

## Functional analysis and intervention of perseverative speech in students with high-functioning autism and related neurodevelopmental disabilities

Emily M. Kuntz, Abby V. Santos and Craig H. Kennedy

Vanderbilt University

Although perseverative speech is a common characteristic of individuals with high-functioning neurodevelopmental disabilities, little is known about the operant functions of these verbalizations. We conducted analogue functional analyses of perseverative speech for 2 students using reinforcement contingencies that included alone, attention, control, escape, and tangible conditions. Results showed the following patterns: attention only (Charlotte) or multiply determined including an attention function (Paul). We then tested an intervention for perseverative speech maintained by social positive reinforcement that included differential reinforcement of alternative behavior and extinction of perseverative speech for 1 participant. The intervention reduced perseverative speech, but did not increase appropriate speech until we added a prompting component. We then replicated this three-component intervention with Paul. The results showed moderate to high decreases in levels of perseverative speech and increased appropriate verbalizations in both cases. The results systematically replicated the interventions of previous studies by adding a prompting component to the intervention.

*Key words:* functional assessment, high-functioning autism, intervention, neurodevelopmental disabilities perseverative speech, social attention

Perseverative speech is common among individuals with high-functioning neurodevelopmental disabilities (Fein, Green, & Waterhouse, 2001) and is defined as repetitive talk focused on a particular topic or set of topics (e.g., dinosaurs) (Kang, Gadow, & Lerner, 2019). This type of speech is a concern because it is a form of repetitive, stereotyped behavior which can dominate a person's repertoire and interfere with the acquisition of more adaptive skills (Grosberg & Charlop, 2017). Relatedly, engaging in perseverative speech can disrupt social interactions with others and lead to the reduced frequency and

duration of social episodes (Kennedy, 2004). Therefore, researchers have sought to understand the nature of these behaviors and intervene to reduce their occurrence.

Although social skills training has long been a topic of analysis and intervention for students with severe intellectual disabilities, less is known about perseverative speech for individuals who are higher functioning (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010). If social skills deficits, such as perseverative speech, are viewed as problem behaviors, an initial question from a behavior-analytic perspective is identifying the operant function(s) of these behaviors (Hanley, Iwata, & McCord, 2003). If researchers can identify the variables maintaining perseverative speech, then this information may help in the development of interventions to improve social outcomes.

Assessing whether perseverative speech serves positive, negative, and/or automatic reinforcement functions similar to other problem behaviors, logically leads to the development of

---

Emily Kuntz is now at the University of Oklahoma, Abby Santos is now at the Savannah-Chatham County Public School System, and Craig Kennedy is now at the University of Connecticut.

The research was supported, in part, by US Department of Education grant H325D050102.

Address correspondence to: Craig H. Kennedy, Educational Psychology Department, Neag School of Education, University of Connecticut, Storrs, Connecticut 06269. Email: craig.kennedy@uconn.edu

doi: 10.1002/jaba.669

function-specific interventions. To date, just two studies, each involving a single participant, have used functional analysis methods to assess the operant function of perseverative speech. Rehfeldt and Chambers (2003) identified the perseverative speech of a man with autism spectrum disorder (ASD) as being maintained by positive reinforcement in the form of social attention. The authors then developed an intervention using differential reinforcement of alternative (DRA) behavior combined with extinction of perseverative speech. The results showed reductions in perseverative speech and increases in appropriate verbalizations. Fisher, Rodriquez, and Owen (2013) also found a social attention function of perseverative speech in a boy with Asperger's syndrome. The resulting function-based intervention used differential reinforcement and a multiple schedule to reduce the child's perseverative speech and increase appropriate verbalizations (Fisher et al., 2013).

Given that just two studies have examined the function of perseverative speech and evaluated function-based interventions for this common problem, we sought to replicate the findings of Rehfeldt and Chambers (2003) and Fisher et al. (2013) using functional analyses to identify the operant function of perseverative speech. In the first analysis, the perseverative speech of a girl named Charlotte was identified as serving a social attention function. We then implemented the Rehfeldt and Chambers procedure using DRA plus extinction. The intervention reduced perseverative speech, but did not increase appropriate verbalizations. We added a prompting component for appropriate speech to the DRA plus extinction intervention and observed increases in appropriate verbalizations. In the second analysis, we then replicated the effectiveness of the DRA plus extinction and prompting intervention with a second child (Paul) whose perseverative speech was also maintained by social attention.

