

# Effects of Echoic-to-Tact Prompt on Reducing Palilalia in a Child with Autism Spectrum Disorder

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《 Abstract 》

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The present study examined whether providing echoic prompt to label items or activities contingent on emission of palilalia was effective in reducing the vocal stereotypy and increasing tacts and mands as appropriate vocal responses in a 9-year old male with autism. A reversal design was used. During the baseline, the palilalia was ignored and mands and tacts were reinforced. During the treatment condition, the experimenter presented echoic prompts to tact actions and objects following the emission of palilalia. The results showed that the treatment didn't produced a significant decrease in the levels of occurrence of palilalia. However, the frequencies of tacts and mands were increased during the treatment conditions.

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Key Words : Palilalia, vocal stereotypy, automatic reinforcement

## I . Introduction

Vocal stereotypy including palilalia is prevalent among individuals with autism spectrum disorders (ASD) (Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011; MacDonald et al., 2007; Lanovaz & Sladeczek, 2012). Mayes and Calhoun

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(2011) reported that more than 85% of children and adolescents with autism showed atypical, repetitive vocalizations or speech and further suggested that those behavioral patterns might persist in adulthood. Vocal stereotypy including palilalia is non-contextual and repetitive vocalization which may or may not serve explicit communicative functions (Greer & Ross, 2008). Palilalia is delayed repetition of words or phrases (Skinner, 1957). Vocal stereotypy may interfere appropriate social interactions and thus impedes learning and social inclusion in individuals with ASD (Lanovaz & Sladeczek, 2012; Martinez & Betz, 2013; Taylor, Hoch, & Weissman, 2005). Intervention for vocal stereotypy can be a critical component in educating children with ASD. However, vocal stereotypy could not be physically stopped, which made treatment much more challenging than treatment of motor stereotypy was (Ahrens et al., 2011; Taylor et al., 2005).

Repetitive vocalization can be maintained by social consequences or non-social consequences (Miguel, Clark, Tereshko, & Ahearn, 2009; Rehfeldt & Chambers, 2003; Taylor, Hoch, & Weissman, 2005). For example, maladaptive vocalization might be maintained due to reinforcement histories where individuals could escape from the demanding tasks or obtain others' attention (Dickman, Bright, Montgomery, & Miguel, 2012; Rehfeldt & Chambers, 2003). In those cases, the vocal stereotypies were maintained by socially mediated consequences. Non-social sensory consequences which were direct products of the vocal stereotypy was another major maintaining variable. Reinforcement process which is resulted from the stereotypic vocalization itself without social consequences is referred to as automatic reinforcement (Skinner, 1953, cited in Leblanc, Patel, & Carr, 2000).

Sources for automatic reinforcement for the repetitive speech sounds can be explained with mechanism where stimulus-stimulus pairing occurs. That is, in the process of a stimulus-stimulus pairing procedure, neutral stimulus (vocalization) is paired with an existing form of conditioned or unconditioned reinforcement such as auditory sensation or vibration of oral cavity, rib cage, or vocal cord. Through these repetitive pairing procedure, sensory outcome of the vocal stereotypy conditioned as reinforcers (Carroll & Klatt, 2008; Esch, Carr, & Michael, 2005; Greer, Becker, Saxe, & Mirabella, 1985; Miguel, Carr, & Michael, 2002; Sundberg, Michael, Partington, & Sundberg, 1996; Yoon & Feliciano, 2007).

The intervention for vocal stereotypy which is maintained by social consequence (e.g., escape from the tasks), manipulating others' behavior (e.g., withhold escaping using a physical guidance) can be one of intervention components. However, intervention for vocal stereotypy maintained by automatic reinforcement which is non-social consequence might be different from those maintained by social consequences (Dickman, Bright, Montgomery, & Miguel, 2012; Rapp & Vollmer, 2005). Furthermore, depending on where the source of reinforcement of vocal stereotypy (e.g., auditory source or kinesthetic source) lies, the focus of intervention might be different (Lanovaz & Sladeczek). Hugh-Pennie (2006) applied a procedure to identify whether sources for maintaining palilalia is auditory stimulation produced by the vocal stereotypy in children with autism. In her study, auditory consequences were manipulated to investigate whether changes in the frequency of palilalia would be functionally related to the absence or presence of auditory consequences for emission of palilalia. For the auditory consequences, taped vocalization of the participants or music were removed or added contingent upon the emission of palilalia. The results demonstrated that there was an overall decrease in palilalia for all of the participants regardless of the type of auditory stimulus, and thus indicated that the palilalia was maintained with auditory stimulation independent of social consequences.

