additional research has focused on environmental triggers for the production of these types of language, suggesting that they may serve some social purpose for children with autism (Rydell & Mirenda, 1994).

Despite the overall agreement in the literature that echolalia is a common linguistic tool for individuals with autism, there is has been very little scientific investigation of how to properly assess it. In many of the studies that have attempted to assess echolalia (e.g., Rydell & Mirenda, 1994), the authors did not systematically manipulate participants' environments to empirically determine the function of the behavior.

Systematic Environmental Manipulation

In some of his early work on some hypotheses regarding self-injury, Carr (1977) detailed the potential motivation behind engaging in this type of behavior. He postulated that a given individual might be likely to engage for a variety of different reasons. First, the behavior may be maintained by positive social reinforcement: that is, self-injury could typically be followed by a preferred given consequence (i.e., extra attention or access to preferred items) which then increases

the probability of that behavior occurring in the future. Second, self-injury may be maintained by the termination of an aversive stimulus (negative reinforcement): in other words, the behavior might typically be followed by the removal of a demand, which can also serve to increase the likelihood that it will happen again in the future. Third, self-injury may be maintained as a means of providing sensory stimulation to the individual (automatic reinforcement): that is, the behavior may produce certain physiological consequences that either feel good to the individual or serve to reduce pain in some way. Carr's hypotheses about the motivation for engaging in self-injury helped support the idea that certain types of behavior may be more likely to occur based on factors in the environment. Carr then went on to suggest that treatment for challenging behaviors should be based on the individual's motivation to engage in them, rather than based on the topography of the behavior itself.

In a later study, Iwata and colleagues (1982) described a methodology to formally assess functional relationships between a given behavior and specific environmental events. The authors repeatedly exposed participants with developmental disabilities to a series of analogue conditions, all of which served to identify the function of self-injury. The conditions of the functional analysis were unstructured play, social disapproval, academic demands, and alone. Unstructured play sessions served as the control (comparison) condition in the analysis: participants received access to preferred items and preferred attention for the duration of the condition and no demands were presented. In the social disapproval condition, attention was withheld (the therapist pretended to read a magazine) and

participants received a reprimand (e.g., “don’t hurt yourself”) paired with brief physical contact contingent on self-injury. The purpose of this condition was to assess if self-injury was reinforced (occurred at a higher rate) by access to attention. In the academic demands condition, participants were presented with educational tasks (e.g., puzzles) and breaks from the task were provided contingent upon self-injury. The purpose of this condition was to assess if self-injury was reinforced by escape from demands. In the alone condition, participants were placed in a room without sources of external stimulation and no social consequences were provided contingent upon self-injury. The purpose of this condition was to assess if self-injury occurred in the absence of social consequences. Participants were exposed to each of the conditions in a design that used a multi-element manipulation. The authors found that higher levels of self-injury were consistently associated with a specific stimulus condition, suggesting that participants’ self-injurious behaviors were evoked and/or maintained by features in the environment. The use of functional analyses has since become a widely used procedure to assess the environmental factors that evoke or maintain behavior.

Following that seminal article, Carr and Durand (1985) presented an alternative method to assess specific situations, which may evoke challenging behavior. More specifically, they altered antecedent events only and compared rates of challenging behavior across easy and difficult demands as well as varying levels of adult attention (e.g., attention every 10s vs. attention every 30s). Results showed that low levels of adult attention and high levels of task difficulty were the most likely to produce challenging behavior. The authors ultimately found that

rates of target behavior varied significantly depending on the antecedent condition used. This study extended previous findings that evaluated environmental determinants of challenging behavior by showing that variations in demand difficulty and attention levels may have differential effects on rates of target behavior.

Assessment of Socially Mediated Vocal Stereotypy

The functional properties of vocal stereotypy, which may include echolalia, are best ascertained through use of functional analysis methodology (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), where potentially controlling environmental antecedents and consequences are systematically manipulated. Much of the behavioral research literature suggests that stereotypic behavior common among individuals with autism is maintained by the sensory consequences that occur as a result in engaging in the behavior. However, there are considerably fewer investigations that have focused specifically on the assessment of vocal stereotypy (Ahearn, Clark, MacDonald, & Chung, 2007). In their study on vocal stereotypy, Ahearn and colleagues conducted functional analyses in order to identify the function of participants' vocal stereotypy. The authors concluded, based on the results of the functional analysis, that their subjects' vocal stereotypy was automatically maintained (i.e., maintained by the sensory consequences of the behavior). Such conclusions are not uncommon: a great deal of the literature on assessment and treatment of vocal stereotypy suggest that the behavior is largely maintained by automatic reinforcement (e.g., Taylor, Hoch, & Weissman, 2005; Rapp & Vollmer, 2005; Wilke et al., 2011). To date, there continues to be a limited number

of studies in the literature about the potential functions of vocal stereotypy. In addition, there are only a handful of studies that investigate the social contingencies that may effect individuals' production of vocal stereotypy.

