Shaping Vocal Stereotypy in Autism Spectrum Disorder: A Non-aversive Communication Teaching Technique

Gül Kahveci^{1,*}, Serin Nergüz Bulut²

¹European University of Lefke, Faculty of Education, Department of Special Education, Lefke,
Northern Cyprus, TR-10 Mersin, Turkey

²European University of Lefke, Faculty of Education, Department of Guidance and Psychology, Lefke,
Northern Cyprus TR-10 Mersin, Turkey

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Abstract Many vocal stereotypy or repetitive vocalizations behaviors of children with autism spectrum disorder (ASD) are now seen as having potential language development, even though they may begin with highly delayed or absence of social consequences by reflexive or non-purposeful responses. The study of these vocal stereotypy or repetitive vocalizations behaviors in children with autism spectrum disorder has been of interest for a long period time. There is an accelerating interest in the communicative potential of repetitive vocalizations in the domain of pre-linguistic behaviors of children with ASD. The present article concentrates on a non-aversive communication teaching technique with shaping protocols. This research aims to answer the question: Do responding to repetitive vocalizations by three communicative behaviors, nonlinguistic contingent response, linguistic contingent responses, and finally linguistic contingent responses to the child's communicative act, guided with a shaping procedure increase frequency of communication attempt in a child with ASD. According to the multiple-probe across behaviors graphic and the anecdotal recordings of the participant affective involvement showed a great acceleration during intervention. This research has important implications, because promising results were gathered related to repetitive vocalizations behaviors in a child with (ASD) by using a non-aversive communication teaching technique with the shaping protocols.

Keywords Autism Spectrum Disorder, Vocal Stereotypy, Repetitive Vocalizations, Shaping, Non-aversive Techniques

neurodevelopmental disorder that exhibit deficits in social interaction and in acquiring and using language for communication [1]. Language skills in autism can vary from completely nonverbal to above-average ability (Dunn and Bates, 2005). In the low average verbal subtype of autism pragmatic language is typically impaired, and unusual restricted and repetitive forms of language may be present [2], [3]. Human language development can take place through three different stages as an evolutionary/developmental point of view [4] where after using sounds and gestures language initially emerges as a system of words with a particular content (meaning) (lexical/semantic system), and then the emergence of a grammatical language, as a system of relations.

Individuals with ASD can demonstrate some restricted and repetitive behaviors, which can be called stereotypy. Stereotypy has been defined as persistent repetitious acts like motor or vocal behaviors with a high variation of topologies in the absence of social consequences [5]. In individuals with autism spectrum disorder (ASD) vocal stereotypy or repetitive vocalizations [6] can contain many forms as well as many functions. For example; a child may repeat previously heard words to take attention whereas another child may repeatedly hum to gain auditory stimulation. However, with the guidance of a non-aversive communication teaching technique, vocal stereotypy or repetitive vocalizations has the potential to turn into functional communication although, requesting, commenting about feelings, thoughts, and needs are relatively rare in children with ASD unlike their typically developing peers. Social skills and adaptive behaviors can be considered as impaired in the case of vocal stereotypy where the behaviors are physically harmless [7] but, these behaviors may interfere with learning conditions [8].

In the case of response interruption and redirection (RIRD) method, it is possible that the intervention functioned as negative punishment via interruption of toy play contingent on vocal stereotypy [13], but in such a

1. Introduction

Autism spectrum disorder (ASD) is a

treatment, child can lose the opportunity to get any praise. For this reason, researches make use of another form of RIRD which is called RIRD plus differential reinforcement for incompatible behavior (RIRD + DRI) condition to reinforce appropriate vocalizations [20].

Although the child gets reinforcement in the next step researchers have overwhelmingly proven that a non-aversive positive reward based approach that can be applied from the beginning without using punishment via interruption, is a more effective way to letting functioning of the brain with a reasonable level of “well-being” state. Some of the more popular non-aversive approaches today, which heavily emphasize positive behavior strategies, as opposed to punishment or interrupting behavior where anger burst can occur/taking things away, which are consequences associated with aversive techniques. Some of the top non-aversive techniques in autism treatment include “*Adapting the Environment*”, “*Positive Behavior Supports*” and “*Teach Replacement Skills*”.

