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Effects of two lexical retrieval cueing treatments on action naming in aphasia

Julie L. Wambaugh, PhD; Patrick J. Doyle, PhD; Aida L. Martinez, MA; Michelene Kalinyak-Fliszar, MS
Department of Veterans Affairs (VA) Salt Lake City Healthcare System and University of Utah, Salt Lake City, UT; VA Salt Lake City Healthcare System, Salt Lake City, UT; VA Pittsburgh Healthcare System, Pittsburgh, PA

Abstract—The effects of two cueing treatments, Phonological Cueing Treatment (PCT) and Semantic Cueing Treatment (SCT), were examined with three chronic speakers with aphasia. The effects of treatment on action naming were measured with the use of single-subject experimental designs. The participants had received PCT and SCT to improve object naming in a previous investigation and had responded positively to both treatments. In the current study, Speaker 1 received SCT, Speaker 2 received PCT, and Speaker 3 received both SCT and PCT. Action naming improved for Speakers 1 and 3, but not for Speaker 2. These findings indicate that PCT and SCT may have utility in facilitating action naming for some speakers with aphasia but that the effects of these treatments may vary across grammatical form classes (e.g., nouns versus verbs).

Key words: *anomia, aphasia, language, speech and language therapy, word-finding.*

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Address all correspondence and requests for reprints to Julie Wambaugh, PhD; 151 A—Building 2, 500 Foothill Boulevard, Department of Veterans Affairs Medical Center, Salt Lake City, UT 84148; 801-582-1565, ext. 1363; fax: 801-583-9634; email: julie.wambaugh@health.utah.edu.

INTRODUCTION

Treatments for lexical retrieval deficits in aphasia typically have been focused on retrieval of object names [1]. Although the examination of verb processing in aphasia has been given increased attention, relatively little research has been conducted concerning treatment of action naming [2–5].

Adequate and accurate verb retrieval should be considered an important aspect of rehabilitation of lexical retrieval problems in aphasia. Like nouns, verbs carry critical meaning in the communicative process. Additionally, verbs are thought to play a crucial role in the structural formulation of sentences. Verb representations are considered to constrain "the assignment of retrieved lexical items to positions within the syntactic frame: poor access to verbs could cause widespread disruption of the specification of sentence structure during production" [6, p. 16].

Some speakers with aphasia have demonstrated more difficulty in retrieving verbs than nouns, and other speakers with aphasia have shown the opposite pattern of retrieval [6–8]. Given the observed dissociation in verb and noun retrieval in some speakers with aphasia and the grammatical function of verbs, verb processing appears likely to differ from noun processing. Some investigators have suggested nouns and verbs may have separate lexicons [8], whereas others have assumed that different processing is required because verb representations contain different information (i.e., more grammatical information,

more movement-based information) than noun representations [6]. Consequently, treatments that facilitate noun retrieval cannot be assumed to facilitate verb retrieval.

Only a few investigations have been reported in which verbs were targeted for treatment. Marshall and colleagues have employed forms of mapping therapies to facilitate verb retrieval in speakers with aphasia who had difficulty processing thematic information and events [9–10]. In both investigations, positive acquisition effects were noted with limited generalization effects.

Linebaugh, Baron, and Corcoran [11] treated nouns and verbs using prestimulation, response-contingent cueing (semantic and phonologic cues), sentence frame completion, and sentence generation. Results indicated that the three participants all experienced more difficulty with verb production than noun production in baseline and treatment phases of the study. However, increased accuracy of verb naming was observed.

McNeil and colleagues employed a cueing hierarchy similar to Linebaugh et al.'s in the treatment of several grammatical form classes (i.e., nouns, verbs, adjectives, and adverbs [12,13]). The treatment of McNeil et al. required the participants to produce a synonym or antonym for a verbally presented word, with the cueing hierarchy applied upon failure to produce a correct response. In their 1997 investigation, Subject 2 achieved criterion for verb and noun antonym production. Subject 1 reached criterion for production of noun synonyms, but failed to reach criterion for adjective synonyms (verbs were not treated). Generalization to untrained items within and across form classes did not occur for either subject. In a follow-up investigation, McNeil et al. trained nouns, verbs, adjectives, and adverbs simultaneously with one participant from the 1997 study in an attempt to facilitate generalization to untrained exemplars [13]. Although the participant responded positively to all trained form classes, no generalization was evident. It appeared that treatment facilitated retrieval of verbs as well as the other grammatical form classes.

