Operant approach to stuttering in children: Two case studies.

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AN OPERANT APPROACH TO STUTTERING IN
CHILDREN: TWO CASE STUDIES

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B.A., University of Montana, 1977

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CHAPTER I

INTRODUCTION

Operant procedures have been applied to stuttering and disfluency in a variety of ways. These particular verbal behaviors have been punished, negatively reinforced, and positively reinforced. The experimental manipulation of stuttering and disfluency utilizing response contingent consequences has been shown to be effective in the reduction of their frequency of occurrence (Flanagan, Goldiamond, and Azrin, 1958; Martin and Siegel, 1966a, 1966b; Quist and Martin, 1967; Haroldson, Martin, and Starr, 1968; Martin and Haroldson, 1969; Alford and Ingham, 1969; Egolf et al., 1971; McDermott, 1971; Costello, 1975; and Reed and Godden, 1977;).

Studies have been performed with people clinically labeled as stutterers as well as normal speakers. Stuttering was usually studied in stutterers and disfluencies examined in normal speakers.

Shaw and Shrum (1972) rewarded fluency in children who stuttered and concluded that the conditioning process was effective in manipulating verbal behavior. In the same study they rewarded stuttering and the result was a decrease in fluent intervals.

Reed and Godden (1977) used the verbal consequence "slow down" contingent on a stuttering behavior produced by two preschool children. The results were a decrease in the percentage of words stuttered by both children. A probe performed eight months later revealed
generalization of the treatment effects.

A token reinforcement system was used by Alford and Ingham (1969) to reinforce fluency in children who stuttered. They utilized a combination of syllable-timed speech, negative practice, and a token reinforcement system. The system was designed to teach the child to use syllable-timed speech, and token reinforcement was delivered contingent on fluency. The authors concluded that it was important to use the combination of approaches for success.

Martin and Siegel (1966a) described an experiment with two adult male stutterers wherein fluency while reading was rewarded and stuttering was punished. "Good" was delivered after each fluent interval of thirty seconds and "not good" was delivered contingent on each instance of stuttering. The reduction in stuttering behaviors extinguished rapidly following removal of the contingent stimuli, so carry-over was affected by establishing a conditioned discriminative stimulus. A bracelet, which the client wore around the wrist, was used.

Two variables, lip protrusion and stuttering, were manipulated by Martin and Siegel (1966b) using response contingent shock. The results demonstrated that all behavior that was being punished decreased when the shock was delivered, but rapidly returned to original levels during the extinction period. They were able to bring the response under discriminative control by pairing a neutral stimulus with the punishing stimulus.

Flanagan, Goldiamond, and Azrin (1958), in a frequently cited experiment, were among the first to explore the extent to which stuttering could be brought under control of contingent consequences.
The subjects were three male stutterers who were required to read under two different conditions of response contingent stimulation. One condition was the delivery of a one second blast of noise contingent on stuttering and the other was escape from ongoing noise contingent on stuttering. Their results indicated that punishment decreased the stuttering response and the negative reinforcement increased the stuttering. The authors concluded that stuttering could be isolated from speech because they were able to manipulate the stuttering behavior independently from speech.

Quist and Martin (1967) experimented with the effect of verbal punishment on stuttering. The contingent stimulus was "wrong" and was used with three male stutterers. Their results supported the contention that stuttering could be punished using an operant approach.

The theoretical basis for the use of time-out as a contingent consequence, according to Haroldson et al. (1968) was that speaking was self-reinforcing and the interruption of speaking would be punishing. To explore this assumption, they studied four male stutterers who experienced a ten second time-out after a moment of stuttering. The results were that stuttering decreased. Some extinction was seen and maintenance data were not reported. The authors stated that there was some evidence that time-out worked best when an alternative reinforced response was available to the subject. Haroldson et al. (1968) concluded that their results lent validity to the hypothesis that propositional speech was maintained, at least in part, by some type of self-reinforcement. They stated:

"An extension of certain conditioning principles leads
to the prediction that if speech responses are maintained on some schedule of self-reinforcement, then making time-out from this reinforcement schedule contingent upon a particular response should decrease the frequency of that response."