However, there been some attention in the behavioral literature to the possibility that stereotypy may be maintained social as well as sensory functions (Cunningham & Schreibman, 2008). Durand and Carr (1987) conducted a study to investigate the social functions of stereotypic behavior, specifically repetitive motor movement. The authors used three experimental conditions: baseline, decreased attention, and increased task difficulty. They ultimately found that stereotypic behaviors increased in the presence of difficult task demands and contingent removal of aversive stimuli. Although their particular study was examining how social contingencies affect motor stereotypic behavior, a similar methodology could be used to analyze the social functions that maintain vocal stereotypy.

Rehfeldt & Chambers (2003) conducted a functional analysis of non-contextual, perseverative speech in an individual with autism and determined this type of speech was maintained by social attention. Results of this study suggest that other forms of non-contextual language, such as echolalia, may be maintained, at least in part, by social consequences. Another study (Mace & Lalli, 1991) used functional analysis methodology to conclude that bizarre, or maladaptive, vocalizations in an individual were also maintained by attention.

Although most research has shown that stereotypical behavior is automatically reinforced, some studies have shown stereotypy to have multiple functions (Kennedy, Meyer, Knowles & Shukla, 2000). In their study, the authors

were able to demonstrate that stereotypical behaviors were multiply determined by a range of behavioral functions. While the target behaviors in this study were motor rather than vocal stereotypy, the results indicate the need to conduct assessments into the function of all forms of stereotypy, rather than assume that stereotypy is maintained purely by sensory consequences.

Despite the acceptance of functional analysis methodology as the gold standard in assessment and treatment of challenging behavior, there are virtually no studies that have assessed the function of echolalia. There have, however, been several articles published on the successful behavioral treatment of echolalia. One such study taught an “I don’t know” response to individuals who engaged in echolalia (Schreibman & Carr, 1978), however, the authors did not conduct a formal assessment of the phenomena. Authors simply taught participants to engage in the appropriate “I don’t know” response to a small set of previously echoed “what,” “how,” and “who” questions using a multiple baseline design. In a separate study, authors sought to reduce subjects’ echolalic responses by teaching them to remain quiet before, during, and briefly after the presentation of demand questions (McMorrow, Foxx, Faw, & Bittle, 1987). Although the results of the study suggested that the procedures used were effective in reducing subjects’ rates of echolalia, the authors did not conduct any formal functional assessment of the target behavior. Research that systematically investigates how environmental variables affect the production of echolalia would be an important step in understanding the phenomena itself. One variable that should be evaluated is the complexity of antecedent utterances. The purpose of the present investigation is to expand on

previous research on the functional assessment of echolalia in individuals with autism. Based on previous literature, it is hypothesized that complex vocal tasks, or novel vocal demands containing multiple words, would be more likely to produce echolalia than more simple mastered vocal tasks.

Method

Participants, Setting, and Data Collection

The participants in this study were 4 students at a university-based center for developmental disabilities who were the first students identified by instructional staff as engaging in echolalia during the school day: Jasper (age 13 years, 8 months), Katherine (age 16 years, 8 months), Courtney (age 13 years, 11 months), and Earl (age 14 years, 0 months). Sessions were conducted at the students' school in a small research room; the 7'x 8' room contained a small desk, a chair for the student, and a chair for the classroom teacher. Sessions were approximately 15 minutes in duration, and two to three sessions were conducted per day.