A variety of procedures have been used to intervene stereotypic vocalization (Rapp & Vollmer, 2005). The intervention procedures include noncontingent reinforcement which involves continuous presentation of access to either unmatched (e.g., sound-producing toys) or matched stimulation (e.g., music) to the sensory product of vocal stereotypy (Ahearn, Clark, DeBar, & Florentino, 2005; Lanovaz, Sladeczek, & Rapp, 2011; Love, Miguel, Fernand, & LaBrie, 2012). The results of the relevant research indicated that the procedures were effective in decreasing vocal stereotypy. However, providing continuous access to sensory stimulation may interfere with engagement in other behavior such as listening to instruction and thus further investigation is required on procedural aspects (e.g., interspersing with other activities) of the treatment. Taylor et al. (2005) compared the effects of noncontingent reinforcement with different reinforcement for the non-occurrence of behavior (DRO) for a child with autism using matched stimuli (i.e., toys that produced auditory stimulation) to the auditory product of stereotypy. The results showed that

DRO schedule led to a reduction of the vocal stereotypy. Haley et al. (2010) used a visual cue (i.e., a red card labeled quiet) to induce a stimulus control in which the child with autism spectrum disorders (ASD) refrained from engaging in vocal stereotypy under control of visual cues.

Aforementioned intervention procedures for vocal stereotypy have been originally developed to treat motor forms of stereotypy (Lanovaz & Sladeczek, 2012). Recently a line of research investigated effectiveness of intervention procedure specifically targeted to decrease vocal stereotypy. Ahearn, Clark et al. (2007) first examined the effects of response interruption and redirection (RIRD) on vocal stereotypy maintained by sensory consequences for four children with ASD. Subsequent research on RIRD were conducted (Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011; Casella, Sidener, Sidener, & Progar, 2011; Miguel, Clark, Tereshko, & Ahearn, 2009). The RIRD procedure involved a teacher stating the child's name and asking a series of questions that required the child to emit a vocal response contingent on occurrence of vocal stereotypy. The key component of the procedure was to interrupt stereotypy and redirect responding to appropriate vocalizations for which reinforcement was provided. Results showed that RIRD was effective in reducing the occurrence of vocal stereotypy and increasing appropriate vocal responses for the children. In general, the procedure was demonstrated to be effective treatment for reducing vocal stereotypy including palilalia. However, effectiveness of the procedure in increasing appropriate vocal responses were not consistent. For example, In Ahrens et al. (2011)'s study, RIRD was effective in reducing vocal stereotypy in four children with autism but the level of appropriate vocal responses were low in three out of four children.

For individuals who emit high rates of repetitive vocal responses, research results indicated that these same individuals also emit a low rate of independent verbal operants (Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011; Casella, Sidener, Sidener, & Progar, 2011; Karmali, Greer, Nuzzolo-Gomez, Ross, & Rivera-Valdes, 2005; Miguel, Clark, Tereshko, & Ahearn, 2009). This phenomenon can be explained in the matching law theory (Choi, 2012), which stated that the proportion of behaviors given to a source can match the proportion of reinforcement received from that source (Herrnstein, 1961, cited in Choi, 2012). In other words, a high rate of vocal stereotypy emitted by a child can be lowered if the child is provided with higher rate of reinforcement

from sources for more functional verbal responses. According to the matching law theory, manipulating reinforcement sources for appropriate verbal responses which will compete the reinforcement sources for vocal stereotypy and providing higher rate of reinforcement for the appropriate verbal responses will reduce the vocal stereotypy.

