An Experimental Analysis of Acquisition, Generalization, and Maintenance of Naming Behavior in a Patient with Anomia

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The aphasia literature is replete with descriptive studies regarding the effects of cueing strategies on word retrieval behavior (Berman and Peele, 1967; Marshall, 1976; Webb and Love, 1977; Pease and Goodglass, 1979). Although a variety of cues have been incorporated into treatment of naming disorders, research aimed at assessing the value of these cues in terms of acquisition, generalization and maintenance of naming behavior are limited and results are equivocal. Rockford and Williams (1962) and Linebaugh and Lehner (1977) investigated the effectiveness of cueing hierarchies on naming behavior. Results of these studies indicated that cues were effective in facilitating naming responses. In both of these studies hosever, subjects learned to respond with fewer cues. That is, the ability to respond without provision of cues was not assessed. Conversely, Brookshire (1975) attempted to train naming by requiring aphasic subjects to imitate words. Analysis of the acquisition data from this study indicated that naming ability was not improved following treatment. Limited and contradictory data are also available in terms of generalization. Weigel-Crump and Koenigsknecht (1973) examined the effects of a nonspecific stimulation treatment on generalization of naming behavior. Although generalization both within and across superordinate categories was reported, these results should be interpreted with caution since control subjects were not included in this study and examiner reliability was not reported. Alternately, Brookshire (1975) reported that generalization was negligeable following treatment. Given the paucity of research available in this area and the inconsistency in findings, the need for further investigation is evident.

PURPOSE

The purpose of the present study was to investigate the effects of a specific cueing hierarchy on the acquisition, generalization, and maintenance of naming behavior in a patient with anomic aphasia. Specifically, the following questions were posed: 1) What are the effects of treatment on the acquisition of naming responses in a patient with anomic aphasia? 2) Does generalization of naming behavior occur to untrained, semantically related lexical items? 3) Are trained naming responses maintained following treatment?

METHOD

Subject. The subject used in the study was a 64-year-old female with anomic aphasia secondary to left cerebral vascular accident. She was four years post onset at the time of testing and did not have history of recurrent neurological involvement. Evidence of apraxia of speech was not observed upon administration of the Mayo Clinic Apraxia Battery (Wertz et al., 1978) and hearing acuity was within normal limits across speech frequencies as revealed by pure tone screening.

The diagnosis of anomia was based upon administration of the Porch Index of Communication Abilities (PICA) (Porch, 1967) and the Boston Diagnostic Aphasia Examination (BDAE) (Goodglass and Kaplan, 1972). Analysis of performance on individual subtests revealed behaviors consistent with anomic aphasia. Specifically the subject evidenced marked impairment in the ability to name while auditory comprehension and repetition skills were relatively unimpaired. The following subtest scores were obtained (Table 1). Additional pretesting revealed that the subject could repeat and auditorily comprehend all stimuli used in the study, however she was unable to name them.

Table 1. PICA and BDAE subtest scores.

PICA		BDAE	
Subtest	Score	Subtest	Score
		Auditory Comprehension	
VI	14.6	Word Discrimination	z=+1
X	15.0	Body Part Identification	z=+1
		Commands	z=0
		Repetition	
XII	15.0	Word Repetition	z=+1
		Hi Probability	z+1
		Lo Probability	z=0
		Naming	
IV	6.8	Responsive Naming	z=-1
		Confrontation Naming	z=-1
		Animal Naming	z=-1
		Body Part Naming	z=-1

Stimuli. Visual stimuli included 40 monosyllabic or bisyllabic nouns matched for spoken and written frequency of occurrence (Thorndike and Lorge, 1959; Jones and Wepman, 1966). All stimuli were displayed in black and white on 4 x 6 inch cards. The 40 stimulus items were divided into 4 word lists of 10 words each. Items on the first list were semantically paired with items on the third list and items on the second list were semantically paired with those on the fourth list. For example, the word "plane" appeared on the first list while the word "train" appeared on the third list. Only

items for which three normal, non-brain-damaged subjects between the ages of 55 and 70 provided the expected lexical response to all picture stimuli and cues were used in the study.