Observers included the principal investigator and graduate students who had been trained in behavioral observation. Observers used laptop computers that recorded real-time data on frequency of immediate echolalia and frequency of teacher demands. *Immediate Echolalia* was operationally defined as each instance where a student engaged in lexically, prosodically, and/or syntactically faithful repetitions (Walenski et al., 2006) that occurred within 3-5 utterances after the antecedent utterances from the staff member. For example, if the staff member's antecedent utterances were singing the first 4 words of the song "The Itsy Bitsy Spider," the following student responses would be counted as immediate echolalia:

1) Exact replication of the words and intonation of the first four words of the song “The Itsy Bitsy Spider” immediately following the adult’s last utterance, 2) Direct repetition of the adult’s intonation (or prosody) using nonsense words or word-approximations immediately following the adult’s last utterance, and 3) a word-for-word direct repetition of the prior utterances with the absence of a prosodic match (i.e. repeating the words but not singing the song) immediately following the adult’s last utterance. Data were also collected on appropriate requests and vocal stereotypy for relevant students. *Vocal Stereotypy* was operationally defined as any non-contextual verbal utterance (e.g., screams, whines, humming, etc.). To calculate interobserver agreement, each session was divided into 10-s partial intervals. Interobserver agreement was calculated for the frequency of echolalia in 30% of the assessment sessions. In addition, agreements on the nonoccurrence of behavior were counted as 100% agreement. Mean agreement of immediate echolalia during the assessment sessions was 97.8% (range 86.6% - 100%). IOA on students’ vocal stereotypy, appropriate requests, and teachers’ antecedent demands were also calculated using the same 30% of assessment sessions (IOA was 87.9%, range 46%-100%; 100%; and 89.7 %, range 57.7% - 100%, respectively).

Treatment integrity was assessed in 30% of assessment sessions, and included a representative sample of each participant and type of condition. Graduate students independently coded videotaped sessions of the protocol for the following 3 variables in each trial: 1) Did the teachers capture students’ attention prior to delivering the intraverbal demand, 2) Did the teachers follow the protocol and deliver the correct demand, and 3) Did the teachers correctly provide no

consequence following the delivery of the intraverbal demand. If the coders answered yes for each of the three variables in a trial, that trial was considered to have been administered with 100% integrity. The total number of trials with 100% integrity was summed to calculate the total % integrity for each condition. Mean treatment integrity for 30% of sessions (25 conditions) was calculated to be 94% (range 70% - 100%).

Procedure

Pre-Assessment. Once the participants were identified, classroom staff were instructed to complete a pre-assessment data form (see Appendix A). This form consisted of 2 “mastered” and 2 “novel” sets of 15 pre-selected questions that would require an intraverbal response from the student. For the “mastered set” of questions, staff were asked to indicate whether their identified student could answer each question with at least 80% accuracy. If they were unsure about whether a student could reliably answer a question correctly, they were asked to probe the questions throughout the day. For the “novel” set of questions, staff were asked to indicate whether, to the best of their knowledge, their identified student had any prior exposure to each question.

Assessment Design and Conditions. Demands that require an intraverbal response were delivered by student’ classroom teacher, and were alternated in a multielement design between novel and mastered trials. In addition, both trials consisted of short utterance demands and long utterance demands, creating 4 separate demand conditions: *Mastered Skill-Short Utterance* (Mastered Short) - short utterance demands were defined as intraverbal demands consisting of no more than 4 words. (e.g., “What’s your name?”); *Mastered Skills – Long Utterance*

(Mastered Long) – long utterance demands were defined as intraverbal demands consisting of 5 or more words (e.g., “Who do you call when you are sick?”); *Novel Skills – Short Utterance* (Novel Short) – were short intraverbal demands (less than 4 words) identified by staff as being novel to their student (e.g., “Where is Kazakhstan?”); and *Novel Skills – Long Utterance* (Novel-Long) – were defined as long intraverbal demands (5 words or greater) identified by staff as being novel to their student (e.g., “Where do you buy discount sneakers?”). In addition, a control condition was included as a means of comparison and to test for an automatic function. During this condition, no demands were in place and the student was allowed free access preferred items. Staff were given a list of neutral statements, consisting of simple declarative short and long utterance phrases (e.g., “The wall is blue”; “June is the best month of the year.”). In addition, staff were instructed not to provide eye contact when delivering the neutral statements; the rationale for avoiding eye contact in the control condition was to minimize the expectation that students were required to respond to the neutral statements.