In 1957, Skinner described the verbal operants of mands and tacts as basic verbal behaviors which a child learns first in his/her natural social environment. Tacts and mands are verbal operants which are not under the control of verbal antecedents, but instead, are evoked by stimuli with which individuals come in contact (tact) and an individual's state of deprivation (mand). A tact is defined as a verbal operant in which a response of a given form is evoked (or at least strengthened) by a particular object or event or a property of an object or event. The reinforcers for tacts are social attentions such as praises from others. Karmali et al. (2005) tested effects of presenting opportunities to echoically tacting actions and objects following emission of palilalia. The rationale for this treatment procedure suggested by the authors was that palilalia might have the same function as tact responses and be reinforced by the same types of consequences. During treatment condition, the investigator modeled a tact associated with the activity in which the participant engaged without stopping the student from engaging in the activity. If the participant echoed the tacts, the experimenter provided verbal praise. If the participant didn't echo the model but stopped emitting palilalia, the participant was allowed to continue the activity. Through this procedure, the reinforcement source for palilalia were replaced with reinforcement source for tacts. Functional relationship between the vocal corrections and emissions of palilalia and appropriate vocal responses (e.g., requesting and labeling) were demonstrated in the study.

Choi (2012) expanded the procedure used in Karmali et al. (2005)'s study by presenting tact trials with two-dimensional stimuli (e.g., pictures of a clock) contingent upon emission of vocal stereotypy in two middle school students with ASD. The purpose of Choi's study was to examine whether the expanded tact procedure would result in consistent effects on vocal responses as in Karmali et al.'s study. The results indicated that the procedure reduced the occurrence of vocal stereotypy for both participants and appropriate verbal responses increased in one of the participants. The

author interpreted that the low rate of tacts with one of the participants during treatment phase was resulted from the procedural effect; presenting contingent tact trials using picture cards functioned as response cost rather than as tact trials. A procedural difference between Choi's and Karmali et al.'s studies was that tact trials in Karmali et al.'s study were associated with activities the participants were engaged in and those in Choi's study were not. The treatment procedure in Choi's study was more like that of RRID in that the procedure functioned interruption and redirection of the vocal stereotypy. Results of studies which implemented RRID procedure showed low levels of appropriate vocal responses (Ahrens, Lerman, Kodak, Worsdell, & Keegan, 2011), which were consistent to those of Choi's study.

In the study conducted by Karmali et al. (2005), praises were delivered contingent upon emission of echoics as tacts in responses to the vocal models, thus the vocal models which were delivered by the experimenters were prompts rather than corrections. The present study replicates the experiment by Karmali et al. (2005) by applying contingent echoic-to-tact prompt to one child with autism spectrum disorders. The rationale for the treatment procedure is as follows: palilalia is functioning in place of appropriate verbal behavior competing with social reinforcement of correct tacts or mands. If the child learns to emit high rates of mands and tacts that are associate his immediate environment and socially reinforced by their audience, then automatic reinforcement of palilalia may be replaced by socially-mediated reinforcement of appropriate mands and tacts. The present study examined the following questions: (1) Would tact prompt which was delivered contingent on emission of palilalia reduce the occurrence of palilalia? (2) Would contingent tact prompt procedure increase appropriate vocal responses such as tacts and mands?

## II. Method

### 1. Participant and Setting

The participant is 9 years old male diagnosed with autism who exhibits palilalia consisting of movie scripts and statements previously made by his mother and his teachers. He also sings and emits repetitive noises that didn't have apparent adaptive function. He followed vocal directions and had preacademic skills such as receptive discriminations of pictures of common items. He does not independently attend in a group of peers without token reinforcers. He demonstrated generalized imitation skills and echoic behavior in highly structured instructional setting in which clear instructional cues and prosthetic reinforcers (e.g., edibles) for correct responses were delivered. His articulation is very clear during palilalia and familiar statements, but he mumbles when unsure about a word or answer to a question. The participant didn't demonstrated fluent functional verbal behavior such as vocal requesting or tacts as vocal labeling. He tacts with extraneous phrases denoting function that is not appropriate to the conversation or faulty tact such as "How about", "Could be", or "OK, relax, back off".

