Increasing Conversation Using Restricted Access and Chain Schedules of Reinforcement

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Abstract

The current study examined the effects of chain schedules of reinforcement and restricting access to reinforcement on increasing the number of words used in conversation for an adolescent with autism spectrum disorder. After access to a video game was restricted, the participant had to meet various chain-schedule requirements of responding to regain access. The results demonstrated that the combined procedures were successful in building multiword conversation between the young man, his mother, and/or a therapist. These results expand on existing literature regarding increasing verbal behavior using reinforcement techniques and the literature regarding increasing the use of trained social skills.

Keywords Autism spectrum disorder · Conversation skills · Chain schedules of reinforcement · Restricted access to reinforcement

Common traits of individuals with autism spectrum disorders (ASD) include social and communication deficits (American Psychiatric Association, 2013). Many children and adolescents with ASD have minimal communication. Additionally, children and adolescents with ASD often engage in a restricted range of repetitive responding. Although this in many cases refers to stereotypic behaviors or restricted interests, this pattern of behaving may also describe repetitive or restricted social responses (e.g., always greeting someone in the same exact manner).

Researchers have begun to look more closely at a global domain of behaviors, typically called social skills, to determine more effective, targeted interventions that address a variety of specific behaviors (Nuernberger, Ringdahl, Vargo, Crumpecker, & Gunnarsson, 2013). Many social skill programs focus on response accuracy (Radley et al., 2014; Radley et al., 2015) rather than topography of the response, such as response variability and length. Others conceptualize

this difficulty as either skill deficits (e.g., Capps, Kehres, & Sigman, 1998; Hood, Luczynski, & Mitteer, 2017) or motivation deficits, in that the reinforcement history with social interactions has not supported various social skills (White, Keonig, & Scahill, 2007).

Conversation seems to be an area of particular difficulty for many individuals with ASD. This could be due to the fact that many of these people suffer from faulty or nonexistent intraverbal repertoires that severely limit opportunities for meaningful social interaction and development (Sundberg & Michael, 2001). Successful communication skills, including day-to-day social interactions, answering questions, and continuing conversation, depend on effective intraverbal repertoires (Coon & Miguel, 2012). Recently, Hood et al. (2017) described procedures to effectively increase conversation related to skill deficits, but questions still remain regarding the contingencies that might compete with motivation deficits related to limited conversational skill.

An approach for addressing potential motivation deficits might include direct reinforcement for spoken language in the context of a conversation. Such an approach could use increasing ratio schedules to target the number of words used during a conversation. Chain schedules lend themselves to the context of a dynamic, reciprocal, and complex interaction between a speaker and listener. Interrupting, or restricting, access to potent reinforcers, which may constitute a conditioned motivating operation–transitive (CMO–

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T), could help increase motivation to engage in conversation if those behaviors reestablish access to the restricted reinforcer. In this arrangement, the answer from an individual in response to a question from another person could be established with a simple fixed ratio 1 schedule (FR 1) in which one or more words produce reestablishment of a restricted reinforcer. When FR 1 responding demonstrates stability, an initial chain schedule could involve moving the initial question to an FR 2, so that answers must include two or more words to produce a follow-up question that is introduced with an FR 1 requirement. When the follow-up question is answered with at least one word, the reinforcer would then be delivered. In this context, the initial question would function as a discriminative stimulus for the availability of access to the follow-up question, which would acquire conditioned reinforcing properties due to its relationship to access the putative reinforcer. Similar chain progressions could be introduced until the individual successfully navigates a conversation with multiple follow-up questions.

There is limited research regarding the expected length of verbal responses for both typically developing children and adolescents and those with ASD. Some literature from speech-language pathology research does present data indicating that adolescents with ASD use significantly smaller mean length of utterances despite similar verbal ability (Hobson, Hobson, García-Pérez, & Du Bois, 2012). The current study aimed to extend the literature on increasing verbal responding for an adolescent with ASD. Specifically, we used an interrupted chain schedule, or restricted access, to increase verbal repertoire and communication skills while systematically increasing response length.

Method

Participants, Materials, and Setting

One adolescent male previously diagnosed with ASD and mild intellectual disability participated in this study. Scooter was a 15-year-old African-American male who attended a day treatment school in the southern United States and received outpatient behavioral services from a university clinic on a weekly basis. Although Scooter had previously exhibited an extensive verbal repertoire outside of sessions, these occurrences were inconsistent. During sessions, however, he rarely responded, except for an occasional “I don’t know.” Scooter had previously participated in a social skills intervention targeting response variability when responding to questions. He failed to demonstrate progress during previous social skills interventions (data available upon request).

All sessions were conducted in a university clinic room, 18 ft. × 11.5 ft. (5.5 m. × 3.5 m.), containing a table, several chairs, and a television, which was used to play video games. Scooter had verbally identified video games as a preferred activity during an initial interview. Scooter and his parent brought video games and a console from home. The three most commonly brought games consisted of a two-player fantasy fighting/battle-themed game, a two-player martial arts game based on actual athletes, and a two-player game based on professional American football. These games are popular with same-aged peers and Scooter’s siblings.