## METHOD

### *Participants and Settings*

Two individuals with neurodevelopmental disabilities participated in the study. Charlotte was a 10-year-old female diagnosed with a moderate intellectual disability and obsessive-compulsive disorder. Paul was a 13-year-old male diagnosed with ASD and a mild intellectual disability. Both participants attended special education programs in public schools. The assessment and treatment procedures occurred at home for Charlotte and at school for Paul. Each session included the participant and a graduate student who conducted the procedures, henceforth referred to as the experimenter. There were no other adults or children present in the room during experimental conditions.

The experimenter conducted Charlotte's sessions in her bedroom and breaks in between conditions were spent in the living room located within approximately 3 to 5 m of her room. Charlotte had access to clothes, pictures, books, and movies while in her room. The experimenter conducted Paul's sessions in an empty office in his school, which contained a table and chairs. Paul did not have access to any materials other than those supplied by the experimenter for certain conditions. Materials included a history book or dictionary, crayons, crossword puzzles/coloring sheets, a pencil, and math worksheets. Paul spent his breaks walking around the hallways of the school with the experimenter. Access to attention did vary across breaks based on people's presence in the hallway.

### *Response Definitions*

Perseverative speech was recorded when a participant emitted verbal phrases, questions, words, or sounds more than once within a session, when they discussed anything not related to the conversation, or when they discussed topics that were otherwise frequently

perseverated upon. We identified the specific topographies of perseverative speech through caregiver interviews. Nonexamples of perseverative speech included words such as conjunctions, prepositions, and articles often used repeatedly in conversations. Appropriate speech was recorded when a participant answered a question within the context of the question, were counting a tangible object or picture (as opposed to counting under breath for no apparent reason), discussed a novel topic not listed as perseverative, requested to go somewhere or to see someone (such as the bathroom or to ask a parent a question), or the first time they said the experimenter's name or another socially acceptable phrase used to gain attention (e.g., "hey" or "hello"). Appropriate speech was defined, in part, based on the absence of perseverative speech as described below for each participant.

Charlotte's perseverative speech included talking about her mother, movies, pajamas, church, her birthday, counting under her breath, and several words and phrases paired with an action (e.g., handstand, cartwheel) such as "yeah," "look" or "look at this," "how's that," "me too," "okay now," "that's funny," "wait," "watch this," and "I can do it." Paul's perseverative speech was defined as any verbalization on the topic of historical and literary figures (fictional or nonfictional) not related to current conversation. Examples included asking about historical and literary figures, quoting or referencing titles or lines of poems, books, movies, and TV shows, asking about countries or cities associated with an era related to previously mentioned figures, and reading aloud from a book.

### *Experimental Design*

We conducted the functional analyses of perseverative speech using a multielement design (Kennedy, 2005) with five conditions based on procedures described by Iwata, Dorsey, Slifer,

Bauman, & Richman (1982): (a) attention, (b) demand, (c) alone, (d) control, and (e) tangible. Following the initial analysis, we evaluated a function-based intervention (i.e., DRA+ Extinction (Ext) and/or DRA+ Ext + Prompt) within a withdrawal design to validate the results of the functional analysis.

### *Procedure*

Each participant visit lasted 40 to 60 min and included five 5-min functional analysis sessions (one per condition) or four to six treatment sessions. All conditions during the functional analysis occurred once every session, one session per day, with a random sequence occurring within each day. For each participant, sessions occurred at approximately the same time every day. The experiments did not record the random daily sequence of conditions for Paul, so his data are presented as daily sessions, rather than individual sessions.