The participant attends a private center for behavioral therapy where he received major educational services. Sessions were conducted in his regular therapy room which contains three tables, instructional materials, art supplies, games, and toys. Two staff members and one child other than the participant were present in the room.

The sessions were conducted three times a day by the experimenter while other staff were working with other student.

### 2. Dependent Variable and Definition of Responses

There are two types of dependent variables in this study: palilalia as vocal stereotypy and appropriate vocal responses which included mands, tacts. Palilalia was defined as a word, phrase, sentence or group of sentences with no direct, observable relationship to any object present or event occurring

in the immediate environment. Any other inappropriate vocalization including singing, whining, or sounds that are not words were not measured as palilalia. Mands were defined as participants' vocal responses emitted under nonverbal antecedent control and conditions of deprivation, which specified a reinforcer. Tacts were defined as correct labels of objects or events in the immediate environment. For example, a mand occurred when the participant said "crayon" when he needed it for coloring and the experimenter delivered a pack of crayon. Tacts occurred when he said "I am coloring" while he colored which was followed by the experimenter's praise.

### 3. Data Collection and Interobserver Agreement (IOA)

Palilalia was measured using partial interval recording within 30-second intervals: When using partial interval recording, the experimenter recorded whether the responses occurred at any time during the 30-second interval. Mands and tacts were measured in frequency. Ten minute treatment sessions were recorded three times during the regular three hour instructional block; one at the beginning, one in the middle, and one at the end. All of the vocalization were recorded using a tape recorder and target vocal responses were transcribed to written data sheets at the end of each day. At the beginning of each 10 minute treatment session, a tape recorder was started and then a digital timer set for 10 minutes. The measure of palilalia was the vocalization of a word, phrase, sentence or group of sentences with no direct, observable relationship to any object present or event occurring in the immediate environment occurring at any time during each 30 second interval. For representation of the data using a graph, the total number of scored intervals were divided by the sum of scored and un-scored intervals and multiplied by 100. Spontaneous tacts and mands for an item, activity, or attention were vocalizations emitted without echoic, physical, verbal, or gestural prompt. The experimenter recorded each occurrence using a tally mark during 10-minute sessions.

Interobserver reliability was obtained by a special education teacher who was trained in the measurement procedure. IOA was calculated for palilalia using an unscored-interval IOA by comparing the nonoccurrence of palilalia in 30-second intervals. The IOA for tacts and mands is calculated by dividing



the smaller of the counts by the larger count and multiplying by 100. IOA was obtained in 30% of each experimental condition. Mean IOA for palilalia, tacts, and mands were 89%, 88%, 98%, and 100% respectively.

#### **4. Design**

The study used a reversal design (ABAB) with initial baseline measures of target behaviors. Treatment began with a stable baseline and continued until a stable pattern of responding was established and then returned to baseline. After a stable rate of responding obtained, the treatment was reintroduced.

#### **5. Independent Variable and Procedure**

During baseline sessions, the child was seated at a table with materials for an activity or on the floor in the free play area. The 10 minute session began by presenting the antecedent "It's time to ----". The child was required to engaged in art activities, looking at books, putting puzzle piece together, or building blocks. If palilalia occurred, the researcher ignored the behavior. If correct tacts were emitted, the researcher delivered verbal praise to the student. If correct mands occurred, the researcher delivered the requested item.