In the Positive Behavior Supports (PBS) technique which is a behavior management system that can be used to understand the reasoning behind the inappropriate behavior. Within this perspective vocal stereotypy can be considered as a communication intention and can be shaped according to PBS where the system has incorporated the elements of applied behavior analysis such as shaping, fading, chaining, prompting, and reinforcement contingencies [21]. In the Teach Replacement Skills (TRS) technique the goal is to replace potentially inappropriate behaviors such as vocal stereotypy with more appropriate communication skills. Educators can shape the vocal stereotypy related behaviors of children, especially by making use of affective involvement which can be defined as the mutual emotions sharing, as having a communicative function. They can provide a verbal model as if it were intentional communication while responding to a child’s potential communicative behavior. According to shaping procedures [22] put forward three classes of shaping related responsiveness: the first class is; “*nonlinguistic contingent responses*”, the second class is; “*linguistic contingent responses*” (to the child’s focus of attention), and finally the third class is; “*linguistic contingent responses to the child’s communicative act*” because different classes of verbal responsivity are appropriate for different communicative stages where the child gets better in communication by having more positive experiences.

In the first class of responsiveness which is called “*nonlinguistic contingent responses*” can be used for acknowledging the participant’s behavior through imitating child’s facial expression and play. This imitation includes exact or reduced imitation of child’s vocalizations while the child was playing with his/her favorite toys like cars with different classes, sizes and colors. In the second class of responsiveness which is called “*linguistic contingent responses*” can involve comments and directives about the preferences of a toy within child’s

focus of attention. The final class of responsivity which is called “*linguistic contingent responses to the child’s communicative act*” and saying what the child might be trying to communicate, these responses add linguistic information to the child’s act. This structured shaping process can be considered as, “employing child echoic imitations and adult expansion” and this kind of responsiveness has been studied in typically developing children as well as in children with ASD [23] and can be considered as non-aversive communication teaching technique. There are many potential benefits to non-aversive interventions. Instead of simply doling out punishment for the individual on the spectrum’s outbursts, these techniques instead aim to avoid the situations, persons, and behaviors that trigger outbursts in the first place. In this way, the quality of life for everyone involved can be improved with the positive behavior supports.

In communication interventions in the case of using a comprehensive communication package there is a danger in depending upon global measures of change in language development that may not be sensitive to changes associated with the intervention procedures. Because of this risky situation in this research three well defined dependent variables were selected to find out the effect of dependent variable which is a group of shaping procedures in a child with ASD. This research aims to answer the question; Do responding to repetitive vocalizations by three communicative behaviors, nonlinguistic contingent response, linguistic contingent responses, and linguistic contingent responses to the child’s communicative act, guided with a shaping procedure increase frequency of communication attempt in three children with ASD?

2. Materials and Methods

2.1. Participants

Participant A is a ten-year-old boy who has ASD. In the presence of an adult, most of the time participant emits a vocalization that does not approximate a word. Participant can touch an object with any one or two fingers for pointing. In order to reach a desired object, he moves one or both arms. In order to lead he can take an adult by the hand or wrist and guides the adult’s hand or wrist to an object. He can produce an intelligible simple word or a meaningful sound that approximates a word. He has impaired communication initiation; stereotypic and repetitive use of language (stereotypy). However, he can very rarely use one or two word containing sentences whenever he wants. The participant was taken to the supplementary education to teach him to be table ready before starting the research for 6 sessions in order to decrease adverse effects of new educational environment.

The participant attended a special education institution near their home for five years and focused mostly on fine

motor skills, like traditional ornamenting applications such as painting, drawing, candle making, soap decoration, and wooden spoon painting. For this reason, the pre-clinical educational experience of the participant was accepted as treatment as usual (TAU) in this study.

Participant B and Participant C are seven-year old male twins who have no education or special education history. Based on the results of a parent interview participant B and C have an audible laughing, mouthing of objects, physical aggression, screaming, body twirling and repetitive vocalizations excluding tic or seizure disorders and diagnosed as ASD recently. They have difficulty maintaining social interactions and engaging in age appropriate play with each other and with their peers. Reason for referral; parents have expressed that they are having difficulty with their morning and school routines, causing behavioral issues. Additionally, most of the time they emit a vocalization that does hardly approximate a word. When they have these issues their entire day is thrown off, resulting in trouble concentrating on schoolwork and increasing difficulties interacting with their teacher and their typically developed peers throughout the day in school. Their teacher would like a special education therapist's recommendations as a starting point in order to allow them to better function in the classroom.