Although results of investigations in which verb production has been targeted for treatment have been positive, data for only a few participants and a few treatments are available [9–13].

This investigation was designed to extend the verb retrieval treatment literature through the examination of the effects of two cueing treatments on action naming in aphasia. The treatments employed were termed "phonological cueing treatment" (PCT) and "semantic cueing treatment" (SCT); that is, the cues comprising the treatments were designed to facilitate retrieval at the lexical-phonological and lexical-semantic levels, respectively. Both treatments had been demonstrated to be effective in promoting object naming with the study's participants [14, 15]. As indicated previously, it could not be assumed that these treatments would have similar effects when applied to action naming. Therefore, this investigation serves as an indirect replication: the treatments were evaluated with the same participants, but with a different grammatical form class (i.e., verbs instead of nouns).

METHODS

Participants

The participants were three speakers with chronic aphasia. Participant characteristics are presented in **Table 1**, and pretreatment assessment results are shown in **Table 2** [16–20]. All speakers had participated in an object-naming treatment investigation before their involvement in this study. They had received the two cueing treatments PCT and SCT, which were applied sequentially and repeatedly to four sets of objects as multiple baseline designs. All speakers responded positively to both treatments. Speaker 1 displayed no apparent response preference to either treatment [15]. Speaker 2 demonstrated a slightly better response to PCT; that is, he did not reach criterion with his second application of SCT [14]. Speaker 3 evidenced a superior response to PCT than to SCT across all treatment applications. Speakers 1 and 2 displayed mixed semantic and phonological-level lexical-retrieval deficits and Speaker 3

Table 1.
Descriptive data of participants.

Characteristics	Speaker		
	1	2	3
Gender	Male	Male	Male
Age	67	57	74
Months Post-onset	43	122	54
Years of Education	14	16	12
Premorbid Handedness	Right	Right	Right
Former Profession	Real estate broker	Manager	Post office courier

Table 2.
Pretreatment measures of participants.

Measures	Speaker		
	1	2	3
Aphasia Diagnostic Profile [16]			
Aphasia severity	103	94	NA
Standard score	58	35	NA
Percentile rank classification	Mixed nonfluent	Mixed nonfluent	NA
Porch Index of Communicative Ability [17]			
Overall score	11.92	10.52	NA
Percentile	63	45	NA
Test of Adolescent/Adult Word Finding [18]			
Total raw score (107 possible)	45	15	5
Correct Information Units (CIUs) [19]			
Total word count	269	471	1,304
Total CIUs	170	277	499
%CIUs	63%	59%	38%
Object and Action-Naming Battery [20]			
Verbs (list A), first response	NA	NA	10/50
Verbs (list A), with prompt	NA	NA	14/50

NA = not available

demonstrated a predominately phonological-level deficit [14,15].

Experimental Stimuli

We asked each speaker to name a set of 128 line drawings depicting actions. The set of items was presented twice, and responses were scored according to a multidimensional scoring system. The error responses for Speakers 1 and 2 consisted predominantly of semantically related noun productions and a few semantically related verb productions. Speaker 3's error responses consisted of relatively equal proportions of semantically related and nonspecific verb productions, gestural responses, and semantically related noun productions.

For Speakers 1 and 2, three sets of stimuli, of 12 items each, were individually selected from the set of 128 pictures (**Appendix A**). For Speaker 3, three sets of stimuli, of six items each, were selected (**Appendix A**). For each speaker, the items that composed each set were matched as closely as possible across sets for (1) verb argument structure, (2) existence of a corresponding noun root, and (3) relative difficulty during extended baseline testing. Also for each speaker, we randomly designated two sets of items for treatment and used the remaining set for evaluating generalization.

Treatment

The treatments selected for investigation (SCT and PCT), were both hierarchical cueing treatments that were designed to be similar to each other with respect to number of steps, relative difficulty of steps, and general application of treatment. We initiated each treatment with a prestimulation phase in which we presented the target item with three picture foils. The prestimulation phase was followed by the application of the cueing hierarchy. The application of the steps of the cueing hierarchies was response-contingent; that is, the steps were applied sequentially until a correct naming response was elicited. Following the correct response, we reversed the order of the steps to elicit correct responses at each of the preceding steps. (See **Appendix B** for treatment descriptions.)