Each session consisted of 10 trials in each condition. All intraverbal questions and neutral control statements were provided to the staff member in written form during the assessment (see Appendix B). Mastered trials (both short and long utterance) consisted of intraverbal tasks identified in the pre-assessment. Novel trials (both short and long utterance) consisted of 10 novel intraverbal tasks. The total length of each session varied depending on the attention of the participant, but sessions lasted no more than 2 minutes. The student’s teacher delivered each demand once the student was attending and eye contact had been established

between the staff member and student. After delivering each intraverbal question, the staff member was instructed to wait 10 seconds before delivering the next question. Staff was asked to remove eye contact after delivering each question, and were not required to record their student's response. Each 10-second latency between questions was verified via a timer. Regardless of the student's response, the staff member was instructed to wait 10 seconds before presenting the next demand. Staff members were instructed to ignore incorrect responses and removed eye contact contingent upon a response from their student. The principal investigator was present throughout all session to ensure consistency across sessions and participants.

Results

Courtney's rates of immediate echolalia are represented as percent of opportunity in Figure 1. Immediate echolalia was observed in both the Novel Short (mean = 4%) and Novel Long (mean = 10%) conditions. Results of the assessment suggest that she was only likely to engage in immediate echolalia during the conditions with the highest levels of demand complexity. In each novel condition, when not engaging in immediate echolalia, she often attempted answer each question by providing scripted responses that did not meet criteria for immediate echolalia (e.g., when asked "What is the capital of North Dakota?" she consistently responded "United States of America"). In addition, Courtney occasionally engaged in contextually relevant though inaccurate responses (e.g., when asked, "what is your favorite brand of toothpaste?" she consistently responded, "brush your teeth").

It is likely that she attended to familiar words (e.g. toothpaste) in an otherwise unfamiliar intraverbal prompt and attempted to provide an appropriate response.

Courtney Immediate Echolalia

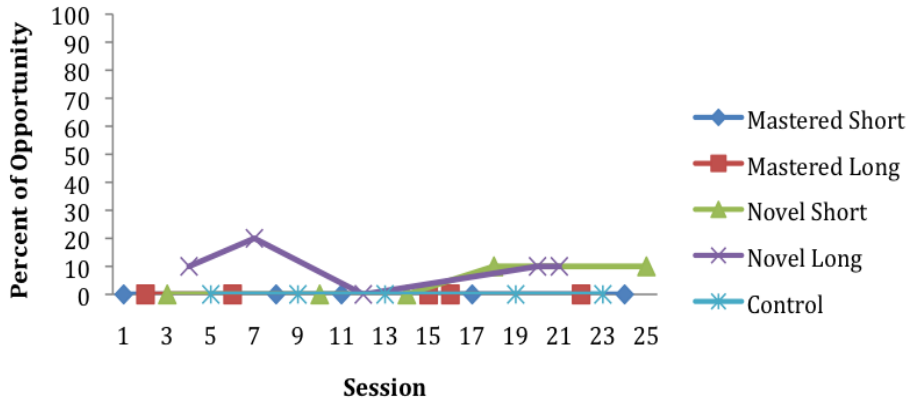


Figure 1. Percent of opportunity that Courtney engaged in immediate echolalia across all conditions.

Results of Jasper’s responding during the echolalia assessment are depicted in Figure 2. Immediate echolalia was observed in both the Novel Short (mean = 46.6%) and Novel Long (mean = 50%) conditions. Jasper did not engage in echolalia during any of Mastered conditions. During one control session (session 9), he did engage in a single instance of immediate echolalia. The neutral antecedent utterance that preceded this instance was “I am hungry,” to which he responded “I am hungry.” During the control condition, Jasper had free access to preferred edibles for the duration of the session; after the session, staff reported that he had a prior history of being prompted to tact the private event that he is hungry before receiving edibles. Furthermore, the staff member who delivered the neutral statements during that session inadvertently made eye contact with Jasper at several points during the session, representing an error in treatment integrity. It is

therefore possible to explain the outlier in the control session as being the product of both previously mentioned factors.