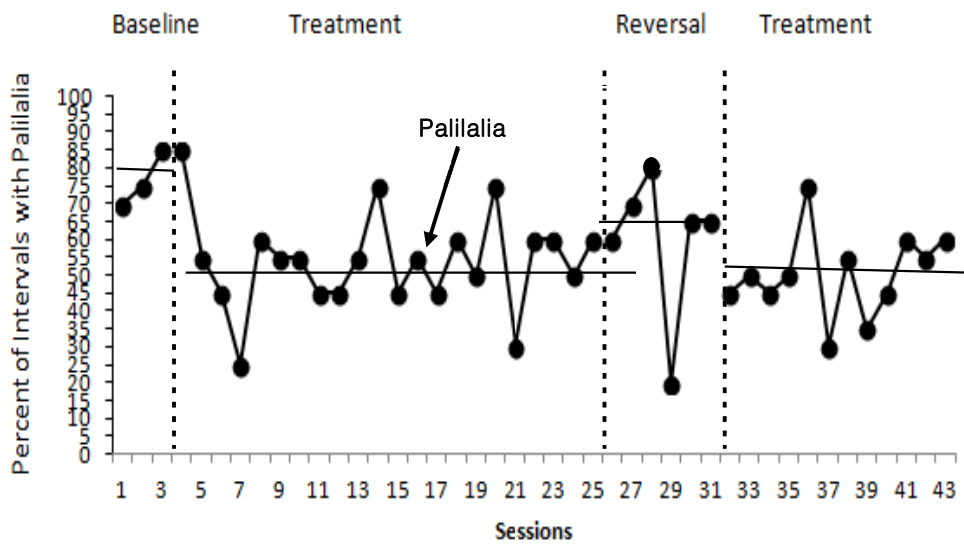
Treatment procedure was conducted when the child was seated at a table or in the free play area as in the baseline phase. The child was required to engaged in the same activities as in the baseline phase. When the participant began palilalia, the researcher immediately modeled a tact associated with the activity in progress without stopping the activity while tacting an item, person, or activity. If the child echoed the tact, the researcher delivered verbal praise. If he did not, and the palilalia continued, the tact was repeated with inflection familiar to the child when doing other echoic activities and prompts. If the child echoed the tact, the researcher delivered verbal praise. If the palilalia continued, the researcher modeled a new tact using the same procedure. During the reversal phase, the procedure was same as in the baseline phase.

### III. Results

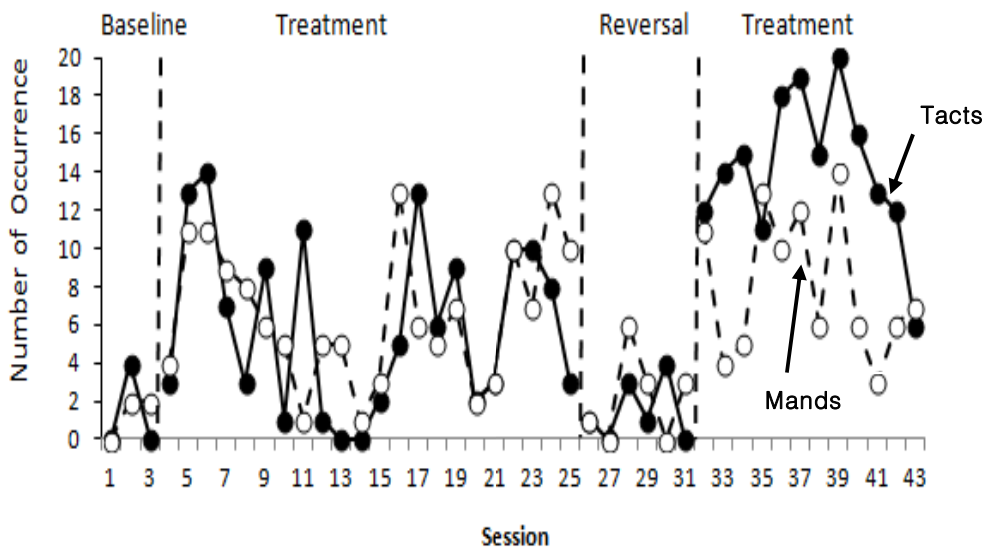
The percents of 30-second intervals in which palilalia emitted are shown in <Figure 1> and the number of spontaneous mands and tacts across experimental phases are shown in <Figure 2>. The means with ranges for each measure are shown at <Table 1>. During the initial baseline condition, mean percent of 30-second intervals with occurrence of palilalia was 78. During the first treatment condition, the mean percent was 54, which indicates a lower overall level of palilalia, yet no decreasing trend is evident. Frequency of spontaneous tacts/mands were variable with some overlap data points with those of the baseline. During the reversal condition, palilalia was initially increasing, yet the increase was not maintained and mean palilalia was 55 with only a slight increase over mean percent of 55 during the first treatment condition. During the reversal condition, mean levels of spontaneous tacts/mands stayed below treatment levels, yet there were overlapping data points between the first treatment condition and the reversal condition. During the second treatment, the mean percent of intervals with palilalia was 50 which was close to the mean (54) during the first treatment condition. The mean frequency of spontaneous tacts/mands did show an increase comparing with all other conditions.

