The Effect of Personalized Cueing on Long-Term Naming of Realistic Visual Stimuli

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Associative learning techniques have been used successfully to teach word pair lists to subjects with brain damage. However, these techniques have not been used systematically to improve naming of complex visual stimuli such as might be found in aphasia therapy. This study examined the effect of an associative learning procedure, personalized cueing, on long-term naming of 40 realistic stimuli by 10 subjects with aphasia and 10 subjects without brain damage. The results showed that subjects without brain damage had significantly higher levels of naming accuracy than subjects with aphasia; however, subjects with aphasia were able to recall approximately 50% of the trained stimuli on both the 1-week and 30-day post-training probes. These results show that subjects with aphasia are able to use personalized cueing to learn effectively the names of items pictured in realistic visual stimuli and that the effects of training can be durable over time.

Research has shown that associative learning tasks can be used successfully to teach special student populations a variety of topics (Atkinson, 1975; Lebrato & Ellis, 1974; Mastropieri & Scruggs, 1989; Mastropieri, Scruggs, & Fulk, 1990). Additional studies have examined how subjects with amnesia (Baddeley & Warrington, 1973), traumatic head injuries (Cancelliere, Moncada, & Reid, 1991), temporal lobectomies (Jones, 1974), and aphasia (Patten, 1972) respond to this type of learning procedure. In general, these studies demonstrated that associative learning tasks can enhance recall of paired word lists by subjects with brain damage if their memory impairments are not too severe. However, the application of these findings to the clinical treatment of aphasia is problematic. Specifically, successful pairing of two nouns via an associative learning procedure does not necessarily mean that the procedure will help the subjects name the complex visual stimuli typically used in aphasia rehabilitation. For instance, Lewinsohn, Danaher, and Kikei (1977) examined the effectiveness of an associative learning procedure to increase recall by subjects with brain injury of two sets of stimuli: a paired word list and names matched to faces. After a 30-minute delay, the results showed enhanced recall for the paired words but not for the names and faces. More importantly from a clinical viewpoint, follow-up assessments showed that no facilitative memory effects were evident for either stimuli set one week after training.

Recently, a series of studies by Marshall and colleagues found that an associative learning procedure known as personalized cueing can enhance long-term recall of words paired to novel symbols by subjects with aphasia (Freed & Marshall, 1995; Freed, Marshall, & Nippold, in press; Marshall, Freed, & Phillips, 1994; Marshall, Neuburger, & Phillips, 1992). Although these studies showed that the subjects' long-term labeling was quite accurate, the use of abstract symbols instead of conventional drawings or photographs limited the generalizability of personalized cueing to clinical applications. Data on this question were needed for the future development of personalized cueing as a treatment for aphasic word-finding deficits, perhaps as a method of teaching a core vocabulary to individuals with moderate or severe language impairment.

Accordingly, this study asked: What is the effect of personalized cueing on naming of realistic visual stimuli by subjects with aphasia and subjects with no brain damage one week and 30 days after training is discontinued?

Method

Subjects

Ten adults with aphasia (APH) and 10 adults with no brain damage (NBD) participated in the study. All subjects met the following criteria: (a) between 45 and 74 years of age, (b) right-handed, (c) native speaker of English, and (d) between 12 and 16 years of education. The APH subjects were a minimum of 12 months postonset of a single left-hemisphere stroke as confirmed by CT scan, MRI, or clinical neurologic examination. All APH subjects demonstrated language deficits consistent with the diagnosis of aphasia as shown by their performance on such diagnostic tests as The Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1983), The Western Aphasia Battery (Kertesz, 1982), and The Minnesota Test for Differential Diagnosis of Aphasia (Schuell, 1972). The APH subjects' overall percentile scores from the Porch Index of Communicative Ability (PICA; Porch, 1981) were used as the measure of aphasia severity. All APH subjects were informally screened for any visual or auditory acuity deficits that would interfere with their ability to participate in the study. See Table 1 for individual APH subject data. None of the NBD subjects had any past medical history of stroke, traumatic head injury, or brain tumor. The NBD group was age matched to the APH group (NBD, M = 62.0, SD = 7.9, range = 48–73 years; APH, M = 60.1, SD = 9.0, range = 46–72 years).