2.2. Setting

Participant A, B and C attended a private clinic and all experimental sessions took place in a playroom with a wide variety of toys. All baseline and intervention sessions performed one on one bases. Participant A, B and C had a primary and secondary trainer. The Participants' primary trainer conducted intervention sessions 2-3 days per week. The secondary trainer was used to facilitate across person generalization.

2.3. Data Collection

Three different classes of verbal responsivity "nonlinguistic contingent responses", "linguistic contingent responses" and "linguistic contingent responses to the child's communicative act" related data were collected for five-minute episode of interaction was recorded on videotape with a range of adult and participant communication behaviors in the experimental setting and in the generalization setting. By using an observation form the frequency the various target communicative behaviors were registered. The observations and scoring were carried out by the authors and by a special education teacher working in the clinic. Prior to formal data collection, the special education teacher was trained to 84% interobserver agreement for all different classes, with the exception of affective involvement because the behaviors occurred too infrequently. Interobserver reliability was computed for 30%

of the videotaped episodes and was found to range from 89% to 100% in the three classes of communicative behavior, with a grand mean of 92.3% across all the categories, with the exception of affective involvement. Affective involvement of the participant was observed via anecdotal recording system.

2.4. Social Validation

For the present study the Social Validity Questions was developed to provide additional support for the effectiveness of the intervention. Following the completion of the 16-week intervention, participant's mother was asked social validity questions and with this questionnaire participant's mother reflects her experiences and shares her thoughts which may or may not have found the intervention to be effective. Questions were prepared according to the three components such as treatment goals, procedures, and outcomes in order to demonstrate that goals or outcomes are meaningful and important in the participant's life and for addressing the social acceptability of the goals, procedures, or outcomes to relevant "consumers" of the intervention [24].

2.5. Experimental Design

Multiple-baseline design shows the functionality of the intervention by demonstrating that the intervention apparently produces the same kind of behavior change across a variety of behaviors of the same subject within a given setting [25]. According to this design behavior change is correlated with the intervention, and moreover, it can be seen that on all other baselines, within which interventions are not occurring at the same time. The multiple-probe technique can be used instead of the continuous baseline measurement of the traditional multiple-baseline technique where measurement during extended baselines is impractical. The multiple-probe across behaviors can effectively evaluate an intervention intended to either accelerate the frequency of a non-reversible behavior such as academic or communicational skills. The selected behaviors are functionally independent and there should be criteria for the performance in order to introduce the intervention to the next behavior [26].

2.6. Experimental Procedures

For all three contingent responses includes affective involvement with a variety of communication acts such as requesting, commenting, other communication acts such as greeting, protests, and yes-no answers to questions, turn-taking [27]. In the first stage the researcher used nonlinguistic contingent responses for acknowledging the Participant's behavior through imitating his facial expression in the first class of responsiveness during play

time. This imitation process includes exact or reduced mimicry of participant's vocalizations and excludes a lip smack (a short noise made by compressing and opening the lip), a tongue click (a quick, sucking sound made by the tongue pressing against and releasing from the roof of the mouth), a raspberry (bilabial trill produced by lips vibrating repeatedly against one another and often produced as playful vocalizations), an alveolar trill (the rapid vibration of the tongue against the alveolar ridge, and a uvular trill (the uvula against the back of the tongue). Additionally, vocalizations produced while mouthing objects (e.g., toys or fingers) or eating were excluded from our analyses. The researcher varied the toys according to the participants' preferences. This session starts with immediate imitation of the child by the researcher followed by the researcher's shaping process. Then with the facilitation of the active involvement, Participants start imitating the vocalization of the researcher.

The second stage was performed by labeling a toy in which the child is interested which is associated with "linguistic contingent responses". The most important aspect is the child's focus of attention and/or communicative message about the linguistic input here apart from shaping. The third stage of responsivity is linguistic contingent responses to the child communicative act. These responses functions like a "linguistic mapping" and add linguistic information to the Participant's act, by

saying what the Participant might be trying to communicate. For example, the researcher may respond "What do you want from me? When a Participant looks at a toy and thereby verbalizing what the Participant appears to be communicating nonverbally [27]. Studies include typically developing children, children with developmental disabilities and children with ASD where this class of responsiveness has been the core concept [23]. Data collected during 5min period were transferred to frequency data by dividing the behaviors by 5 to calculate number of related behaviors (frequency of "*nonlinguistic contingent responses*", "*linguistic contingent responses*" and "*linguistic contingent responses to the child's communicative act*" in a minute.