A study comparing two treatment procedures, one a time-out procedure and the other a counseling approach directed at giving information and changing the stutterers' attitudes, was performed by Martin and Haroldson (1969). Their results showed a decrease in stuttering frequency for the time-out procedure and no change in stuttering in the counseling group. There was no significant change in either group's scales. They concluded that the small number of subjects and the short treatment period made generalization dangerous, but it was clear that the time-out procedure was effective in decreasing the frequency of stuttering.

McDermott (1971) described a case study which involved rewarding fluency and the use of time-out from speaking contingent on stuttering. Her data indicated that the percent of disfluency was 3.4% after treatment, which was considered normal by the clinician, the child, and his parents. This case study was one of the few reports of punishment and reward being utilized clinically for intervention.

Three case studies using a time-out procedure were reported by Costello (1975). Her subjects all evidenced a decrease in stuttering frequency under the time-out condition. The subjects indicated that the time-out procedure was not emotionally unpleasant and Costello noted an added advantage of developing their ability as conversationists as evidenced by less dependence on note cards for topics. Both
Costello (1975) and Haroldson et al. (1968) cite the clinical advantages of simplicity and effectiveness as reasons for time-out being appropriate for clinical application.

Egolf et al. (1971) used a time-out procedure with a group of ten stutterers. Their method was different from most others in that the period of time-out was unspecified. In the group situation, one speaker was given the floor until they were required to relinquish their turn to talk. Improved fluent performance was the result of the time-out contingency.

Response contingent consequences have been applied to normal speakers' disfluencies in experimental procedures. A study by Siegel and Martin (1969) with adult normal speakers revealed that the delivery of the word "wrong" contingent upon disfluency decreased the frequency of disfluencies. A buzzer had the same effect.

Hasbrouck and Martin (1975) examined speech disfluencies in four normally-speaking children and found that time-out from speaking delivered contingent on disfluencies reduced the occurrence of disfluency in all subjects. Disfluency in two subjects in the Hasbrouck and Martin (1975) study was successfully negatively reinforced, causing an increase in that behavior.

Many variables besides the nature of the response consequence have been shown to have an effect on the outcome of an operant procedure. These include the immediacy of the consequence, the strength, and the schedule.

Martin and Hasbrouck (1977) examined the effects of punishment schedule on normal speakers' nonfluencies. The schedules of punishment

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experimented with were 25% variable ratio and 100%. They had two groups, one which received the 25% time-out contingent on nonfluencies and then the 100% schedule. The other group received the same treatment in the opposite order. The results were that for both groups the 100% punishment schedule produced a marked decrease in nonfluency. The 25% schedule maintained whatever level of fluency was present when the schedule was instituted. The effect of the order of the two schedules was found to be significant in terms of extinction. The 25%-100% ratio schedule revealed a greater amount of extinction than the 100%-25% schedule.

In an additional study involving two groups of different subjects, a schedule of 100%-100% had the same effects as a 100%-25% schedule. In this case, little extinction occurred for either group. The conclusion that the authors reached was that intermittent punishment was capable of maintaining disfluency at the level established prior to introduction of the intermittent schedule, while continuous punishment effectively reduced the frequency of response. The significance of the order of schedule presentation is confusing because different patterns of extinction occurred depending on the order of schedule presentation.

Brookshire and Martin (1967) researched the effects of three verbal punishers on the disfluencies of normal speakers. The theoretical basis for the study was that for a nonverbal aversive consequence, the behavior was, at least in part, a function of the intensity of the stimulus. They examined the effects of "no", "wrong", and "uh-huh", with one hundred normal speakers during reading. The
contingent behavior was either a repetition or an interjection. "Wrong" was most effective, then "uh-huh", and "no" was least effective. Another indication from this study was that delivering punishment immediately after the response was important. In the random punishment group this was not done and the disfluency output was not altered.

The studies that have been reviewed this far have dealt with stuttering in stutterers and disfluencies in normal speakers. The following studies examined stuttering and disfluencies together in the population labeled as stutterers.

Based on two studies, the continuum of interruptions in verbal behavior will be divided into two separate response classes for the purpose of classification for the therapeutic procedure reviewed in this paper. The basis for this division is found in MacDonald and Martin (1973) and Hasbrouck, Graham, and Brooks (1976). MacDonald and Martin (1973) illustrated that stuttering and disfluency were identified as two unambiguous response classes in the same speaker. They did not specify behaviors in each of the two classes.