For functional analyses, the experimenter used the following procedures. During the attention condition, the experimenter provided approximately 5 s of attention (i.e., a generic comment not requiring a participant response) contingent on verbal perseveration. During the demand condition, the experimenter asked participants to complete a nonpreferred academic or functional task, identified based on parent interview, teacher consultation, and initial observations. Any instances of perseverative speech during this condition produced a 20-s break from the task, with the task being represented after the time elapsed. During the tangible condition, the experimenter provided the participant with access to a highly preferred item, identified during preliminary interviews, contingent upon perseverative speech. During the alone condition, the experimenter left the participant alone in the room and recorded instances of perseverative speech using a video recorder. During the control condition, the experimenter provided each participant with

various preferred activities and delivered attention every 20 s in the form of social praise, physical contact (e.g., a pat on the back), and/or reciprocal play. Items unique to a condition were not present at other times.

During the baseline condition of the treatment evaluation, the experimenter implemented the same procedures as the attention condition of the functional analysis to establish an attention contingency for perseverative speech. During DRA + Ext (Charlotte only), the experimenter ignored perseverative speech (i.e., did not respond verbally and diverted eye contact) and provided attention contingent on appropriate speech. During DRA + Ext + Prompt, the experimenter ignored perseverative speech, provided attention contingent on appropriate speech, and delivered a prompt for every 1 min that the participant did not engage in appropriate speech. Prompts included statements and questions such as, "I have a dog named Lacey, would you like to talk about dogs," and "It has been raining a lot today, would you like to talk about the weather outside?"

#### *Response Measurement, Interobserver Agreement, and Procedural Fidelity*

All sessions were videotaped and subsequently verbalizations were coded using a 10-s partial interval recording system (Kennedy, 2005). Data were recorded from videotape in real time using INTMAN software downloaded onto hand held personal digital assistants (Tapp et al., 2006) for Charlotte or pencil and paper for Paul. Two independent data collectors scored responding for interobserver agreement (IOA) during no less than 31% of all sessions. Data were compared on an interval-by-interval basis and total IOA agreement per session was calculated by dividing the number of agreements by the number of agreements plus disagreements multiplied by 100%. Agreement on perseverative speech averaged 90% for Charlotte (range:

75% to 100%) and 88% for Paul (range: 65% to 100%). Agreement on appropriate speech during intervention sessions averaged 86% for Charlotte (range: 65% to 100%) and 90% for Paul (range: 70% to 100%).

Two independent observers scored procedural fidelity during 31% of sessions using a pencil and paper 10-s partial interval recording system while watching videos of sessions. Procedural fidelity included all elements of the functional analysis, intervention, and baseline procedures. Behaviors measured included whether or not the experimenter gave attention, a tangible, or escape following perseverative speech during functional analysis conditions, whether or not the experimenter gave attention following appropriate speech during intervention conditions, and how often the implementer gave attention during the control condition. Procedural fidelity across functional analysis conditions averaged 96% for Charlotte (range: 67% to 100%) and 84% for Paul (range: 40% to 100%). The low fidelity session (i.e., 40%) was the initial tangible condition in which items were provided 40% of the time the criterion behavior occurred. Procedural fidelity across intervention conditions averaged 93% for Charlotte (range: 85% to 100%) and 80% for Paul (range: 75% to 90%).

## RESULTS

The top panel of Figure 1 depicts the results of the functional analysis for Charlotte. Perseverative speech initially occurred during the attention ( $M = 49\%$ ), demand ( $M = 42\%$ ), and control ( $M = 44\%$ ) conditions. Perseverative speech occurred less frequently during the tangible ( $M = 26\%$ ) and alone ( $M = 33\%$ ) conditions. However, an accelerating trend occurred over the last three attention sessions that differentiated this condition from the others. The results suggest that positive reinforcement in the form of social attention maintained verbal perseveration for Charlotte.