Generalization sessions were conducted by the secondary trainer. 5-min play sessions were conducted to permit assessment of generalization across trainer, setting, and materials. Other than previously known materials used to represent different examples of the same themes. Additionally, another room was selected for generalization of the setting.

A part from single subject research design researchers preferred to use of "treatment as usual" (TAU) as a control condition which consists of a considerable amount of non-specific treatments. TAU as a control agent has been used in psychology [29], [30] and it resembles pre-treatment period in this research.

Figure 1. The multiple-probe across behaviors graphic for frequency of “nonlinguistic contingent responses”, “linguistic contingent responses” and “linguistic contingent responses to the child’s communicative act” behaviors

3. Discussion and Results

This research has important implications because promising results were gathered related to repetitive vocalizations behaviors in a child with ASD by using a non-aversive communication teaching technique with the shaping protocols. The Participant A's intended communication acts were reshaped starting from "*nonlinguistic contingent responses*" to an increased form of "*linguistic contingent responses to the child's communicative act*". In the beginning of the intervention sessions Participant A's *nonlinguistic contingent responses* were (frequency values) under 5 and in the end of intervention the frequency values were jumped above 25. Similar promising data were gathered for the "*linguistic contingent responses*" and "*linguistic contingent responses to the child's communicative act*" behaviors where the best results were around 15 and 10-15 respectively.

The relatively short-term outcome gathered from the generalization sessions have showing valuable results and even a greater value for the "*linguistic contingent responses*" which may affect long term outcomes positively like reduced school dropout rates, increased academic achievement, and even vocational placements.

According to the multiple-probe across behaviors graphic and the anecdotal recordings of the participant affective involvement showed a great acceleration during intervention. During baseline sessions participant had a negative mood and he preferred to stay or play alone without sharing his toys or any playing materials. However, during intervention participant showed positive emotions by making sounds of pleasure with a smiling face in combination with an eye contact with almost diminished repetitive vocalizations according to the anecdotal recordings. Participant receiving the PBS treatment system performed better in his communication act with highly decreased vocal stereotypy according to "treatment as usual" (TAU), a control condition, which consists of a considerable amount of non-specific treatments that was applied in special education institution for five years (related data gathered via anecdotal recordings from participant's mother). In order to decrease negative effects of prior non-specific treatments the experimenters regulated the intensity of the interaction in order to preserve the well-being of the participant. Otherwise, Participant A was in the habit of exhibiting negative emotions by showing vocal stereotype behaviors in combination with other inappropriate behaviors. The experimenters regulated affective involvement by regulating the intensity of the intervention as well as by repeating participant's utterances or any intentional linguistic contingent responses in a perceptive way.

After the completion of the 16-week intervention and generalization sessions, participant A's mother was answered goal, procedure, and outcome related social validity questions and she mentioned about the great

increase in the intended communication acts such as; he started to use sentences for requesting, commenting, greeting, protests, and yes-no answers to questions and turn-taking. She shared her thoughts about this procedure and she admitted that she can advise these shaping procedures for other individuals with ASD and for the teachers of students with ASD. According to the participant's mother his son starts talking during shopping, makes greetings for grandmother and grandfather in their birthday and in the eve of a religious festival which makes the teaching process socially important and applicable. She mentioned about how happy his son was during the shaping procedures and he smiles most of the time due to the fact that system works on positive supports and she added that intervention was worth the time and effort invested and she was satisfied with the communication goals of the clinic [31].

The Participant B and C's intended communication acts were reshaped starting from "*nonlinguistic contingent responses*" to an increased form of "*linguistic contingent responses to the child's communicative act*". In the baseline sessions Participant B's *nonlinguistic contingent responses* were (frequency values) $(19+14+18)/3=17$ and in the end of intervention the frequency values were decreased to 7-8. In the "*linguistic contingent responses*" frequency values were around 5 and in the end of intervention the frequency values were increased to 12-14. In the "*linguistic contingent responses to the child's communicative act*" behaviors were increased from 0.1 to 9-10. For Participant B high rate "*nonlinguistic contingent responses*" were in the way of turning into "*linguistic contingent responses*" and "*linguistic contingent responses to the child's communicative act*". Additionally, generalization sessions were reflecting the Participant B's increased communicative act.