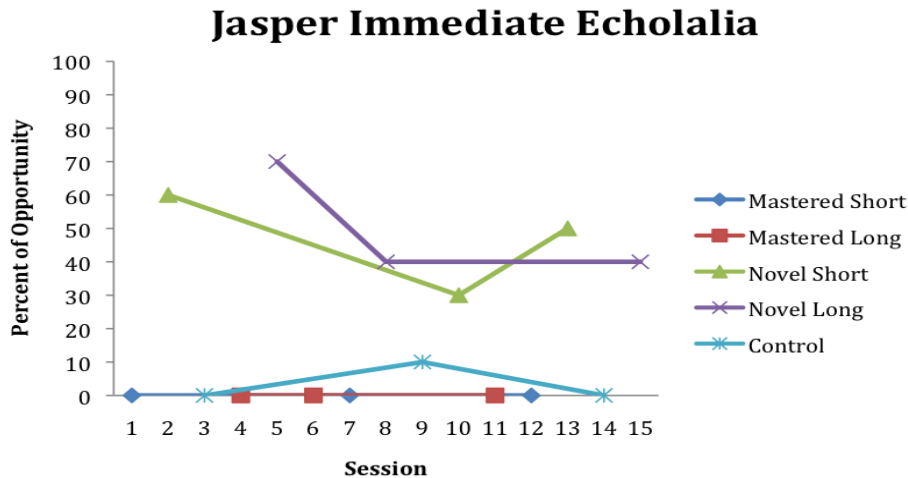


Figure 2. Percent of opportunity that Jasper engaged in immediate echolalia across all conditions

Figure 3 depicts the results of the echolalia assessment with Earl. Immediate echolalia was observed in all 5 conditions, and occurred most frequently in the Novel Short (mean = 76.7%) and Novel Long (mean = 60%) conditions. The data in Figure 3 suggest that Earl’s echolalia was evoked most often in the Novel-Short antecedent utterances, given that the majority of his responses contained immediate echolalia in that condition. However, Figure 4 depicts the responses per minute of Earl’s vocal stereotypy, which consisted of non-contextual words or phrases. Earl engaged in vocal stereotypy at an average rate of 6.11 times per minute in the Novel Long condition, as compared to the Novel Short condition (which averaged 2.6 times per minute). It is possible that the difference in Earl’s responding reflect the increase in demand complexity: he attempted to provide an appropriate response by engaging in immediate echolalia for short novel questions, however when novel

questions became longer, the response effort to attempt to provide an appropriate response became too high and he shifted his responding to vocal stereotypy.

Earl Immediate Echolalia

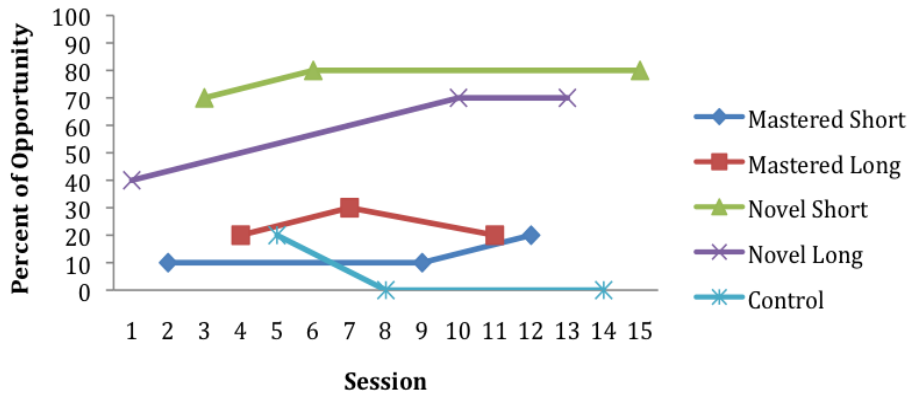


Figure 3. Percent of opportunity that Earl engaged in immediate echolalia across all conditions.

Earl Vocal Stereotypy

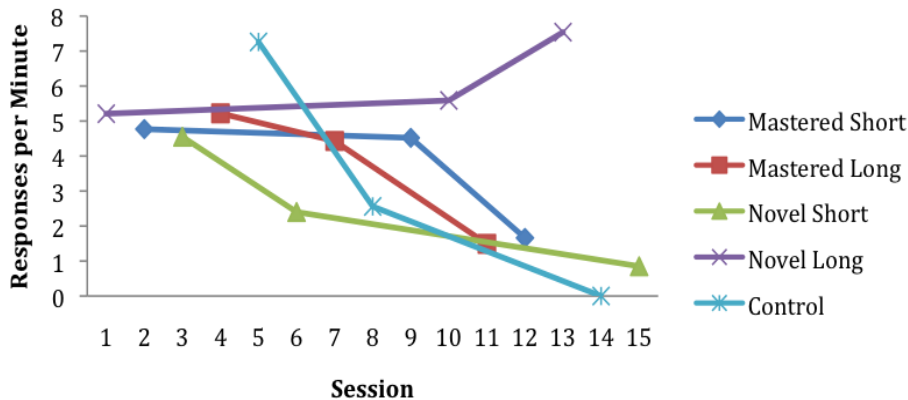


Figure 4. Responses per minute that Earl engaged in vocal stereotypy across all conditions.