DESIGN

A multiple baseline design across behaviors was used in this investigation (Baer et al., 1968; Hersen and Barlow, 1976). In a design of this nature, a number of independent behaviors are selected and measured in the baseline condition or A phase. In the B phase, treatment is sequentially applied to one behavior at a time while baseline is maintained for all other behaviors. Experimental control is demonstrated when behavioral change occurs only when treatment is applied. A design of this nature is particularly appropriate for investigation of generalization (LaPointe, 1978). In the present study, the four independent behaviors examined were the word lists previously described. The phases of the study were as follows:

Baseline. In the baseline condition, naming performance was assessed for each word list on four separate occasions. The visual stimuli were individually presented in random order and the subject was asked to name them. No feedback was provided during this condition.

Treatment. In the treatment condition, each word list was sequentially trained while baseline continued to be collected on untrained lists. Training was continued on individual word lists until a 90% criterion was reached or until 20 treatment sessions had been completed. Treatment entailed random presentation of a visual stimulus from the word list in training and its associated cueing hierarchy. Contingent verbal feedback was also provided.

The cueing hierarchy used to facilitate naming consisted of 1) a 3-6 syllable sentence completion cue (i.e., You fly in an .....), 2) the sentence completion cue plus a phonetic cue, and 3) the sentence completion cue plus a verbal model. (Target items and cueing hierarchies are contained in the appendix.) Upon presentation of a visual stimulus, a sentence completion cue was provided. The subject was given 10 seconds to respond. If a correct response was not elicited, the remaining cues in the hierarchy were presented. The first verbal response to occur within the 10 second time interval following presentation of a stimulus was scored. A response was considered to be correct when an intelligible verbal production of the target lexical item was elicited. Word productions in which one phoneme was distorted, substituted, added or omitted were permitted unless word boundaries were crossed. All other responses were scored as incorrect.

The subject was seen 2 to 3 times per week for a total of 84 sessions. The subject did not receive concurrent treatment of any kind during the course of the investigation. An independent observer scored responses from every third experimental session. Point-to-point reliability was 95% across all samples.

RESULTS

Results of this investigation provided information concerning the acquisition, generalization and maintenance effects of treatment on naming behavior in a subject with anomia. With regard to acquisition, the cueing hierarchy used in training was effective in facilitating naming behavior

for the subject under study. The total number of correct naming responses is depicted in Figure 1 for each phase of the investigation. Examination of the data reveals that average naming performance during the baseline phase was below 20% on all word lists. When treatment was sequentially applied to each word list, acquisition was readily evident for the treated lists while baserate performance was maintained on untrained lists. As can be seen, the subject reached a 90% level of correct responding on all word lists during the treatment phase.

Further examination of Figure 1 reveals the effects of treatment on generalization across semantically paired word lists. Recall that lexical items contained on the first list (list A1) were semantically paired with those on the third list (list B1) and items contained on the second list (list A2) were semantically paired with those on the fourth list (list B2). As can be seen, when treatment was applied to list A1, performance on list B1 (the semantically paired list) remained stable and unchanged. Similarly, when treatment was applied to list A2, performance on list B2 was maintained at baserate. These data demonstrate that the behaviors under study were independent, since a general effect was not observed after treatment had been applied to one behavior. These data further suggest that some patients' naming behavior may not generalize to semantically related untrained items when naming is trained using a cueing hierarchy. Furthermore, these data raise questions regarding the nature of naming disorders and the process of word retrieval. Naming disturbances are often described as an impairment in the activation and reliability of access mechanisms to the lexicon (Weigel-Crump, 1973; Seron et al., 1979 and others). According to this notion, therapy is viewed as a mechanism for improving the general retrieval process such that naming of both trained and untrained items would be expected to improve simultaneously. The present data do not lend support to this view.

Finally, the maintenance effects of treatment can be seen by inspection of the maintenance phase in Figure 1. The data demonstrate that naming performance on trained word lists was maintained at a level superior to baseline throughout the maintenance phase. This phase represented a time period of several months following treatment. Mean percent correct during the baseline and maintenance phases was calculated for lists A1, A2 and B1. A marked difference in performance was seen before and after treatment. That is, mean performance prior to treatment was less than 20% on all word lists, while mean performance following treatment ranged from 57 to 65% correct. As might have been expected, performance was maintained at a rate below that noted during treatment. These data suggest that strategies specifically designed to facilitate carryover might have been beneficial for this patient.

