A Functional Analysis of Non-Vocal Verbal Behavior of a Young Child With Autism

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The functions of an American Sign Language response were experimentally evaluated with a young boy diagnosed with autism. A functional analysis procedure based on that reported by Lerman et al. (2005) was used to evaluate whether the target sign response would occur under mand, tact, mimetic, or control conditions. The target sign was observed most often in the mand and mimetic test conditions, very seldom in the tact test condition, and never in the control condition. These results support those reported by Lerman et al. and extend previous research by evaluating a non-vocal verbal response using a brief multi-element arrangement with a single control condition. The implications for language assessment and suggestions for future research are discussed.

Key words: American Sign Language, autism, functional analysis, verbal behavior

Recently, Lerman et al. (2005) reported an experimental analysis of the verbal behavior of four young children with developmental disabilities, based on functional analysis procedures developed by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Lerman et al. alternated separate test and control conditions for each of several vocal verbal operants (mand, tact, intraverbal; see Skinner, 1957) according to a sequential multiphase multielement arrangement.

Overall, the analysis appeared to identify a clear function for verbal operants across all participants and the functions seemed to correspond to those identified in Skinner's functional taxonomy. This step seems a promising one for the future of verbal behavior research. However, the Lerman et al. analysis was lengthy because a separate control condition was arranged for each verbal operant tested and the experimental conditions were evaluated sequentially; lengthy assessments might not lend themselves to frequent use in research or practice.

More recently, Kelley et al. (2007) reported the conduct of a verbal behavior functional analysis employing test and control conditions similar to those described in Lerman et al. (2005) but incorporating a discrete-trial procedure in which 10 trials were arranged per experimental session and responding was reported as percentage of trials with appropriate verbal responses. Despite the procedural alterations employed, their results mostly support the findings of Lerman et al., although mand responses occurred less often than in the Lerman et al. study.

The purpose of the present study was to assess the reliability of the general functional analysis strategy described by Lerman et al. (2005) and extend that work by assessing the occurrence of nonvocal verbal behavior (an American Sign Language [ASL] response) and utilizing a brief multi-element experimental design with a single control condition. Additionally, intraverbal conditions such as those employed by Lerman et al. and Kelley et al. (2007) were omitted, as the means by which one would select the appropriate antecedent verbal response forms is unclear, thereby precluding any clear interpretation of the intraverbal condition. Essentially, to rule out an intraverbal function one would have to test an extensive array of antecedent verbal stimuli, something that was not possible in the current study or likely to be feasible in practice.

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METHOD

Participant and Setting

Mark, a 7-year-old boy diagnosed with autism, participated. Mark communicated using one-word signs but did not evidence any vocal language. All sessions were conducted in a quiet, secluded room of participant's home that contained chairs, tables, and the materials required for each experimental condition.

Response Measurement and Reliability

Based on a parent interview, the ASL sign for "soda pop" was selected as the target response because it was one of the few signs Mark was observed to make consistently. However, Mark's parents indicated that he was not allowed soda and that this sign was used to request flavored water, instead. The sign "soda pop" was scored if Mark was observed to make a loose fist with his left hand and place the thumb and index finger of his right hand into the left fist, followed by the striking of the right palm onto the left fist. Frequency measures of the target sign were collected during all experimental conditions. Four trained graduate students collected data using hand-held computers equipped with behavioral data collection software. Data are expressed as the total number of responses observed per experimental session. A second independent observer collected data on the target response for 30% of all sessions. Interobserver agreement scores were calculated by dividing the smaller number of responses by the larger number of responses and multiplying by 100 to yield a percentage. Agreement levels averaged 91.7% across sessions. The range was 50%–100%, but only a single session resulted in 50% agreement (all other sessions resulted in 100%). For that session, one observer scored a single response and the other observer scored two responses.

Experimental Design and Procedure

A single-case multi-element design was used in which four experimental conditions (3 test and 1 control) were alternated in a counterbalanced fashion. All experimental sessions were 10 min in duration, except for the third tact test session, which was shortened because the supply of flavored water was exhausted. Each

condition is briefly described below (see also Lerman *et al.*, 2005).

Mand. This condition assessed whether the target response could be occasioned by a contrived motivating operation. Mark had no access to flavored water 60 min prior to the experimental session. At the start of the experimental session, Mark was shown the flavored water and it was then placed out of sight. Mark was allowed to sign "soda pop" at any time throughout the session. Each time Mark signed "soda pop," he was provided 20 s access to the flavored water. If the sign did not occur within 20 s, the therapist asked Mark, "What do you want?" If the sign did not occur within 1 min following the prompt, the item was removed from the bag. All behavior other than the target response was ignored.

Tact. This condition assessed whether the target response could be occasioned by a nonverbal stimulus. Mark had continuous access to the flavored water for 60 min prior to and during the entire experimental session. The water was replenished if consumed. Every 20 s, the therapist asked Mark, "What is it?" while holding the object in close proximity to him or pointing to the item. If Mark signed "soda pop" in response, brief verbal praise was delivered (but did not include the name of the item). All behavior other than the target response was ignored.