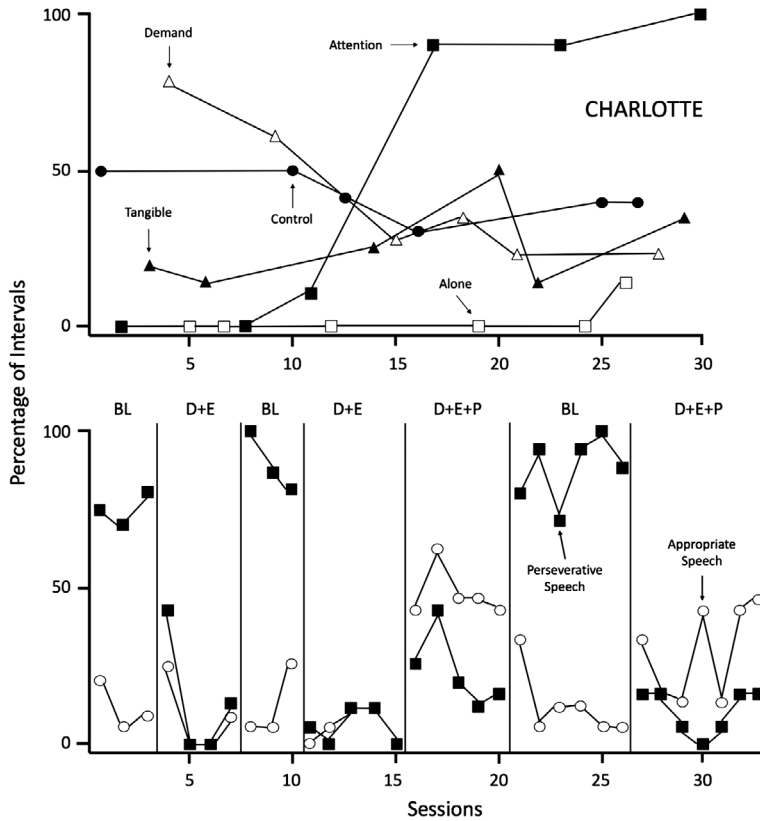


Figure 1. The top panel displays the percent intervals of perseverative speech for Charlotte. Functional analysis conditions included Alone, Attention, Control, Demand, and Tangible. The bottom panel shows the percent intervals of perseverative and appropriate speech. Baseline (BL) was a continuation of the attention condition shown in the top panel. Interventions were composed of differential reinforcement of alternative behaviors plus extinction (D + E) or differential reinforcement of alternative behaviors plus extinction and prompting (D + E + P).

The bottom panel of Figure 1 depicts the results of the treatment analysis conducted with Charlotte. During baseline, Charlotte displayed high levels of perseverative speech and low levels of appropriate speech. When DRA + Ext was implemented, Charlotte emitted lower levels of both perseverative and appropriate speech and this pattern was replicated in subsequent baseline and DRA + Ext phases.

To increase appropriate speech and maintain low levels of perseverative speech, we then tested a DRA + Ext + Prompt condition where the experimenter prompted appropriate speech. Appropriate speech increased to moderate levels in this condition, but perseverative speech also

increased relative to levels observed in DRA + Ext in the prior phase. Upon return to the baseline condition, high levels of perseverative speech and low levels of appropriate speech occurred. The second introduction of the DRA + Ext + Prompt condition decreased perseverative speech and resulted in moderate to low levels of appropriate speech.

Functional analysis outcomes for Paul are shown in the top panel of Figure 2. Perseverative speech occurred most consistently during the attention condition ( $M = 84\%$ ), followed by the tangible condition ( $M = 62\%$ ), the alone condition ( $M = 48\%$ ), the control condition ( $M = 30\%$ ), and then the demand condition