In summary, the cueing hierarchy used in the present investigation appeared to be effective in facilitating naming behavior for the anomic patient under study. In addition, trained naming behavior was maintained for several months subsequent to treatment at a performance level superior to baseline. However, generalization to untrained, semantically paired stimuli was negligible. These findings are particularly interesting in terms of the applied generalization literature. Marholin, Siegel and Phillips, 1976, suggest, for example, that it is commonly assumed that generalization will occur automatically whenever treatment is successful. Although the present data do not support this notion, replication of these findings is necessary in order to infer similar results for other brain damaged patients with aphasia. The present data suggest, however, that

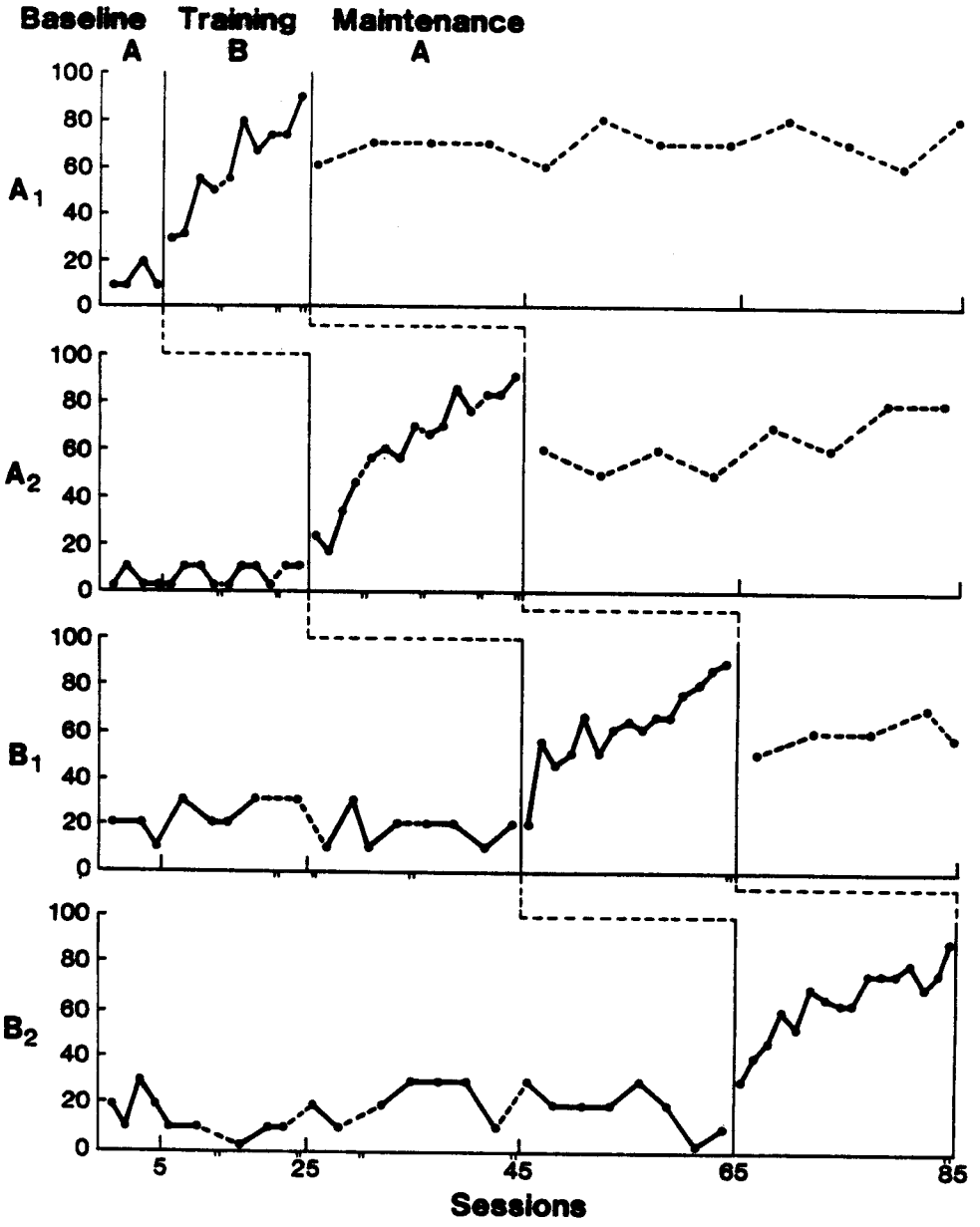

Figure 1. Percent correct naming for a patient with anomic aphasia on word lists A1, A2, B1, and B2.

aphasiologists should adopt Baer, Wolf and Risley's, 1968, suggestion that "generalization should be programmed rather than expected or lamented."