Mimetic. This condition assessed whether the target response could be occasioned by a nonvocal verbal stimulus sharing point-to-point correspondence and formal similarity (see Michael, 2004). Mark had continuous access to the flavored water for 60 min prior to and during the entire experimental session. The water was replenished if consumed. Every 20 s, the therapist stood in front of Mark and modeled the sign "soda pop." If Mark signed "soda pop" immediately after the model, brief verbal praise was delivered (but did not include the name of the item). All behavior other than the target sign was ignored.

Control condition. This condition served as a control for those test conditions (Mimetic and Mand) in which responding was observed. Mark had continuous access to the flavored water for 60 min prior to and during the entire experimental session. The water was replenished if consumed. Throughout the session, the therapist remained seated across the room from Mark, but did not talk to, look at, or

Figure 1. Rate of signs per minute observed under each of the four experimental conditions.

otherwise interact with him. No programmed consequences were provided for the target response or any other behavior.

Results and Discussion

Figure 1 depicts the results of Mark's functional analysis. The mimetic and mand conditions produced the highest rate of signing. Mark signed "soda pop" an average of 1.5 times per minute (range 1 to 1.9) in the Mand condition, 2.2 times per minute (range 1.3 to 3.1), in the Mimetic condition, with the Tact and Control conditions occasioning almost no responding. These results suggest that the verbal responses occurred only under specific sources of stimulus control, similar to those described by Skinner (1957).

The results support those of Lerman et al. (2005) insofar as clear functions were suggested by the experimental analysis, and extend their research by using a brief multielement experimental design with a nonvocal verbal response. Additionally, like Lerman et al., but unlike Kelley et al. (2007), a mand function was identified for the response form observed. This brief assessment format might prove a useful tool to identify the functions of existing language for individuals with language delays so that intervention programs can be designed to target specific functions absent from their current repertoire. It also could be used to evaluate the effectiveness of on-going language

acquisition programs by assessing whether the verbal operants being taught are occurring under the appropriate stimulus conditions outside of the instructional situation. For example, Mark's parents reported that he had been taught to "label" the flavored water using the sign "soda pop," but he was not observed to do so under the tact condition.

The results of the brief functional analysis might also suggest ways in which an existing intervention can be modified to increase its efficacy. For example, if an individual exhibits high rates of responding in a mimetic condition but low rates in a tact condition, a successful intervention might employ modeling the desired response to teach the targeted tact. For example, when teaching Mark to sign "soda pop" as a tact, we might first ask, "What is it?" and immediately model the correct response for Mark to imitate. Reinforcement would then be delivered for imitation of the desired response. The brief assessment format requires less time to implement than a full functional analysis. Clinicians can quickly establish what verbal operants need to be targeted and more rapidly develop an intervention. When time is a factor due to financial constraints on assessment length or other variables, the brief functional analysis might provide a reasonable starting point for clinicians to design or evaluate an intervention.

Several limitations of the current study warrant mention. First, only a few sessions were

conducted for each condition during the analysis and a more extended analysis might yield different results. Second, although the presentation of the test and control conditions in a multielement arrangement was time efficient, it introduces the possibility of carry-over effects among conditions. Such carry over might lead to stimulus generalization or transfer of stimulus control after repeated exposure to the varying arrangements. This might explain the initial absence of signing in the tact condition for Mark and the subsequent emergence of signing under the same condition during Session 3, following repeated exposure to the other test conditions. This could have resulted from the similarity of the tact condition to the mimetic condition, the latter of which provided multiple opportunities for Mark to contact reinforcement for signing "soda pop." In both the tact and mimetic condition, continuous access to the flavored water was provided before and during the sessions and the experimenter presented a verbal discriminative stimulus, following which Mark could produce reinforcement by signing "soda pop."

A third limitation concerns the length of time that Mark was denied access to the flavored water prior to mand sessions being based on the method reported by Lerman *et al.* (2005) rather than on an empirically established standard. Evaluation of the optimal length of deprivation prior to mand conditions and the optimal duration of access prior to other test and control conditions are important areas for future research. Fourth, the control condition was based in part on the Lerman *et al.* report and it is unclear whether it adequately served this function. A single control condition matching the mand control described by Lerman *et al.* was used in the current study for the sake of brevity due to time constraints imposed by the family. Because the item was present in the control condition, it differed from the tact control condition described by Lerman *et al.* because a potentially critical controlling variable for the tact (sight of the item) was not eliminated. Although this poses a potential problem under some circumstances, it does not appear to affect the interpretation of these results, as responding almost never occurred in the tact conditions. Moreover, tact responding was not evident absent a verbal prompt such as, "What is it?"