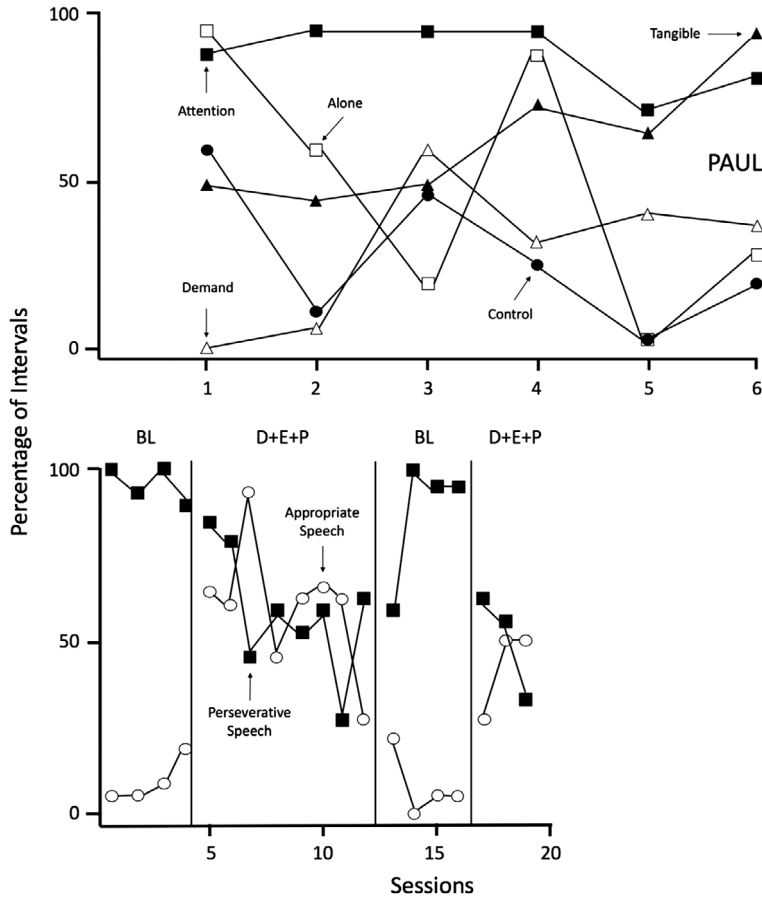


Figure 2. The top panel displays the percent intervals of perseverative speech for Paul. Functional analysis conditions included Alone, Attention, Control, Demand, and Tangible. The bottom panel shows the percent intervals of perseverative and appropriate speech. Baseline was a continuation of the attention condition shown in the top panel. Interventions were composed of differential reinforcement of alternative behaviors plus extinction (D + E) or differential reinforcement of alternative behaviors plus extinction and prompting (D + E + P).

( $M = 29\%$ ). The results indicate that perseverative speech for Paul was multiply determined by positive reinforcement in the form of social attention and access to tangible objects.

The bottom panel of Figure 2 depicts the results of the treatment analysis conducted with Paul. During the attention baseline, we observed high levels of perseverative speech and low levels of appropriate speech. The introduction of DRA + Ext + Prompt produced a moderate reduction in perseverative speech and a moderate increase in appropriate speech for

Paul. A return to baseline conditions replicated the perseverative and appropriate speech levels of the initial baseline. Reintroducing the DRA + Ext + Prompt condition again resulted in moderate levels of perseverative and appropriate speech for Paul.

## DISCUSSION

Our results show that the perseverative speech of two individuals with high-functioning neurodevelopmental disabilities can

be maintained by social attention from adults. These findings replicate two previous single case studies that showed a similar pattern of verbalizations being maintained by positive reinforcement in the form of attention (Fisher et al., 2013; Rehfeldt & Chambers, 2003).

Along with this direct replication of social reinforcement, our findings also systematically replicated and extended previous studies on function-based interventions for perseverative speech in individuals with high functioning ASD. That is, the results partially replicated the findings of Rehfeldt and Chambers (2003) and Fisher et al. (2013) by showing that DRA plus extinction effectively reduced perseverative speech for Charlotte, though no concomitant increase in appropriate speech occurred until the prompting procedure was added. The addition of a verbal prompt to the intervention successfully increased appropriate verbalizations. A similar intervention of DRA plus extinction and prompt also successfully reduced perseverative speech and increased appropriate speech for Paul.

Potential reasons for the beneficial effects of the prompting procedure observed in this investigation include: (a) the adult-delivered prompt may have (a) functioned as a discriminative stimulus for emitting appropriate speech pertaining to new conversational topics; (b) functioned as a conditioned motivating operation momentarily increasing the value of talking about different topics; or (c) brought appropriate speech about novel conversational topics into contact with the positive reinforcement contingency. At this juncture, these hypothesized behavioral mechanisms remain speculative, but they warrant further investigation to assess why prompting may be a necessary component of differential reinforcement interventions for decreasing perseverative speech with some individuals.

In addition to identifying social attention as a maintaining variable, the perseverative speech of Paul also appeared to be maintained by

positive reinforcement in the form of tangibles. This demonstration adds to the possible maintaining conditions of perseverative speech and shows that such behaviors can be multiply determined. Both findings warrant further investigation with larger cohorts of participants, given that our study involved just two participants and the prior two studies on this topic involved just one participant each (Fisher et al., 2013; Rehfeldt & Chambers, 2003).