<Table 1> Mean and Range of Percent of Intervals and Number of Responses

	Baseline 1	Treatment 1	Baseline2	Treatment2
Palilalia				
Mean(%)	78	54	55	50
Range(%)	70-85	25-75	20-80	30-75
Spontaneous Tacts				
Mean	1.75	6.2	1.3	14.5
Range	0-4	0-14	0-4	6-20
Mands				
Mean	2.0	6.7	2.3	8.5
Range	1-4	1-13	0-6	3-14



<Figure 1> Mean percents of 30-second intervals with occurrences of palilalia within 10-minute sessions are shown



<Figure 2> Mean number of occurrence of tacts and mands are shown. Closed circles represent number of occurrence of tacts, and open circles mands

## IV. Discussion

The purpose of the present study was to examine whether increasing rate of reinforcement from functional verbal responses using echoic-to-tact prompt would decrease rate of palilia. The implementation of the treatment procedure was premised on the assumption that palilalia emitted by the participant was maintained by automatic reinforcement, which was competing appropriate verbal behavior including correct tacts. In other words, if the child learned to emit high rates of tacts that were socially reinforced by their audience, then automatic reinforcement may be replaced by generalized reinforcement which was resulted from appropriate tacts (Karmali, Greer, Nuzzolo-Gomez, Ross, & Rivera-Valdes, 2005). However, the differences in frequency levels of palilalia across baseline and treatment conditions were not significant.

There might be some explanations for possible sources for the results. First, the results suggested that the major controlling variables of palilalia emitted by the participant was not just automatic reinforcement and social contingency (e.g., escaping from the tasks or obtaining attention) might be also involved. Research revealed that inappropriate social behaviors, including palilalia, may be learned operants that are maintained by social reinforcement contingencies (Frea & Hughes, 1997; Lanovaz & Sladeczek, 2011). A functional analysis conducted by Frea and Hughes (1997) on the maintaining variables of inappropriate social behavior revealed that social attention reinforced the participant's perseverative speech involving repeated utterances. When considering the appropriate alternative behaviors, deficits in the student's repertoire or the lack of reinforcement from the social environment may contribute to inappropriate social communication. In either case, by considering the operant function of inappropriate and appropriate social behavior, more effective interventions can be developed. For example, Wilder et al. (2001) used functional analysis procedure to examine variables that maintain bizarre vocalization emitted by an adult with schizophrenia. The results of functional analysis suggested that the behavior was maintained by attention. A function-based treatment consisting of extinction where attention was withheld was effective in reducing bizarre speech. Similarly, Rehfeldt and

Chambers (2003) identified social attention as a reinforcer which maintained perseverative speech of an adult with autism and mental retardation through functional analysis. The target behavior was reduced effectively with function-based treatment in which extinction for the perseverative speech was conducted accurately in the study. The limitation of the present study was that it lacks of identification of possible social contingencies which might maintain palilalia. Using an experimental manipulations (i.e., functional analysis), controlling variables of the palilalia should have been identified as automatic reinforcement prior to the intervention implemented.

Secondly, the praises delivered as reinforcers contingent upon emission of echoic tacts might not function as reinforcers strongly enough to compete the reinforcing source of emitting the palilalia. This might be also associated to the lowered frequency levels of tacts and mands during the reversal phase, which meant that tacts emitted during the treatment phase were not maintained when the echoic prompts were removed. Considering that the matching law theory was a major theoretical basis for the treatment procedure, sources for reinforcement to compete the reinforcing source for palilalia should have been identified systematically using preference assessment and reinforcer assessment prior to the treatment phases.