Figure 5 depicts the results of the echolalia assessment with Katherine.

Immediate echolalia was observed in all 5 conditions, and occurred most frequently in the Novel Short (mean = 27.5%) and Novel Long (mean = 32.5%) conditions. Similar to Jason, Katherine engaged in a single instance of immediate echolalia following the “I am hungry” neutral statement in each of the control conditions.

Katherine’s responding during this condition can similarly be explained by a history of prompting to tact private events in the presence of edibles. Decreasing trends in immediate echolalia in both the Novel Short and Novel Long conditions can be explained by the data in Figure 6. Beginning in session 7, Katherine began to respond to novel questions with an “I don’t know” response. Classroom staff later indicated that in the past they had taught her to functionally provide that response when presented with ambiguous stimuli. Although the “I don’t know” response did appear to functionally replace immediate echolalia for the majority of each session, instances of immediate echolalia continued to be observed at low levels in the Novel Long and Novel Short conditions.

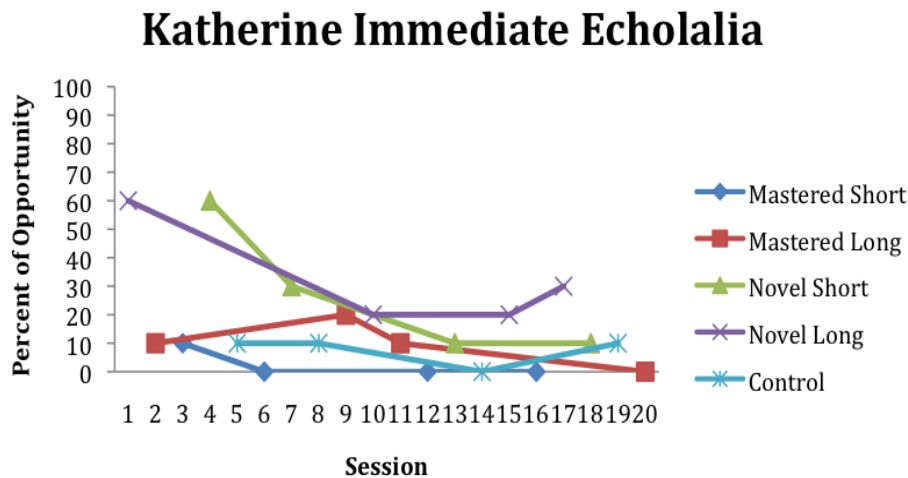


Figure 5. Percent of opportunity that Katherine engaged in immediate echolalia across all sessions.

Katherine "I Don't Know" Responses

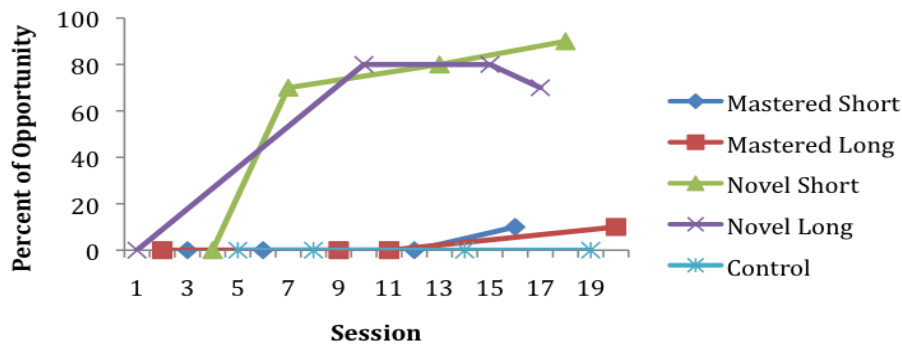


Figure 6. Percent of opportunity that Katherine engaged with an "I don't know" response across all sessions.