It is worth noting that we observed less robust decreases in perseverative speech for Paul and less robust increases in appropriate speech for both participants in the current study than did Rehfeldt and Chambers (2003) with their participant, Vince, and Fisher et al. (2013) with their participant, Derek. The observation that Paul's perseverative speech appeared to be multiply determined might help explain why we did not observe a complete reduction in his perseverative speech. Some of his verbalizations could have occurred because the establishing operation for tangible reinforcement may have been in effect during the treatment even though a contingency between perseverative speech and tangible reinforcement was not. Future efforts may consider the design of interventions for multiply determined perseverative speech and whether, as a result, more robust declines in perseverative speech occur.

It remains less clear why there were not large increases in appropriate speech when the experimenter prompted and delivered differential reinforcement for this response for both participants. One possibility is that our participants had less well-developed verbal repertoires for appropriate speech relative to the participants in prior studies. If this represents the primary reason for the less than stellar gains in appropriate speech, it suggests that additional teaching procedures (e.g., video or peer modeling) may be required to produce more robust increases in appropriate speech for some participants. Future research should more thoroughly assess participants' receptive and expressive vocabulary

to better situate the effectiveness and nature of prompting. Again, these findings may set the occasion for additional analyses of perseverative speech with larger cohorts of individuals with high-functioning ASD and related neurodevelopmental disorders.

## REFERENCES

- Fein, D., Green, L., & Waterhouse, L. (2001). Autism and pervasive developmental disorders. In H. S. Friedman (Ed.), *The disorders: Specialty articles from the encyclopedia of mental health* (pp. 97–106). <https://doi.org/10.1016/B978-012267805-9/50011-0>.
- Fisher, W. W., Rodriguez, N. M., & Owen, T. M. (2013). Functional assessment and treatment of perseverative speech about restricted topics in an adolescent with asperger syndrome. *Journal of Applied Behavior Analysis, 46*, 307–311. <https://doi.org/10.1002/jaba.19>.
- Grosberg, D., & Charlop, M. H. (2017). Teaching conversational speech to children with autism spectrum disorder using text-message prompting. *Journal of Applied Behavior Analysis, 50*, 789–804. <https://doi.org/10.1002/jaba.403>.
- Hanley, G. P., Iwata, B. A., & McCord, B. E. (2003). Functional analysis of problem behavior: A review. *Journal of Applied Behavior Analysis, 36*, 147–185. <https://doi.org/10.1901/jaba.2003.36-147>.
- Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities, 2*, 3–20. [https://doi.org/10.1016/0270-4684\(82\)90003-9](https://doi.org/10.1016/0270-4684(82)90003-9).
- Kang, E., Gadow, K. D., & Lerner, M. D. (2019). Atypical communication characteristics, differential diagnosis, and the autism spectrum disorder phenotype in youth. *Journal of Clinical Child and Adolescent Psychology, 15*, 1–15, 13. <https://doi.org/10.1080/15374416.2018.1539912>.
- Kennedy, C. H. (2004). Research on social relationships. In E. Emerson, C. Hatton, T. Paramenter, & T. Thompson (Eds.), *International handbook of applied research in intellectual disabilities* (pp. 297–310). London: Wiley.
- Kennedy, C. H. (2005). *Single-case designs for educational research*. Boston: Allyn and Bacon.
- Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure: Alternative Education for Children and Youth, 54*, 275–282. <https://doi.org/10.1080/10459881003785506>.
- Rehfeldt, R. A., & Chambers, M. R. (2003). Functional analysis and treatment of verbal perseverations displayed by an adult with autism. *Journal of Applied Behavior Analysis, 36*, 259–261. <https://doi.org/10.1901/jaba.2003.36-259>.
- Tapp, J., Ticha, R., Kryzer, E., Gustafson, M., Gunnar, M. R., & Symons, F. J. (2006). Comparing observational software with paper and pencil for time-sampled data: A field test of Interval Manager (INTMAN). *Behavior Research Methods, 38*, 165–169. <https://doi.org/10.3758/BF03192763>.

Received June 6, 2019

Final acceptance September 30, 2019

Action Editor, Wayne Fisher