If responding had occurred under tact conditions, then a more appropriate tact control condition would have been necessary to demonstrate experimental control. For efficient clinical application, it might prove useful to conduct control conditions only for those test conditions in which responding occurs. The appropriate arrangement of control conditions is an important consideration for future research and practice.

Of potential relevance to the functional analysis of verbal behavior is that Skinner's (1957) taxonomy describes the characteristic controlling variables for the various response *forms* of the verbal operants, rather than those characteristic variables controlling the *occurrence* of a verbal response. That is, Skinner described those variables determining what was said if anything was said at all. Understanding why or whether a response was made requires an analysis of controlling conditions that are not necessarily specific to verbal behavior. Therefore, it seems appropriate that a valid experimental analysis of verbal behavior would arrange test and control conditions that produce similar rates of responding but that differ with respect to the response form observed. Future research should evaluate ways to produce similar rates of verbal responding across experimental conditions while differentiating the response form observed, especially if empirical support for the general validity of Skinner's analysis is to be inferred. Toward this end, it is important that researchers also investigate the verbal repertoires of typically developing participants to determine the generality of findings from experimental analyses with other populations.

That verbal behavior is undoubtedly under multiple sources of control and would therefore not correspond neatly to the various elementary verbal operants also is relevant to the design and conduct of verbal behavior functional analyses. For example, with respect to the emission of a verbal response, saying or signing "soda pop" in the presence of a bottle of soda is controlled not only by the sight of the bottle, but also by other characteristics of the situation such as a history of reinforcement in the presence of certain members of the verbal community, motivating conditions related to characteristic consequences (e.g., attention) for saying or signing under similar circumstances, etc. With respect to the

specific topography of the response, saying or signing "soda pop" (as opposed to "water" or "juice") might be controlled by a recent history of deprivation combined with the presence of a bottle of soda (as opposed to a bottle of water or cup of juice). Additionally, a history of reinforcement for certain response forms in the presence of certain members of the verbal community when other controlling conditions are held constant might result in "soda" being emitted in one situation and "pop" in another.

In the functional analysis methodology utilized in the current study, as well as that described by Lerman et al. (2005) and extended by Kelley et al. (2007), the functional independence of the various verbal operants is assumed and fairly discrete units of verbal responding are targeted, otherwise nondifferential responding would be observed across experimental conditions and any clear interpretation of function would thereby be precluded. The problem of multiple control, then, remains to be addressed. With the present methodology, it is unclear in any given situation whether undifferentiated responding is evidence of a failure to isolate the specific source of control over the target response, or evidence that the response is multiply controlled. How, or if, this issue can be addressed is unclear, but it is a matter that deserves attention.

Finally, the empirical validation of the results from functional analyses of verbal behavior is important. For example, whether Mark's failure to sign "soda pop" in the tact condition provides evidence that Mark cannot tact "soda pop" or indicates a failure of the tact condition to adequately assess the function of the verbal operant is unclear at the present time. The latter possibility deserves considerable attention. There is a sizeable research literature validating the functional analysis methodology developed by Iwata et al. (1982/1994), mostly through the evaluation of clinical interventions based on the results of such functional analyses. This approach to empirical validation seems inappropriate for verbal behavior analyses, but alternative strategies are possible. One ap-

proach might be to establish several novel verbal operants under specific sources of stimulus control and have an independent evaluator conduct the recommended test and control conditions to see if the functional analysis identifies the correct function of each verbal operant.

In summary, the verbal behavior functional analysis method described by Lerman et al. (2005) might prove a useful tool for both clinicians and researchers working in the area of verbal behavior. The extent to which such a method might prove useful is unclear at the present time, but a number of interesting research possibilities exist. At minimum, this method might ultimately serve as a useful clinical assessment tool to evaluate verbal behavior intervention programs even if it proves less useful as a general experimental model.

REFERENCES

- Eshleman, J. W. (1991). Quantified trends in the history of verbal behavior research. *The Analysis of Verbal Behavior*, 9, 61–80.
- Iwata, B. A., Dorsey, K. F., Slifer, K. J., Bauman, K. J., & Richman, G. S. (1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, 27, 197–209. (Reprinted from *Analysis and Intervention in Developmental Disabilities*, 2, 3–20, 1982)
- Kelley, M. E., Shillingsburg, M. A., Castro, M. J., Addison, L. R., LaRue, R. H., Jr., Martins, M. P. (2007). Assessment of the functions of vocal behavior in children with developmental disabilities: A replication. *Journal of Applied Behavior Analysis*, 40, 571–576.
- Lerman, D. C., Parten, M., Addison, L. R., Vorndran, C. M., Volkert, V. M., & Kodak, T. (2005). A methodology for assessing the functions of emerging speech in children with developmental disabilities. *Journal of Applied Behavior Analysis*, 38, 303–316.
- Michael, J. (2004). *Concepts and principles of behavior analysis* (Rev. ed.). Kalamazoo, MI: Society for the Advancement of Behavior Analysis.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.