For both SCT and PCT, each of the pictures designated for treatment was presented individually, in random order (12 pictures for Speakers 1 and 2, and 6 pictures for Speaker 3). Three presentations of each item constituted a "complete" treatment session. For Speakers 1 and 2, we randomly presented them the third set of pictures (exposure control and generalization items) with the treatment items (three presentations of each), but they did not receive treatment. That is, the participant was provided with the opportunity to name these items, but received no feedback or training on the items. For Speaker 3, the third set of items was not presented during either of the treatments and was used only to measure generalization effects in probes.

Experimental Design

We used a multiple baseline design across behaviors for Speakers 1 and 2. Speaker 1 received SCT and Speaker 2 received PCT, with each treatment applied sequentially to two sets of actions (**Appendix C**).

An alternating treatments design was employed for Speaker 3. He received PCT applied to Group 1 items and SCT applied to Group 2 items (**Appendix A**), with treatments being applied concurrently. Specifically, on

each day that Speaker 3 received treatment, one treatment was applied, a rest period of 30 to 45 minutes was provided, and then the other treatment was applied. Treatments were alternated in keeping with design constraints (**Appendix C**).

Baseline Phase

During baseline probes, we presented the experimental picture stimuli (i.e., three sets of pictures) in random order. The participant was instructed to name each action to the best of his ability, and a 15-second response interval was provided. Each final response was scored according to a multidimensional scoring system. A binary scoring system was used to graph probe data and to determine the timing of phase changes in the experimental design.

Treatment Phase

We conducted treatment two to three times per week. Probes, identical to those administered in the baseline, were conducted immediately before the start of each treatment session. For Speakers 1 and 2, treatment continued until at least 90 percent of the treated items were named correctly during 2 of 3 consecutive probe sessions or until 15 treatment sessions were conducted for a particular set of items. For Speaker 3, 20 applications of each treatment were completed.

RESULTS

The percentage of actions that Speaker 1 named correctly in probe sessions is depicted in **Figures 1** to **3**. Responses for each group of actions are shown on separate graphs. **Figure 1(a)** and **(b)** show responses to the groups that received treatment (SCT), and **Figure 1(c)** shows responses to the exposure control and generalization action pictures.

During the four baseline sessions, Speaker 1 demonstrated relatively stable, correct naming of all three groups of actions (correct responses ranged between 25 percent and 42 percent). Following application of SCT to Group 1 actions, Speaker 1's correct naming responses increased rapidly for trained actions. He met the training criterion within four sessions. However, because of a relatively large decrease in correct naming in probe session 7, we conducted an additional training session and probe. Speaker 1 demonstrated increases in correct naming of untrained actions during Group 1 treatment. The increases were observed more consistently with the Exposure Control Group than with Group 2. When we initiated treatment with Group 2 actions, Speaker 1 again demonstrated rapid increases in correct naming of trained actions. Additional slight increases were observed for the Exposure Control Group during Group 2 treatment.

The percentage of actions that Speaker 2 named correctly in probe sessions is shown in **Figure 2**. **Figure 2(a)** and **(b)** show responses to the groups that received PCT, and **Figure 2(c)** shows responses to the Exposure Control and/or Generalization pictures.

During the four baseline sessions, Speaker 2 demonstrated stable or declining naming performance with all three groups of actions (correct responses ranged between 0 percent and 25 percent). Speaker 2 demonstrated an increase in correct naming of treated actions when PCT was applied to Group 1 actions. However, he failed to reach criterion within 15 treatment sessions. Performance on untrained actions remained relatively unchanged from baseline levels following application of treatment to Group 1 (i.e., occasional increases in correct naming of one or two actions for Groups 1 and 3, respectively). When we applied treatment to the actions of Group 2, very little change in correct naming of trained actions occurred. Correct productions of previously trained Group 1 items decreased to baseline levels during Group 2 treatment. No changes were observed in the Exposure Control and/or Generalization items.

The percentage of actions that Speaker 3 named correctly in probe sessions is shown in **Figure 3**. **Figure 3(a)** shows responses to the items that received PCT (•) and SCT (Δ). **Figure 3(b)** shows responses to the generalization actions (Group 3).