Experimental Stimuli

The experimental stimuli consisted of colored 8 x 10-inch photographs of subordinate members of the semantic categories dogs and birds. To select the visual stimuli that would be used for training, the subjects were asked during one trial to name up to 60 photographs of the target animals. From the photographs they could not name, 40 were selected randomly as the experimental stimuli. The subjects were taught the names of 20 of

TABLE 1. Data on subjects with aphasia.

APH Subject	Age	MPO	PICA OA Percentile	PICA Verbal Percentile	Etiology
1	60	42	55	58	TE
2	69	50	61	61	TE
3	57	100+	64	49	H
4	64	89	69	72	TE
5	72	76	70	72	TE
6	61	53	75	81	TE
7	72	100+	86	78	TE
8	46	54	86	80	H
9	53	63	87	74	TE
10	47	57	88	80	TE
Mean	60.1	68.4	74.1	70.5	
SD	9.0	20.3	11.5	10.4	

Key: MPO = Months Post Onset; PICA = Porch Index of Communicative Ability (Porch, 1981); TE = Thromboembolic; H = Hemorrhagic.

the dogs pictured in the stimuli via personalized cueing. Ten additional dog pictures and 10 bird pictures served as untrained, semantically related, and untrained, semantically unrelated, control items, respectively. A short paragraph containing historical and general information about the pictured animals was printed on the back of each photograph.

There were two methodological benefits in using these animal stimuli instead of the pictured objects customarily found in naming research. First, a firm baseline of naming accuracy was quickly obtained for all subjects because the target animals were sufficiently obscure so as not to be readily named. (However, they were familiar enough that most of the subjects stated they had seen many of the animals at some previous time.) This factor was especially important given that day-to-day naming variability of subjects with aphasia makes it difficult to obtain a set of traditional stimulus pictures that the subjects truly cannot name (Freed, Marshall, & Chuhlantseff, in press). Second, all subjects, both APH and NBD, were able to be trained on nearly identical sets of stimuli since the animals were, overall, equally unknown to all subjects. This greatly facilitated comparisons of naming accuracy across subjects and, in particular, across groups.

Pretraining Procedures

Before the start of training, the examiner told the subjects the name of the target dog or bird and read aloud the informational paragraph. In addition, the APH subjects were asked to repeat the name of the animal. If they were not able to intelligibly produce the name, that item was not used, and another unnamed photograph was selected. The subjects were then asked to create separate personalized cues for each of the 20 trained photographs. The subjects were asked to draw on their semantic knowledge of the target dogs' names, the dogs' history, and any visual characteristics of the animals that would help them remember the names. For most subjects, the examiner provided only minimal assistance during the creation of these cues. Examples of personalized cues by APH subjects for the Pharaoh hound included, "Egyptian king dog," "ears look like pyramids," and "royal tomb." A six-word limit was placed on each cue to maintain a consistent length across subjects.

Training

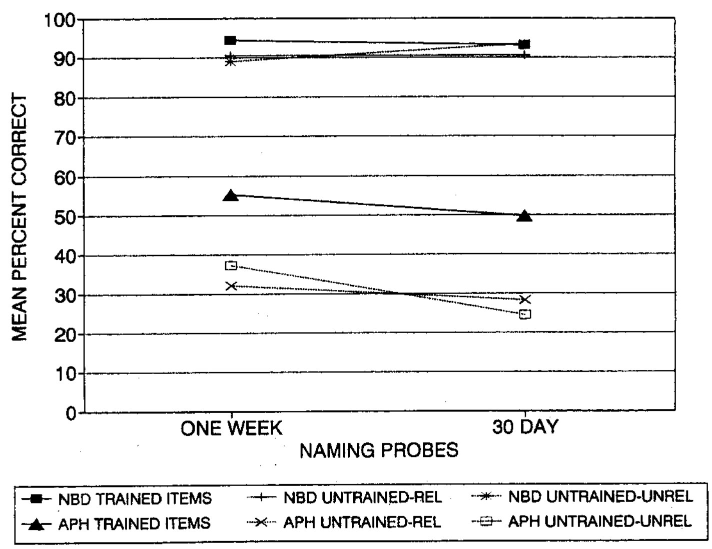
For the 20 trained items, the examiner verbally provided the personalized cues and asked the subjects to name the dog in the photograph. Correct responses were acknowledged, and the next item was presented. When a response was incorrect, the examiner verbally provided the correct response and repeated the personalized cue. For the 20 untrained control stimuli, the examiner simply presented the pictures and named them for the subjects. No verbal or gestural responses were required from the subjects for these control items.