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APPENDIX

List A-1

bread	You bake a loaf of _____. You bake a loaf of /br/. You bake a loaf of bread.
tie	You wear a shirt and _____. You wear a shirt and /t/. You wear a shirt and tie.
train	You ride on a _____. You ride on a /tr/. You ride on a train.
kite	You fly a _____. You fly a /k/. You fly a kite.
moon	You land on the _____. You land on the /m/. You land on the moon.
towel	You dry with a _____. You dry with a /t/. You dry with a towel.
chair	You sit on a _____. You sit on a /tʃ/. You sit on a chair.
cow	You milk a _____. You mild a /k/. You milk a cow.
plate	You put food on a _____. You put food on a /p/. You put food on a plate.
stove	You cook on a _____. You cook on a /s/. You cook on a stove.

List A-2

church	You pray in a _____. You pray in a /tʃ/. You pray in a church.
ear	You hear with your ___. You hear with your /i/. You hear with your ear.
snake	You kill the rattle _____. You kill the rattle /s/. You kill the rattle snake.
brush	You paint a house with a _____. You paint a house with a /br/. You paint a house with a brush.
glass	You drink from a _____. You drink from a /gl/. You drink from a glass.
pen	You write with a ___. You write with a /p/. You write with a pen.
blanket	You cover up with a _____. You cover up with a /bl/. You cover up with a blanket.
nail	You hang a picture with a ____. You hang a picture with a /n/. You hang a picture with a nail.
ruler	You measure with a _____. You measure with a /r/. You measure with a ruler.
broom	You sweep with a _____. You sweep with a /br/. You sweep with a broom.

List B-1

pie	You bake an apple ___. You bake an apple /p/. You bake an apple pie.
socks	You wear shoes and _____. You wear shoes and /s/. You wear shoes and socks.
airplane	You fly in an _____. You fly in an /ɛ/. You fly in an airplance.
sled	You slide on a ____. You slide on a /s/. You slide on a sled.
cloud	Rain comes from a _____. Rain comes from a /k/. Rain comes from a cloud.
soap	You wash your hands with ____. You wash your hands with /s/. You wash your hands with soap.
desk	You work at a ____. You work at a /d/. You work at a desk.
duck	You hunt for a ____. You hunt for a /d/. You hunt for a duck.
knife	You cut with a _____. You cut with a /n/. You cut with a knife.
sink	You run water in the ____. You run water in the /s/. You run water in the sink.

List B-2

barn	You stack hay in the ____. You stack hay in the /b/. You stack hay in the barn.
foot	You kick a ball with your ____. You kick a ball with your /f/. You kick a ball with your foot.
mouse	You catch a _____. You catch a /m/. You catch a mouse.
comb	You fix your hair with a ____. You fix your hair with a /k/. You fix your hair with a comb.
bowl	You mix in a ____. You mix in a /b/. You mix in a bowl.
pencil	You draw with a _____. You draw with a /p/. You draw with a pencil.
pillow	You rest your head on a _____. You rest your head on a /p/. You rest your head on a pillow.
hammer	You pound with a _____. You pound with a /h/. You pound with a hammer.
tape	You stick it together with ____. You stick it together with /t/. You stick it together with tape.
floor	You walk on the _____. You walk on the /fl/. You walk on the floor.

DISCUSSION

Q: Could you again explain the procedures used during the maintenance phase?

A: Procedures used during maintenance were identical to those used during the baseline phase. That is, the subject was presented with a picture and asked to name it. No cues or feedback were provided.

Q: Do you have any idea if naming of trained items improved during spontaneous speech?

A: I do have an idea. However, the subject's naming performance was not directly measured in spontaneous speech, so my response to that is purely subjective. I can say that she used targeted items during spontaneous speech following training. However, I cannot comment on the frequency of that behavior relative to pretraining.

Q: In choosing your training items, do you think that you might have seen a difference in generalization if you had selected words that the patient presented to you as paraphasia rather than selecting words on the basis of frequency of occurrence in the language?

A: You're suggesting that we might have determined through pretesting specific words on which the patient evidenced paraphasic errors and incorporated them into treatment. I don't think that would have made a difference in acquisition or generalization. The subject was severely anomic and evidenced minimal literal and/or verbal paraphasias. Her output was characterized by circumlocutory speech. It would have been difficult to determine specific vocabulary that was difficult for her.

Q: Obviously I'd like to thank you for the very nice data. It allows us to raise some good questions for future research both in terms of theory and behavior. One question is, one could look at your data and ask the question, is there really processing that one goes through in naming and naming generalization?