Hasbrouck et al. (1976) further defined the components and examined their relationship. Stuttering was defined as any audible instance of muscular tension or physical struggle which interfered with the production of a speech sound in a single word. Disfluency was defined as any other audible fluency disruption in which no muscular tension or physical struggle was perceived. Hasbrouck et al. (1976) hypothesized three relationships between disfluencies and stuttering: 1) that disfluency functioned to avoid or prevent stuttering;
2) disfluency functioned as a discriminative stimulus for stuttering; or 3) that there was no relationship.

In the investigation they required three male stutterers to speak and punished only their disfluencies by means of a response cost procedure. The results indicated that the response class defined as stuttering decreased with the decrease of disfluencies for all three subjects. There was an additional statement to the effect that this particular relationship has not held true in all cases clinically. The implication of the results was that classifying behaviors in this way might serve to facilitate more efficient modification and elimination of stuttering.

The crucial problem of maintenance or permanent effect was addressed in a few studies. The study comparing intermittent punishment with continuous punishment by Martin and Hasbrouck (1977) showed different effects on extinction of different combinations of punishment schedules.

McDermott (1977) reported successful generalization which was accomplished by bringing in listeners and changing the therapy site.

Costello (1975) reported that generalization was different for each of her three subjects, but that in general, there was maintenance of fluency up to one year later.

Carry-over was affected in some instances by use of discriminative stimulus, such as a bracelet worn around the wrist (Martin and Siegel, 1966a, 1966b).

The definition of punishment used in this study was any consequence of behavior that reduced the future probability of that behavior.
occurring (Azrin and Holz, 1966). The punishment was delivered on a 100% schedule immediately after the instance of disfluency or stuttering.

The questions this study investigated were: 1) will a time-out procedure used with children be effective as a method of reducing stuttering and disfluent behavior; and 2) what effect will there be on stuttering and disfluency when disfluencies only are punished in one child and stuttering behaviors only are punished in another child.

The procedure described was patterned after an experiment by Martin et al. (1972). The results of their experiment indicated that it was possible to manipulate the stuttering of children using a time-out procedure.
CHAPTER II

METHOD

Subjects

The two subjects were male stutterers, five and seven years of age. They were identified as stutterers on the basis of the amount of tension-related stuttering and disfluencies present in their conversational speech. The baserate counts illustrated by Figures 1-10 show the specific amounts of stuttering behaviors and disfluencies present prior to the introduction of the time-out procedure. Both clients were dependents of active duty military personnel and thus were eligible for services provided by the Speech/Language Rehabilitation Section of Fitzsimons Army Medical Center. Neither child had had previous treatment for a stuttering problem. Other than stuttering, Subject 1 had normal speech and language skills. Subject 2 presented some developmental articulation errors, notably a /θ/ for /s/ substitution, in addition to his stuttering.

Apparatus and Procedures

The child sat in a chair that faced a glassed-in box containing a puppet. The puppet's box was wired with two light bulbs that were controlled by a foot switch. The clinician sat behind a partition which framed the puppet's box, out of sight of the child. On a table behind the clinician was a Sony reel-to-reel tape recorder, Model TC 105A,
with a microphone that was placed through an opening in the front of the puppet's box. The puppet had a string attached to his nose so manipulation of the string by the clinician approximated articulatory movement of the puppet's mouth.

The room was dark, except for the lighted box containing the puppet, during all sessions. There was a small light behind the clinician to illuminate the stop watch during a time-out interval. Therapy sessions and baserate sessions were twenty minutes long, and were all tape-recorded. The child conversed with the puppet for the entire session. The clinician moved the puppet's string as she produced its voice.

Each time the child produced a disfluency or stuttering, the clinician immediately depressed the foot switch darkening the room for ten seconds. The time-out period was timed with a stop watch. Each child was instructed that he was to remain silent while the puppet's light was off. The clinician explained to each child individually that there were certain ways that he spoke that the puppet didn't like and that the light would go off whenever he talked in that way. The clinician gave examples by demonstrating the behavior to which the puppet would respond with time-out.

Prior to the initiation of the study, the response class of stuttering was defined according to Hasbrouck et al. (1976) as sound repetitions, sound prolongations, and silent blocks; that of disfluency was defined as word repetitions, phrase repetitions, sound interjections, and word interjections.