In the baseline session Participant C's *nonlinguistic contingent responses* were (frequency values) 12.3. In the end of intervention, the frequency values were increased to 21.2 (min:14-max:27). In the baseline session Participant C's "*linguistic contingent responses*" were 2.6. During the intervention, the frequency values were increased to 4.6 (min:3-max:8). In the baseline session Participant C's "*linguistic contingent responses to the child's communicative act*" were 0. During the intervention, the frequency values were increased to 3,5 (min:1-max:7). Additionally, generalization sessions were reflecting the Participant C's increased communicative act.

The relatively short-term outcome gathered from the generalization sessions have showing valuable results and even a greater value for the "*linguistic contingent responses*" which may affect long term outcomes positively like reduced school dropout rates, increased academic achievement, and even vocational placements.

According to the multiple-probe across behaviors graphic and the anecdotal recordings of the participant A's affective involvement showed a great acceleration during

intervention. During baseline sessions participant had a negative mood and he preferred to stay or play alone without sharing his toys or any playing materials. However, during intervention participant showed positive emotions by making sounds of pleasure with a smiling face in combination with an eye contact with almost diminished repetitive vocalizations according to the anecdotal recordings. Participant receiving the PBS treatment system performed better in his communication act with highly decreased vocal stereotypy according to “treatment as usual” (TAU), a control condition, which consists of a considerable amount of non-specific treatments that was applied in special education institution for five years (related data gathered via anecdotal recordings from participant’s mother). In order to decrease negative effects of prior non-specific treatments the experimenters regulated the intensity of the interaction in order to preserve the well-being of the participant. Otherwise, Participant A was in the habit of exhibiting negative emotions by showing vocal stereotype behaviors in combination with other inappropriate behaviors. The experimenters regulated affective involvement by regulating the intensity of the intervention as well as by repeating participant’s utterances or any intentional linguistic contingent responses in a perceptive way.

According to the multiple-probe across behaviors graphic and the anecdotal recordings of the Participant B’s and C’s affective involvement showed acceleration in the end of intervention. During baseline sessions Participant B and C had very limited play behaviors with each other. In the same room they were preferred to stay at the different corners without sharing their toys. However, during intervention Participants showed more positive emotions by making sounds of pleasure with a meaningful smiling face according to the anecdotal recordings.

After the completion of the 16-week intervention and generalization sessions, participant A’s mother was answered goal, procedure, and outcome related social validity questions and she mentioned about the great increase in the intended communication acts such as; he started to use sentences for requesting, commenting, greeting, protests, and yes-no answers to questions and turn-taking. She shared her thoughts about this procedure and she admitted that she can advise these shaping procedures for other individuals with ASD and for the teachers of students with ASD. According to the participant’s mother his son starts talking during shopping, makes greetings for grandmother and grandfather in their birthday and in the eve of a religious festival which makes the teaching process socially important and applicable. She mentioned about how happy his son was during the shaping procedures and he smiles most of the time due to the fact that system works on positive supports and she added that intervention was worth the time and effort invested and she was satisfied with the communication goals of the clinic [31].

After the generalization sessions, participant B’s and C’s mother was answered goal, procedure, and outcome related social validity questions and she mentioned about the positive changes in the intended communication acts such as; they started to use single or two word (with approximation) for requesting, greeting, and yes-no answers to questions. She shared her thoughts about this procedure and she admitted that she can advise these shaping procedures for other individuals with ASD and for the teachers of students with ASD. She mentioned that they started to visit public places without any tantrums and they could share their needs by communicative acts. Lastly, she claimed that related educational structure worked well and that intervention was worth the time and effort invested and she was satisfied with the communication goals of the clinic.