And two, one could ask, what was maintaining that naming behavior during the maintenance phase? Could you give us insight into how one might use those maintaining behaviors to facilitate generalization?

A: I'll respond first to the question directed toward the naming process. You're right, the notion that naming is a process is questioned by the present data. At least for this patient, naming did not generalize to untrained words as might have been expected according to a process notion. For some patients, then, generalization may not occur following naming training.

In response to your second question (What was maintaining her behavior?), we do have some preliminary data. That is, that during treatment it was noted that the patient began to generate a self-cueing strategy--she orally spelled target words prior to naming them. This behavior occurred within the 10 second response interval. What we're doing with that now is analyzing the acquisition of self-cueing behavior in relation to naming behavior. Preliminary analysis suggests that the behaviors are parallel. Further, there appears to be a relationship between those items that were maintained in the maintenance phase and those items on which she successfully self-cued during the acquisition phase.

Q: I'd like to make a comment. To say that the patient could not generalize may be stepping out a little too far. What you can say is given these training procedures, the patient did not generalize.

A: That's exactly right. Obviously, we cannot say that this same effect will be seen for all patients or when other treatment procedures are used. What's important is that these data indicate that for some patients we can't assume that generalization will occur. In addition, the behavioral literature indicates that that's a poor assumption regardless of theory.

Q: I think it's a poor assumption given the particular therapy that you used. You may have seen more generalization had you used a different therapy approach. Perhaps a more elaborate procedure would have heightened generalization of the word-retrieval process. Also, I wonder what you were referring to with regard to methods that might facilitate generalization. What did you have in mind?

A: First, I'd like to say that I agree that a different type of treatment might facilitate greater generalization. At the present time however, data are not available in the literature to suggest what these treatments are. Studies using a "stimulation" approach to naming discussed previously were confounded and procedures used during training were not specifically described. We need further controlled study to determine what types of treatments will facilitate generalization.

With regard to methods that might facilitate generalization, I am specifically referring to methods described by Stokes and Baer, 1977. In that article, the authors outlined numerous strategies which might facilitate generalization. One method which is particularly appropriate for aphasiologists is to "mediate generalization" by training self-cueing strategies such that both trained and untrained items can be accessed. Another method is to train sufficient exemplars—both response exemplars and stimulus exemplars. For example, we may need to train a sufficient number of items within a response class (i.e., nouns) before generalization will occur to other items within that class. Similarly, in terms of stimulus generalization, we may need to train a response to occur across stimuli (i.e., in other settings or with other examiners) before we can expect that the trained response will generalize to new stimulus situations. The important point here is that we need continually to probe for generalization across responses and environments such that we can determine when generalization has occurred.

Q: With respect to the genralization issue and naming I think it's important to take into account that there are a number of different components of the naming process and a number of different stages. To expect generalization you need to have determined at which stage or stages the process is breaking down so that you can facilitate the particular component that's disturbed. I think that that maybe a component that we need to understand is generalization. They're not generalizing, but why? What was broken down and what were we treating? When you do a naming task there are so many things going on besides just retrieving the word, I think it's important to ferret out these things.

Q: There are things you can look for that will tell you to some extent what it is you're working on. For example, a sentence completion cue,

intuitively, will probably facilitate naming in someone that has a word retrieval problem but it probably will not be facilitative for someone who can't comprehend. Responses to the strategy that you provide for the patient are dependent on the nature of the problem or the process that's involved. A little checking on these parameters might provide us with some nice differentiation of procedures.

A: I think we need data on the effects of different kinds of treatment strategies that we use in order to determine which kinds of treatment strategies will facilitate generalization. I agree, also that the effects of these strategies might be different for patients presenting with various deficits.

Q: You did use a cueing hierarchy, didn't you? I mean, did the data show that the patient had more trouble on the first level than on later cues?

A: Yes. Pretesting showed that the subject could repeat all stimulus items prior to treatment but that she could not retrieve them given a sentence completion cue. These behaviors were subject selection criteria that were determined prior to beginning the study. We did not, however, pretest the subject's ability to retrieve words given a phonetic cue, (the second cue in the hierarchy).

Q: I'm wondering if it would be worthwhile to look at semantic classes in terms of a Piagetian sense—a developmental order of semantic classes. Also I'm wondering if you could extract distinctive features and perhaps teach cueing on terms of distinctive features.

A: I think that's an interesting notion. To my knowledge that's not explored in the aphasia literature.