One of the questions posed at the beginning of treatment was what effect punishing just stuttering in one child and just disfluencies in
the other child would have on the remainder of the child's verbal behaviors. The decision about which responses would receive the time-out was made according to each child's individual patterns of stuttering and disfluency. Subject 1 exhibited primarily stuttering behavior while Subject 2 produced mainly disfluencies. At the beginning of the treatment procedure, the time-out for Subject 1 was delivered when he produced a silent block or a sound repetition. The punished responses for Subject 2 were phrase repetitions, word repetitions, sound interjections, and word interjections.

Generalization would be accomplished by bringing different listeners into the therapy room. The first listener would be one of the parents.
CHAPTER III

RESULTS

The results for Subject 1 are illustrated in Figures 1-4. His stuttering behaviors, which were being punished, consisted of sound repetitions and silent blocks. His disfluencies, which were not being punished, consisted of word and phrase repetitions. During three twenty minute baserate sessions, Subject 1's stuttering, that is, his silent blocks and sound repetitions, were approximately 100 and 104, respectively, per session. The total for stuttering was approximately 200 instances per baserate session. Introduction of ten seconds of time-out contingent on stuttering resulted in a reduction of stuttering to approximately 3 to 4 per twenty minute session.

Disfluencies, the word and phrase repetitions, numbered approximately 50 and 36, respectively, during each of the three baserate sessions. Disfluencies decreased to 4 or 5 per twenty minute session after the introduction of time-out contingent on stuttering.

After the fifth training session, the time-out period was reduced to five seconds for Subject 1. The rationale for the reduction was that the interruption of conversation was punishing, not the amount of time the child was required to remain silent. The shorter period of interruption did continue to be effective, with one stuttering behavior, the silent blocks, showing a temporary increase. The other observed
responses continued to decrease. One advantage of the five second
time-out interval was an increase in talking time. Talking time also
increased as the child became more fluent.

Subject 2's disfluencies, which were punished, consisted of
sound interjections ("uh"), word interjections ("but"), word repeti­
tions, and phrase repetitions. His stuttering behaviors, which were
not initially punished, consisted of sound repetitions and blocks.

Baserate measurements of Subject 2's disfluencies were approxi­
mately 60 to 80 per session, showing a large amount of variability
over the four sessions. This is illustrated by Figures 5-8. After
introduction of the ten second time-out period contingent on disflu­
cies, the disfluencies decreased to approximately 20 to 30 per session.
The word interjections showed the most dramatic decrease.

Subject 2's stuttering behaviors consisted of sound repetitions
and silent blocks. These were not punished in the first eleven sessions
and did not consistently decrease. The behaviors to be punished by
time-out were changed after eleven sessions to include silent blocks
and sound repetitions as well as disfluencies. The result of punishing
these behaviors was that the silent blocks decreased while the sound
repetitions increased slightly.

Phrase repetitions, classified as a disfluency, were less variable
and continued to decrease after the time-out became contingent on both
stuttering and disfluency. The other disfluent behaviors, which were
still receiving time-out did not show any noticeable change.

Subject 2's disfluencies and stuttering behaviors were more variable
and resistant to the time-out procedure than Subject 1's behaviors.
The time-out procedure in both cases served to decrease the frequency of stuttering and disfluency. The plans for carry-over had not yet been instituted at the time this paper was written. Subject 1's mother reported that he was much more fluent at home than he was before the treatment procedure was begun. Subject 2's mother reported that he was more talkative and appeared to be better able to communicate.
CHAPTER IV

DISCUSSION

Although the therapeutic procedure was not yet complete, it appeared that time-out from speaking was effective in decreasing both stuttering and disfluent behaviors. The most crucial question clinically was not answered, and that is the question of maintenance. From a parental report obtained shortly after cessation of this study, the preliminary indication for Subject 1 was that the procedure would probably enable the child to generalize his fluent behavior to situations outside the clinic.

For Subject 1, the interaction between his stuttering behaviors and disfluent behaviors was that they both decreased with punishment of stuttering only. This result lends support to the idea that, in this case, stuttering and disfluency are related, but probably do not belong to the same response class. One possible relationship is that stuttering may be a stimulus for disfluency. In the process of eliminating stuttering behaviors, the conditioned connection between stuttering and disfluent behaviors could have been disrupted. If the stuttering behaviors were a discriminative stimulus for disfluency, there would be less reason for disfluency to occur if the stuttering behaviors were decreasing.