Discussion

This study examined whether increases in demand complexity produced corresponding increases in immediate echolalia in students with autism. It was hypothesized that increased demand complexity would produce corresponding increases in participants' immediate echolalia if their echolalia was, at least in part, socially mediated. The results of these analyses suggest that participants' immediate echolalia was maintained by social contingencies. Katherine, Jasper, and Courtney engaged in the highest percentage of immediate echolalia during the Novel Long condition, which was hypothesized to be the condition with the highest amount of demand complexity. Although Earl engaged in higher rates of immediate echolalia in the Novel Short condition than in Novel Long condition, his average rate of vocal stereotypy was nearly 3 times higher in the Novel Long than the Novel Short condition, suggesting that vocal stereotypy may have replaced immediate echolalia when demand complexity was highest.

While some studies have examined the possibility that stereotypy may be maintained by social functions (Cunningham & Schreibman, 2008; Durand & Carr, 1987; Mace & Lalli, 1991) there have been no formal assessments to date of the behavioral function of echolalia. By systematically evaluating the effects of demand complexity on immediate echolalia, this study sought to add to the literature by determining whether echolalia is differentially evoked by environmental variables. Formal assessment of the function of target behaviors has been shown to lead to effective interventions. In the case of immediate echolalia, evidence of a socially mediated function could lead to interventions designed to teach more functionally appropriate responses, such as an “I don’t know” response (Schreibman & Carr, 1978). Evidence for the effectiveness of such an intervention was demonstrated in this study by Katherine’s responding during the novel conditions. Although she continued to engage in immediate echolalia following novel demands throughout the assessment, overall rates of immediate echolalia reduced from 60% to 30% in the Novel Long conditions and from 60% to 10% in the Novel Short conditions. It can be argued that such reductions represent a clinically meaningful improvement in functional responding.

One of the limitations of this study is that we only assessed the effects of demand complexity on immediate echolalia and chose to exclude delayed echolalia. Delayed echolalia, often referred to as “scripting,” is a commonly reported verbal phenomenon in individuals with autism (Prizant & Rydell, 1984). Delayed echolalia can be a challenging behavior to formally assess because it requires an extensive knowledge of individuals’ prior exposure to verbal stimuli across multiple contexts.

While acquiring the information necessary to conduct a formal assessment of delayed echolalia was beyond the scope of this study, future studies could systematically evaluate how demand complexity affects rates of delayed echolalia.

Another limitation of the study was that consequences of echolalia were not manipulated: only stimuli that evoke the behavior and not the maintaining variables of the behavior were identified. Thus, while it is possible to hypothesize how consequences may have maintained participants' echolalia (e.g., echolalia may have provided a form of escape, in that the teacher moved on to the next question), it was not experimentally tested in this protocol. Future studies could examine how the manipulation of consequences could affect participants' rates of echolalia (i.e. whether repeating the question contingent upon echolalia has any effect on the rates of the behavior).

The generalization of this study is also limited because of the environment in which the data for this study were conducted. Sessions were held in a quiet research room free from outside auditory stimuli or other potential distractors. While these conditions were ideal for avoiding potentially confounding variables, the research setting did not approximate students' typical learning environment. Future research should explore whether the findings from the current study generalize to other settings.

Despite several limitations, the results of this study are promising and contribute to the relatively sparse literature on the functional assessment of echolalia. Echolalia can be a socially stigmatizing verbal behavior and can further be disruptive to academic learning in educational settings. Information about the

behavioral function of echolalia can lead to the development of effective interventions, which can meaningfully improve individuals' quality of life.

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Appendix A

Effects of Demand Complexity on Echolalia

Pre-Assessment Data Sheet

Version 5.28

Please Indicate which of the following verbal questions are currently in your student's repertoire (i.e. does your student have a history with any of the following questions?)

Mastered - Short Utterance (5 words or less)

	YES (80% accuracy)	NO (<80%)	N/A
<i>What's your name?</i>			
<i>Where do you live?</i>			
<i>What does a dog say?</i>			
<i>What's your Dad's name?</i>			
<i>What's your Mom's name?</i>			
<i>What does a cat say?</i>			
<i>What do you eat?</i>			
<i>What do you drink?</i>			
<i>What does a cow say?</i>			
<i>What's your teacher's name?</i>			
<i>Where do you sleep?</i>			
<i>Where do you swim?</i>			
<i>What do you write with?</i>			
<i>What do you play with?</i>			
<i>What color is the sky?</i>			

Additional Mastered Questions (≤ 5 words):

- 1.
- 2.
- 3.
- 4.
- 5.