The training sessions were conducted three times per week for four consecutive weeks. All 20 subjects completed each of the 12 sessions. During each session all trained and untrained items were presented twice in random order. Naming probes, which consisted of the presentation of stimulus pictures without cues or feedback from the examiner, were administered one week and 30 days after the training sessions were completed.

Results

Figure 1 illustrates the subjects' mean percentages of correct responses for the trained, untrained-related, and untrained-unrelated items on the two post-treatment naming probes. Separate two-way

Figure 1. The subjects' mean percentages of correct responses for all trained and control items on the two post-training naming probes.



ANOVAs (subject group x probe) with repeated measures on the probes were performed on the data from each of the three stimulus sets. The results indicated that for all three sets, only the group effect was significant [Trained Stimuli: ($F(1,18) = 32.05$, $p < .001$); Untrained-Related Stimuli: ($F(1,18) = 45.49$, $p < .001$); Untrained-Unrelated Stimuli: ($F(1,18) = 73.36$, $p < .001$)]. The probe effect and group by probe interactions were not significant ($p > .05$). Overall, these ANOVAs showed that the NBD subjects performed significantly better than the APH subjects on all three sets of stimuli.

Within-group analysis (stimulus set x probe) showed that for the NBD subjects, neither of the main effects nor the interaction between them were significant ($p > .05$), indicating that the level of naming accuracy for the target names was approximately the same regardless of whether the subjects were using personalized cues. For the subjects with aphasia, however, this analysis revealed a significant stimulus effect [$F(2,8) = 5.54$, $p < .05$], with higher naming accuracy for the stimuli trained via personalized cueing. Neither the probe effect nor the stimulus set/probe interaction for the APH subjects were significant ($p > .05$). Table 2 lists the percentage means, standard deviations, and range of scores for all probes and stimulus sets.

Discussion

Whereas the results indicated that NBD subjects performed significantly better than APH subjects, the most clinically relevant finding of this study is that APH subjects are able to use personalized cueing to effectively learn the names of items pictured in realistic visual stimuli. Most important, this study found that the effects of training were durable over time. The strength of the APH subjects' long-term recall is seen in their scores for the trained items. They were 55.25% correct one week after training was completed and 49.75% correct after 30 days.

Although direct comparisons are not possible, this level of naming accuracy over such a long period appears to be much more robust than that reported in other studies using associative learning procedures with subjects who have brain damage (Baddeley & Warrington, 1973; Cancelliere et al., 1991; Jones, 1974; Patten, 1972). There are several probable explanations for the long-term results seen in this study. One is the length of training. The subjects in the current study were given distributed practice over a 4-week period to securely associate their cues with the target names and pictures. In contrast, the earlier, related studies frequently used only a brief period of training (Lewinsohn et al., 1977). A second explanation may be found in the content of the personalized cues themselves. It is likely that when the APH subjects recalled a personalized cue during one of the naming probes, the cue provided additional semantic information that aided in the retrieval of the target name. Several APH subjects confirmed that a process very much like this occurred on many of the items during the training trials and the naming probes. Conversely, most NBD subjects reported that they really did not need the personalized cues to remember the target names after the fourth or fifth training session. This is confirmed by the NBD subjects' nearly identical performance for all three stimulus sets.