If stuttering and disfluency were part of the same response class for Subject 1, punishing only stuttering would have set up an intermittent
punishment paradigm. With the response on a less than 100% schedule, the expectation would be that none of the observed behaviors would have changed significantly. Since the observed behaviors did decrease immediately and rapidly, the idea of two different, related response classes was supported.

Subject 2's stuttering behaviors were expected to decrease as his disfluencies were punished, but this did not occur. The conclusion in this respect was that his disfluencies were not acting as a discriminative stimuli for stuttering and there appeared to be no relationship between the two in this order of punishment. Therefore, the two response classes could be manipulated independently. All the behaviors required the time-out interval before they decreased.

Subject 2's stuttering and disfluencies were slightly more resistant to the treatment procedure. One of the reasons this could be true was that all observed behaviors were due to some common underlying reason. The behaviors could have been part of the same response class, in contrast to having been two separate, unrelated response classes. The treatment procedure, being contingent only on a portion of these behaviors at the outset, could have been on a less than 100% schedule. This sort of schedule, according to the findings of Martin and Hasbrouck (1977), with disfluency only, could cause maintenance of ongoing fluency patterns.

The point contradictory to that conclusion is that the interjections decreased immediately. The reason that word and phrase repetitions were slow to reduce could have been a combination of the frequency of occurrence and less frequent punishment compared to the
interjections "but" and "uh". It is possible that the complexities of the reinforcement and punishment schedules occurring daily in response to the child's verbal behavior patterns made those patterns less responsive to this particular treatment procedure.

The results of this treatment method so far supported the idea that propositional speech is maintained by some type of self-reinforcement. This may be one explanation of why this procedure was effective.

Another possible explanation was suggested by Martin and Siegel (1969) and reiterated by Costello (1975). This was the hypothesis that the real reason that operant procedures were effective was because they simply called attention to or highlighted the disfluencies or stuttering. The point here was that the behaviors were carrying their own punishment. Some credibility was lent this hypothesis by the fact that Siegel and Martin (1966) found that when "right" was delivered contingently and then discontinued, the behaviors decreased and then increased when the stimulus was removed.

Biggs and Sheehan (1969) concluded from their study of six male stutterers that their results were due to a distraction effect rather than punishment. Experiments that revealed an increase in stuttering or disfluency when those behaviors were positively or negatively reinforced are contradictory to Biggs's and Sheehan's conclusion. Some of these studies include Shrum and Shaw (1972), Hasbrouck and Martin (1975), Hasbrouck (1973), and Shames and Sherrick (1963).

If the results of the therapeutic procedure presented in this paper are interpreted as support for operant control of stuttering and disfluency, what are the implications with respect to the onset,
development, and nature of stuttering? The success, however tentative, of this procedure was in direct opposition to theories that hypothesized that increased attention or reaction to a child's speech interruptions would increase those interruptions (Johnson, 1949).

Shames and Sherrick (1963) presented a number of possible operant paradigms that could operate in the establishment of nonfluent behaviors. They stated that it was possible to view the repetition response as a class of verbal responses with a history of complex schedules of reinforcement.

Relative to this point, Ingham and Andrews (1973) reported that the studies they reviewed implied that stuttering was maintained by complex and ill-understood reinforcers.

The conclusion that seems reasonable at this point is that despite the knowledge that stuttering can be manipulated through operant means, the nature of stuttering as a complex behavior needs further definition. Martin (1968) reached this conclusion and stated that classical conditioning as well as operant conditioning should be investigated in terms of onset. The paradigms that Shames and Sherrick (1963) presented are believable but are purely theoretical, and are not backed by any research.

Martin and Ingham (1973) expressed the opinion that "the empirical demonstration that stuttering frequency can be modified by response contingent consequences does not necessarily mean that stuttering is an operant behavior, nor does it mean that the onset and development of stuttering are best explained in terms of environmental consequences."
A therapeutic procedure utilizing time-out from speaking with two children who stuttered was presented. The results supported a tentative conclusion that this approach was successful. The conclusion is tentative because the maintenance data is not available.