Mastered - Long Utterance (6 words or more)

	YES (80% accuracy)	NO (<80%)	N/A
<i>Where do you go to school?</i>			
<i>What do you find in the bathroom?</i>			
<i>What do you find in the bedroom?</i>			
<i>Who do you call when you are sick?</i>			
<i>Who do you call when you need help?</i>			

<i>What do you find at school?</i>			
<i>What do you like to eat?</i>			
<i>What do you like to drink?</i>			
<i>What do you do at school?</i>			
<i>What do you wear on your feet?</i>			
<i>What do you wear on your hands?</i>			
<i>What do you wear on your head?</i>			
<i>What do you wear when it is cold outside?</i>			
<i>What do you like to play with?</i>			
<i>What do you buy at the Supermarket?</i>			

Additional Mastered Questions (≥ 6 words):

- 1.
- 2.
- 3.
- 4.
- 5.

Comments regarding student's echolalia:

Please indicate which of the following verbal questions are NOT in your student's repertoire? (i.e. which of these questions are brand new to your student?)

Novel – Short Utterance (5 or fewer words)

	YES	NO
<i>What's a cypress?</i>		
<i>Where is Argentina?</i>		
<i>What's a fedora?</i>		
<i>Who is Barack Obama?</i>		
<i>Where do ostriches live?</i>		
<i>What is hummus?</i>		
<i>What are cleats?</i>		
<i>Where is Kazakhstan?</i>		
<i>What is disinfectant?</i>		
<i>Who is Hillary Clinton?</i>		
<i>What is a Mandolin?</i>		
<i>What is a coffee grinder?</i>		
<i>What is a steamer?</i>		
<i>What is the internet?</i>		
<i>What's the Bill of Rights?</i>		

Additional Novel Questions (≤ 5 words):

- 1.
- 2.
- 3.
- 4.
- 5.

Novel – Long Utterance (6 or more words)

	YES	NO
<i>How many pennies are there in a dollar?</i>		
<i>Who was the first president of the United States?</i>		
<i>How many decades are there in a century?</i>		
<i>What's the difference between a desk and a chair?</i>		
<i>What's your favorite brand of orange juice?</i>		
<i>What's the difference between McDonalds and Wendys?</i>		
<i>What do you do at a bank?</i>		

<i>What's the capital of North Dakota?</i>		
<i>What do you do when the power goes out?</i>		
<i>Where can you find discount sneakers?</i>		
<i>What's your favorite brand of toothpaste?</i>		
<i>What do you use to cut your nails?</i>		
<i>What do you do when you are lost?</i>		
<i>What language do they speak in France?</i>		
<i>What do you do when you are frustrated?</i>		

Additional Novel Questions (≥ 5 words):

- 1.
- 2.
- 3.
- 4.
- 5.

Comments regarding student's echolalia:

Effects of Demand Complexity on Echolalia
Staff Antecedent Utterance Sheet

Version 6.2

Student: _____

Mastered Phrase – Short Utterance

1. What's your name?
2. What does a dog say?
3. What does a cat say?
4. What do you drink?
5. What do you eat?
6. Where do you sleep?
7. What is your Dad's name?
8. What do you write with?
9. What do you play with?
10. Where do you live?

Mastered Phrase – Long Utterance

1. What do you like to eat?
2. What do you like to drink?
3. What do you write with in school?
4. What sound does a dog make?
5. What sound does a cat make?
6. What sound does a cow make?
7. What do you play with at home?
8. What do you wear on your feet?
9. What do you find at school?

10. What do you like to watch?

Novel Phrase – Short Utterance

1. What's a cypress?
2. Where is Argentina?
3. What's a fedora?
4. Who is Barack Obama?
5. Where do ostriches live?
6. What is hummus?
7. Where is Kazakhstan?
8. What is Mandolin?
9. What is the internet?
10. What is a coffee grinder?

Novel Phrase- Long Utterance

1. How many pennies are there in a dollar?
2. Who was the first president of the United States?
3. How many decades are there in a century?
4. What's the difference between a desk and a chair?
5. What's the capital of North Dakota?
6. What do you do when the power goes out?
7. Where can you find discount sneakers?
8. What's your favorite brand of toothpaste?
9. What do you do when you are lost?
10. What language do they speak in France?

Control Condition Phrases

1. The wall is yellow
2. The carpet is soft
3. I am hungry
4. Today is Monday
5. I had a nice weekend
6. June is a nice month
7. The sun is shining
8. This room is quiet
9. Summer is my favorite season
10. Jellybeans are round