An examination of individual APH subject performance revealed no specific reasons for the wide range of naming accuracy noted on the two probes (see Table 2). A natural assumption would be that the degree of aphasia severity predicts the level of naming accuracy; however, this was not obviously the case. The highest scoring subject (subject 10 from Table 1) did have the highest PICA scores, but the poorest performing subject (subject 7), who accounted for nearly all of the low scores shown in Table 2, also had relatively high PICA scores. Although there are a number of possible reasons for this subject's difficulty, one factor may have been the quality of her cues. A post-study review of all the APH subjects' cues suggested that those describing a clear connection between the dogs' names and an easily recognizable associate usually had a higher naming accuracy than those who did not. For example, with the Maltese dog, subject 10 used the cue "Bogart's falcon," a highly imageable phrase that is readily associated with the target name. Subject 7, in contrast, used the less precise "The movie dog." The ambiguous nature of this cue was not the result of word finding difficulty since the subject mentioned the title of the movie while formulating the cue.

It did appear, however, that aphasia severity was related to the subjects' ability to create detailed cues. Two of the more severely impaired subjects (subjects 1 and 3) had difficulty developing effective cues for a number of the stimuli. For example, their cues were often only one or two words in length, lacking adverbs and adjectives, and sometimes only marginally related to the target item. In earlier studies using novel symbols (Freed & Marshall, 1995; Freed et al., in press), neither of these two subjects had problems creating personalized cues. Their difficulty with the current study's realistic stimuli probably reflects the need to integrate more specific semantic and visual information when creating cues for this more complex material. For instance, with the novel symbols, the subjects only needed to develop cues that imaginatively linked concrete nouns to abstract line drawings that could be "seen" as many different things. In contrast, the realistic stimuli used in this study restricted the subjects' opportunities to find creative associations for the dogs' names. As a result, the subjects had to be much more

TABLE 2. Mean percent correct scores, standard deviations, and range of total percent correct for both subject groups on the post-training naming probes.

	Mean	*SD*	Range
NBD Subjects			
One Week Trained Items	94.5	7.15	80.0–100
One Week Untrained, Related Items	90.5	16.06	50.0–100
One Week Untrained, Unrelated Items	89.0	15.24	50.0–100
One Month Trained Items	93.0	8.89	82.5–100
One Month Untrained, Related Items	90.5	12.5	70.0–100
One Month Untrained, Unrelated Items	93.5	8.51	75.0–100
APH Subjects			
One Week Trained Items	55.25	24.56	5.0–85.0
One Week Untrained, Related Items	32.0	21.24	0.0–60.0
One Week Untrained, Unrelated Items	37.25	26.31	0.0–80.0
One Month Trained Items	49.75	21.81	20.0–77.5
One Month Untrained, Related Items	28.25	29.81	0.0–80.0
One Month Untrained, Unrelated Items	24.5	18.48	0.0–60.0

precise when developing the cues, a task that the more severely impaired subjects had difficulty doing. Nevertheless, when this problem was encountered, it was found that working with the subjects to modify or expand their initial cue could result in a final cue that was detailed and generally effective.

One additional beneficial feature of personalized cueing is the relative ease with which most of the APH subjects were able to create their own cues for many of the 20 untrained items. Although the APH subjects' naming accuracy for the trained stimuli was significantly higher than for untrained stimuli, approximately 20–30% of the untrained stimuli were still named correctly by the APH subjects on the naming probes. Post-study interviews indicated that all APH subjects, without direction from the examiner, attempted to develop their own cues for many of the untrained items as training progressed. It is assumed that at least some of the long-term naming accuracy for the untrained items was the result of these unsolicited personalized cues.

In summary, this study shows that personalized cueing can result in long-term naming accuracy of realistic stimuli by NBD and APH subjects. Future work will focus on maximizing its effectiveness for subjects who are moderately and severely impaired by aphasia.

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