The fact that the time-out method was successful is seen as support for the research data showing operant control of stuttering and disfluent behaviors.

For one child, punishing stuttering behaviors also caused a decrease in disfluencies. For the child whose behaviors were primarily disfluencies, a reduction in stuttering behaviors was not in evidence until the stuttering behaviors were subjected to time-out periods. The punished behavior for both subjects showed a decrease.

For Subject 1, the idea of disfluency and stuttering as two separate but related response classes was supported. The relationship may be, in this case, that stuttering served as a discriminative stimulus for disfluency.

In the case of Subject 2, disfluencies and stuttering behaviors could have been part of the same response class or completely separate, unrelated response classes. Disfluency appeared not to be a discriminative stimulus for stuttering in this case.
The implication of this operant procedure for the author as a clinician is that it can be applied clinically with success. This is especially true with children and may be less true in terms of maintenance with adults. Time-out from speaking is a realistic way to directly approach a child's speech behavior. Like Costello (1975), I did not see evidence that the therapeutic procedure was emotionally unpleasant. The children appeared to enjoy conversing with the puppet. Again, the definition of punishment used was "a stimulus that would decrease behavior." For this procedure specifically, the possibility exists that the reinforcing nature of continued conversation overshadowed the time-out periods. The children neither one expressed a fear of the room being darkened, and it was never completely dark.

The procedure was not difficult to implement clinically and could be adapted for use in the public school. I would accomplish this by using the time-out procedure without darkening the room. A specific reinforcement for specific intervals of fluency could also be used in combination with the time-out in a public school.

If an older child required discussion with respect to information or attitude, or if a child's environment was aiding in the maintenance of his fluency interruptions, then these problems could be addressed clinically along with direct intervention.
An advantage of the procedure in my opinion was that it facilitated a natural interaction, and conversation took place in a realistic manner. Another advantage was that using a puppet, I was able to develop the puppet's character in such a way that he could ask questions that an adult could not ask a child. The puppet knew nothing so there was virtually everything to talk about.

I did not feel cruel delivering the punishment, and the children thought of the puppet as the one who objected to certain speaking behaviors. This was true in spite of the fact that they both knew I was the puppet's voice and that I turned off the light. During one session, Subject 1 told the puppet about something that had happened to him and after the session told me the exact story again.

An unexpected benefit for me was that I was often reminded by the conversation that children view the world from a completely different perspective than an adult.

It was interesting to me that the children knew, without any instruction, what to do to discontinue their stuttering and disfluency.

Dividing the continuum of interruptions of verbal behavior into stuttering and disfluency gave me a different perspective on the problem labeled stuttering and added to my theoretical consideration of the disorder.

As a clinician, I feel more confident in approaching stuttering in children. I have another method that I can utilize.

Initially, it was difficult to keep an accurate count of the specific verbal behaviors during the twenty minute session. With practice, I did not have to listen to each session again to count
the specific behaviors each child produced during the treatment session. Of course, they were both producing fewer behaviors that required tabulation as the procedure progressed.

Another aspect that was difficult was being certain that the punishment was administered on a 100% schedule. It was absolutely necessary to utilize the time-out every time the child produced a behavior that was to be punished.

The last disadvantage was one that applies to every therapeutic procedure, that is, this method will not work with everyone. The tentative conclusions from this particular study cannot be generalized to all children who stutter.

It was, however, preliminarily successful and this information will be useful for me in making clinical judgments concerning my individual approach to the problem of stuttering in children.
Figure 1. Silent blocks for Subject 1, baserate and treatment conditions.

Figure 2. Sound repetitions for Subject 1, baserate and treatment conditions.
Figure 3. Phrase repetitions for Subject 1, baserate and treatment conditions.

Figure 4. Word repetitions for Subject 1, baserate and treatment conditions.
Figure 5. Word repetitions for Subject 2, baserate and treatment conditions.

Figure 6. Interjections of "uh" for Subject 2, baserate and treatment conditions.

Figure 7. Interjections of "but" for Subject 2, baserate and treatment conditions.
Figure 8. Phrase repetitions for Subject 2, baserate and treatment conditions.

Figure 9. Sound repetitions for Subject 2, baserate and treatment conditions.

Figure 10. Silent blocks for Subject 2, baserate and treatment conditions.
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