Table 1 displays the questions presented to Scooter. Open-ended questions were selected based on Scooter’s common interactions and interests, following an open-ended interview

Table 1 Questions asked of scooter by group and order

Group	Question	Order
1	How was school today?	Primary
1	Who did you see at school today?	Secondary
1	Did anything interesting happen today?	Tertiary
1	What did you learn about?	Quaternary
2	What do you want to do when we go home?	Primary
2	Why do you want to do that?	Secondary
2	What should we do for dinner?	Tertiary
2	What could we do this weekend?	Quaternary
3	What do you and your brothers and sisters do for fun?	Primary
3	What music do you like?	Secondary
3	Who’s your favorite singer?	Tertiary
3	What sports do you like?	Quaternary
4	What should we play? / What are you going to play next?	Primary
4	How do we play this?	Secondary
4	What’s this game about?	Tertiary
4	Why do you like this game?	Quaternary

with his mother. Questions are organized into four groups of four ordinal questions.

Dependent Variables

For the current study, the main dependent variable included the total number of correct and appropriate words used in response to a therapist's or parent's question. Scooter's responses were recorded verbatim, and the total number of correct and appropriate words per response was tallied. For a word to be counted as appropriate, it must be heard and understood; mumbles and unintelligible sounds were not included in word count. To score appropriate words, they also had to be related to the question asked. Responses of "I don't know" were not included in the tally but were recorded verbatim. Words per response were collapsed across ordinal class.

For at least 90% of sessions, a secondary observer recorded Scooter's verbatim responses. Total count interobserver agreement (IOA) per each of the 20 responses was calculated and averaged each session. IOA ranged from 80% to 100%; IOA was variable largely due to Scooter's quiet volume when responding.

Design and Procedures

A concurrent multiple-baseline design across main and follow-up questions was employed to determine the effect of the combined use of reinforcer restriction and chain schedules of reinforcement on the number of correct and appropriate words used in responding to therapist and/or parent questions. Question sets included a primary question, secondary question, tertiary question, and quaternary question. Each session included the asking of all four question sets.

Baseline Baseline consisted of a therapist or his mother alternating asking Scooter the listed questions, which were randomly assigned their order. Of the first four baseline sessions (before any intervention had been introduced for any responding), Scooter either played video games noncontingently or was questioned with no video game present. For the first and third baseline sessions, Scooter was allowed noncontingent access to his video games while the questions were asked. For the second and fourth baseline sessions, Scooter, his mother, and therapists sat at a table with no activity while the questions were asked.

General Intervention Procedures Intervention consisted of interrupted access to the video game, where game use was restricted, until Scooter met the FR schedule of reinforcement assigned to the question presented. Scooter was not told these schedule requirements. When the chain schedule was introduced, Scooter had to meet all schedule requirements for each link in the reinforcement chain to gain eventual access to the video game. Intervention procedures were implemented in

four 2-min trials (one trial per group of questions). When the game was paused, Scooter had 2 min to respond and meet schedule requirements, and then play his game. Therefore, the faster he responded with the required number of words, the longer he was able to play his video game before the next interruption from the subsequent trial.

For all intervention sessions, after setting up the console and game, Scooter was allowed to play the game for 5 min prior to the start of each session. Therapists read the following statement to Scooter prior to the start of each session: "We are going pause and ask you questions. If you answer with something other than 'I don't know,' we'll hit play." The game was then paused by a clinician (also playing the video game) and the lead therapist or his mother presented the questions. If a follow-up question was still in baseline (meaning the chain schedule had not yet been introduced), it was presented while Scooter had access to the video game.

FR 1 During this phase, Scooter had access to the video game for 5 min. The therapist restricted access to the item and asked a primary question. Access to the video game was given for any correct and appropriate response of one word or more to primary questions. Follow-up questions were then asked 5 s after the conclusion of the participant's responses or after a 5-s period without a response.

FR 2/FR 1 During this phase, the therapist restricted Scooter's access to the video game and asked a primary question. Scooter was required to give a response to the primary question consisting of at least two correct and appropriate words to access the first follow-up question. Access to the video game was given for any appropriate, relevant response of one word or more to the first follow-up question.

FR 4/FR 2/FR 1 During this phase, the therapist restricted access to the item and asked Scooter a primary question. He was required to give a response to the primary question consisting of at least four correct and appropriate words to access the first follow-up question. Scooter then had to give a response to the first follow-up question consisting of at least two correct and appropriate words to access the second follow-up question. Access to the video game was given for any correct and appropriate response of one word or more to the second follow-up question. A third and fourth follow-up question were also included, but they only progressed to FR 2/FR 1 due to the semester ending.