Selecting an intervention for three boys with vocal stereotypy or repetitive vocalizations, one might inspect the resulting profile matching those children’s problems and characteristics, and attempt to identify a manual whose contents most closely match the practice element profile is quite difficult. However, another approach that could be employed where the techniques themselves could be matched to specific target behaviors is a type of modular applications. If educators perceive vocal stereotypy as a communication intention they can make use of PBS tools like applied behavior analysis such as shaping, fading, chaining, prompting, and reinforcement contingencies for improving “*nonlinguistic contingent responses*”, “*linguistic contingent responses*” and “*linguistic contingent responses to the child’s communicative act*” behaviors as modular applications. Modular applications give the educator to construct the treatments specifically for the child’s developmental stage. Among three different stages of language skills [4], sounds/gestures, lexical/semantic and grammatical communication act, participant in this research can be considered at the level in between sounds/ gestures, lexical/ semantic step. Considering continuous progression of language during child language development [32] and considering participants’ repetitive forms of language not as a disruptive behavior to be diminished but as a ASD way of learning language by using PBS tools we tried to be more in the lexical/ semantic segment and by using more verbs the participant can make small developmental steps for the grammatical communication acts level.

Limitations of the study. Communication of individuals with various disabilities often shows different patterns [33]. Individuals with ASD due to many factors, such as severity, type, and extent of support from communication partners, secondary conditions, and other behavioral, emotional, and social factors will display considerable variation in their communication skills or performance. Therefore, any information gathered related to communication patterns should be considered only as one source data and limitations of single subject design methodology should be

kept in mind for generalization purposes.

4. Conclusions

Educators need to better understand ASD and the myriad complexities that the disorder encompasses [34] in order to make the most effective intervention choice which may focus on the acquisition of interactively used vocalizations/object-verb correspondences. There is a well-known relationship between interactively used vocalizations and the development of spoken language, children who use vocalizations to make requests, to engage in social interaction, or to establish joint attention with a communicative partner are demonstrating their ability and desire to communicate [35], [36], [37], [38]. This understanding of pre-linguistic communication is thought to provide the conceptual and social foundation for later expressive language so that children who use vocalizations to make requests, to engage in social interaction, or to establish joint attention with a communicative partner are demonstrating their ability and desire to communicate.

Only a small number of studies have distinguished vocalizations used communicatively from those not used communicatively. Given the core social communication deficits of children with ASD, it is equally important to investigate vocalizations within communicative acts to better understand the relationship of vocalizations to speech, language, and communication development [39], [40], [41], [42]. However, special education teachers need more examples of non-aversive communication techniques even totally different perspectives can be more motivational like knowing biological basis of language deficiencies so that we can choose the best practices individually without losing time.

Biological basis of human speech and language is being transformed by developments in molecular technologies. Advances in genotyping and sequencing of whole genomes are shedding new light on the genetic architecture underlying language difficulties. Forkhead Box P2 (*FOXP2*) and Contactin-Associated Protein-Like 2 (*CNTNAP2*) can be the first candidate language-related genes in several disorders characterized by language impairments such as ASD. Language-related genes may have complicated relations like; for *FOXP2*-mediated regulation of *MET* (may be an important molecular component of human temporal lobe development including regulation of subcortical efferent pathway signaling that may underlie some aspects of language and cognition). The existence of a specific variant of these genes may help to choose for designing the best teaching strategies individually even in very early stages of language development in the future [43].

When it comes to programming, it is vital that educators have the training, the knowledge, and all the support they require in ensuring that the needs of students with ASD

starting from social and communication behaviors are being completely taken into consideration and effectively handled [44]. Keeping in mind the increasing prevalence of ASD, it is critical that special education teachers in the field of education increase their understanding and knowledge of ASD and its sub-types as a neurodevelopmental disorder and its interventions to meet the diverse needs of students diagnosed with this disorder.

If we can encourage children with ASD to learn to vocalize or speak, this could lead to an increased communicative ability, which makes not only the child's life easier, but also increases their chances of functioning in the world around them. Therefore, the study described in this article has, in an effort to better meet the needs of a very unique participant of learner, provided an opportunity to design a more compatible to the participant's language stage developments and their well-being. The next step will be to implement a similar but improved study with larger sample sizes, systematic behavior sampling, and precise coding of vocalization variables to provide additional clarity on the relationship including the sub-populations of ASD and with non-aversive communication techniques such as "*Adapting the Environment*", "*Positive Behavior Supports*" and "*Teach Replacement Skills*" to overcome repetitive vocalizations behaviors and concurrently to increase communication behaviors.

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