Lastly, the rate of tacts increased especially during the second treatment phase while the levels of palilalia remained close to those in the phases without treatment. Considering that contingent delivery of praises on emission of echoic tacts might not functioned as reinforcers strongly enough to compete the reinforcing sources of palilalia, it was possible that behavioral principle involved in the increase of tacts could be negative reinforcement; the participant emitted those verbal responses to avoid echoic-to-tact prompts delivered contingent on emissions of palilalia. Then the mechanism involved in decreased palilalia might be response cost rather than the reinforcement contingencies with tacts which were assumed to replace the reinforcement contingencies involved in maintaining the palilalia. In the original study by Karmali et al. (2005), the researchers modeled a tact to interrupt palilalia; praised an echoic of the tact; and continued with the activity if there was no echoic, but palilalia ceases. If palilalia continued, a different tact was presented to the child. In this study, presentation of antecedent for echoic tacts was more salient by repeating the tact model and waiting 5 to 10 seconds withholding

the activity in order to prompt the tact. This procedural variation might be the controlling source for the behavior changes in which aforementioned negative reinforcement and response cost were involved.

One of limitations of the study is that a reversal design might not be appropriate for the study, due to a possible irreversibility of the target responses. A multiple baselines across participants with reversals might have demonstrated functional relations between the treatment and targeted behavior changes more clearly. There are extraneous variables present in the data. The procedure required practice to implement correctly and some data was discarded because of low treatment integrity. The increase in frequency of responses by the participant during the second treatment phase may be attributed to increased treatment integrity by the researcher.

In the present study, collateral increases of mands, other functional verbal operant than tacts demonstrated during treatment phases and this was consistent to the results of Kamali et al.'s study (2005). As tacts increased with the echoic-to-tact prompt procedure, reinforcement history with functional verbal behavior strengthened, and thus other functional verbal behavior, mands also increased. Due to concurrent occurrences of repetitive words or phrases with low rates of appropriate conversational skills, individuals with ASD who engage in palilalia often lack socially appropriate language and fail to contact reinforcement from natural environment through social interactions (Martinez & Betz, 2012). Therefore, identifying sources of controlling variables of palilalia and developing treatment procedures for the stereotypic vocal responses are critical components of intervention for individuals with ASD. The findings of the presents study provided an implication for future research: Identifying reinforcing sources for palilalia through functional analysis, finding competing stimuli in the environment which reliably replace the sources for reinforcing the maladaptive vocal responses, and manipulating concurrent schedules of the reinforcement from the different sources with behavioral strategies are research agenda relevant to understanding and treating vocal stereotypy including palilalia.

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## 에코익을 통한 음성 명명하기 (tacts) 촉구가 자폐성 장애 아동이 보이는 동어반복증 (palilalia)의 감소에 미치는 영향

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### <요약>

음성상동의 한 유형인 동어반복증(palilalia)은 사회적 환경에서 기능적이지 못한 반복적으로 발화되는 단어나 문구를 지칭한다. 동어반복증을 지속시키는 환경적 요인으로 사회적 맥락과 동떨어진 자동적 강화를 들 수 있고 이렇게 자동적 강화에 의해 지속되는 동어반복증은 자폐성 장애인에게 많이 나타난다. 본 연구는 동어반복증이 나타날 때마다 적절한 음성언어로 주변의 아이টে이나 일어나고 있는 활동을 명명하도록 에코익 촉구를 제공함으로써 그 상동행동을 줄일 수 있는지, 또한 동시에 명명하기(tacts)나 요구하기(mands)와 같은 적절한 음성언어가 증가하는 지를 점검하였다. 본 연구에 ABAB 반전설계가 이용되었다. 기초선 조건 하에서는 동어반복증은 무시되고 적절한 언어반응에는 칭찬으로 강화하였다. 중재조건 하에서는 동어반복증이 발생되면 실험자는 주변의 사물이나 대상자가 하고 있는 활동을 명명하도록 에코익 촉구를 하였다. 결과에 의하면 중재절차가 동어반복증의 발생빈도를 낮추었고 적절한 언어반응인 명명하기와 요구하기는 증가하였다.

**주제어 :** 동어반복증, 음성상동행동, 자동강화