Reciprocal Question The final intervention phase, only included for the primary question, included a rule requiring Scooter to respond to the question asked of him and then ask a question as part of his response. The primary question, response, and follow-up question were considered a question class. When the reciprocal-question schedule was implemented for

the first question class, an FR 4 schedule was implemented for the following question class, an FR 2 schedule was implemented for the next question class, and an FR 1/FR 1 was introduced for the last question class.

Increases in schedule requirements were always introduced to the primary question first, and the previous schedule requirement was introduced to the subsequent question class. Once the FR 1/FR 1 intervention was introduced to the final question class, no more schedule requirement increases were introduced.

Results

Figure 1 depicts the results of the combined use of item restriction and chain schedules on the total number of correct and appropriate words used by Scooter across questions. Each time the combined item restriction and chain schedule was implemented, an increase in the number of correct and appropriate words followed. Specifically, he responded more to questions for which game play was contingent on his response as compared to subsequent questions not affecting access to the game. The data in the first panel display Scooter's average number of words per response across the four primary questions in one session. During baseline, the average words per response were 0.375 for primary questions, 0.477 for secondary questions, 0.6278 for tertiary questions, and 0.659 for quaternary questions. When the FR 1 schedule requirement was put in place, responses averaged 2.214 words for primary questions. When FR 2 was implemented with primary questions, average responses were 3.625 words. Concurrently, the FR 1 schedule was put in place for secondary questions, resulting in responses with an average of 3.979 words. FR 4 was then implemented for primary questions, resulting in an average number of words per response of 3.833. At the same time, the schedule for secondary questions was increased to FR 2, resulting in an average of 3.055 words per response. FR 1 was concurrently implemented for tertiary questions, resulting in responses with an average of 1.986 words. Quaternary questions were moved to FR 1 and had responses with an average of 3.490 words. When the reciprocal-questions phase was implemented with primary questions, responses had an average of 9.417 words.

Discussion

The current study sought to increase an adolescent's length of verbal responses using a chain schedule of reinforcement and interrupted, or restricted, access to reinforcement. These increases topographically appear similar to intraverbal increases, in that they are verbal responses to verbal stimuli without point-to-point correspondence; however, the verbal

responses more closely likely function as mands, as verbal response is under the control of a motivating operation of a specific reinforcer—in this case, the video game. Nonetheless, using the video games may have created a convergent multiply controlled mand (Michael, Palmer, & Sundberg, 2011). Specifically, the video games appear to have served as a CMO-T (Cooper, Heron, & Heward, 2007), in which the access to video games serves as the initial reinforcer for responding, until the source of control has been transferred and social interaction becomes the reinforcer—as evidenced by anecdotal reports that Scooter was more communicative at school.

Also anecdotally, Scooter was observed engaging in conversation with a particular therapist without the video game present. Multiple therapists were used across the study and varied from session to session. Data were not collected on prior engagement with Scooter or his preference of therapist. Also, attention types were not controlled for. It was noted that after multiple sessions, the previously mentioned therapist was one that Scooter frequently chose to play the video game with. Perhaps through stimulus pairing, this therapist's attention began to function as a conditioned reinforcer. If so, the anecdotal observations may have included responses in which stimulus control had transferred from mand to intraverbal. Therapist attention during the video game was not controlled during this study, and baseline conditions were not conducted in a manner that would allow an experimental demonstration of transfer of control from mand to intraverbal. Future research should more carefully control therapist attention, along with specific baseline conditions that would allow for an evaluation of stimulus pairing between attention and a reinforcer used in a CMO-T arrangement on transfer of control.

Although the study appeared to answer the research question, there are other methodological limitations that should be addressed. One major limitation of the current research study involves the variable environmental factors present in baseline conditions—namely, that baseline sessions were conducted with and without the video game present. Additionally, when the video game was present, it was present without restriction. Once after a session, Scooter commented that it was easier to respond when the video game was paused because he could hear and pay attention more easily than while he was playing. Future research should more carefully control the stimulus conditions related to the restriction of reinforcers. Although the current study constitutes data-based problem solving and applied research, these results warrant further in-depth research to more closely evaluate the effects of these procedures on the acquisition of more elaborate forms of conversation. Another limitation involves the consistent replication across all question types. Although the FR 1 schedule was replicated across all four question types, the FR 2 schedule was replicated across three question types, and the FR 4 schedule was replicated across two question types. Future research should

Fig. 1 Average correct and appropriate words for Scooter across primary (top panel), secondary (upper middle panel), tertiary (lower middle panel), and quaternary (bottom panel) questions

use consistent schedules across all question types. The pattern of responding within the tertiary question is a limitation in that

the responding between the FR 2 and FR 4 phases resulted in an upward trend followed by a drop. Also, the study is limited

by the small question pool used. Scooter may have simply learned a small set of chained responses. This, coupled with the lack of assessment for generalization to novel questions, should be explored by future research.

Compliance with Ethical Standards

Conflict of Interest All authors certify that there are no actual or potential conflicts of interest in relation to this article.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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