During the three baseline sessions, Speaker 3 correctly named only one or two items from each group (correct responses ranged from 0 percent to 34 percent). Upon application of SCT and PCT, correct responses steadily increased for both groups of items, with the percentage of correct responses being very similar across probes. Speaker 3 reached levels of 100 percent correct naming for SCT-treated items and PCT-treated items within 16 and 17 sessions, respectively. Follow-up probes at 2 and 6 weeks following treatment revealed that correct naming was maintained at high levels for both treated groups. No generalization of

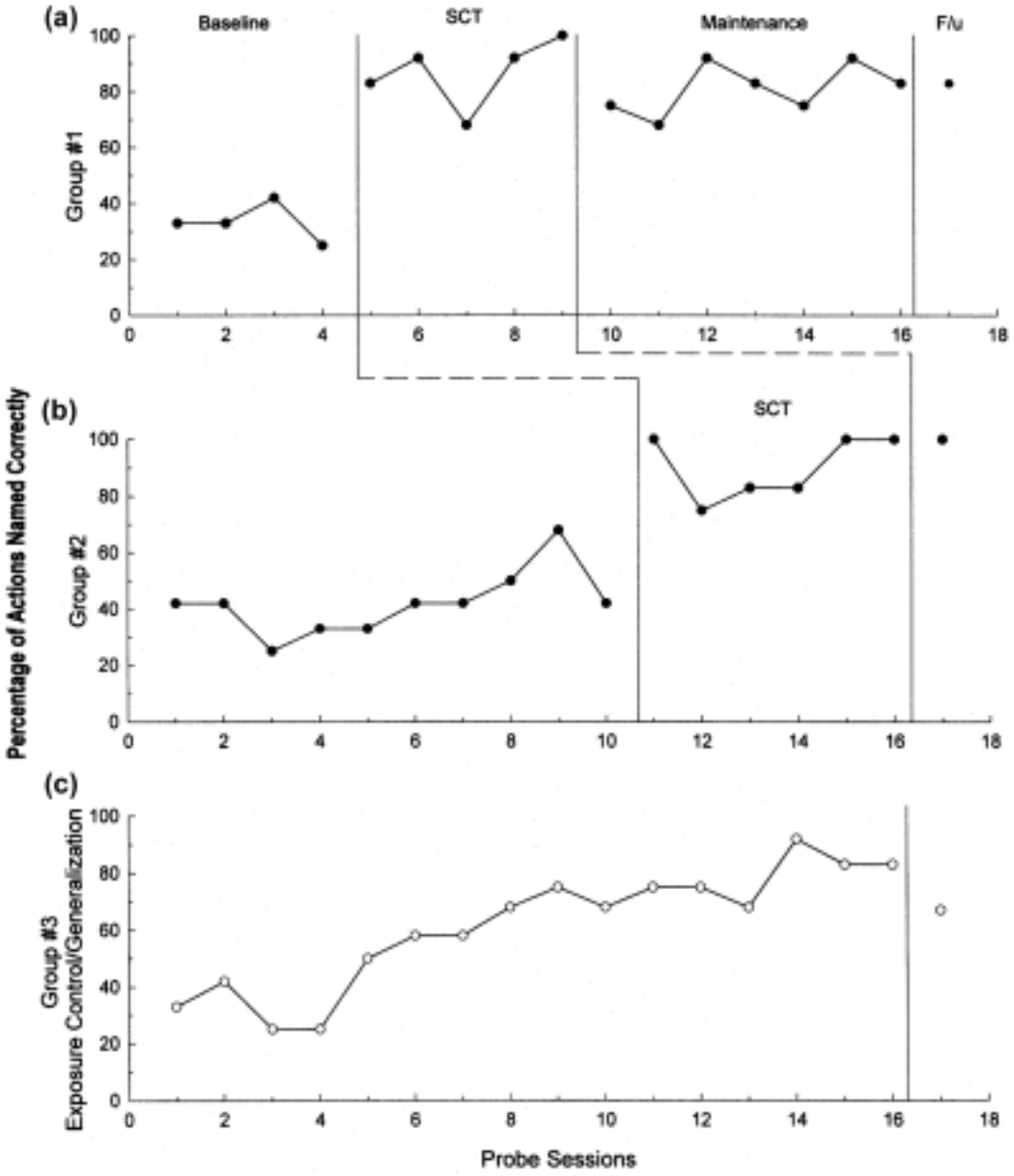

Figure 1.
Percentage of actions named correctly in probes by Speaker 1. **(a)** and **(b)** Responses to groups of actions that were submitted sequentially to SCT. **(c)** Responses to the Exposure Control and Generalization Group of actions. F/u = follow-up.

treatment effects to the untreated group of items was observed.

DISCUSSION

The results from this investigation are certainly preliminary, but suggest that these cueing treatments may be effective in promoting improved retrieval of action names for some speakers with aphasia. Additionally, it appears that the treatments may have differential effects on naming of words from different grammatical form classes.

Speaker 1's response to SCT applied to verbs was very similar to his response to SCT applied to nouns [15].

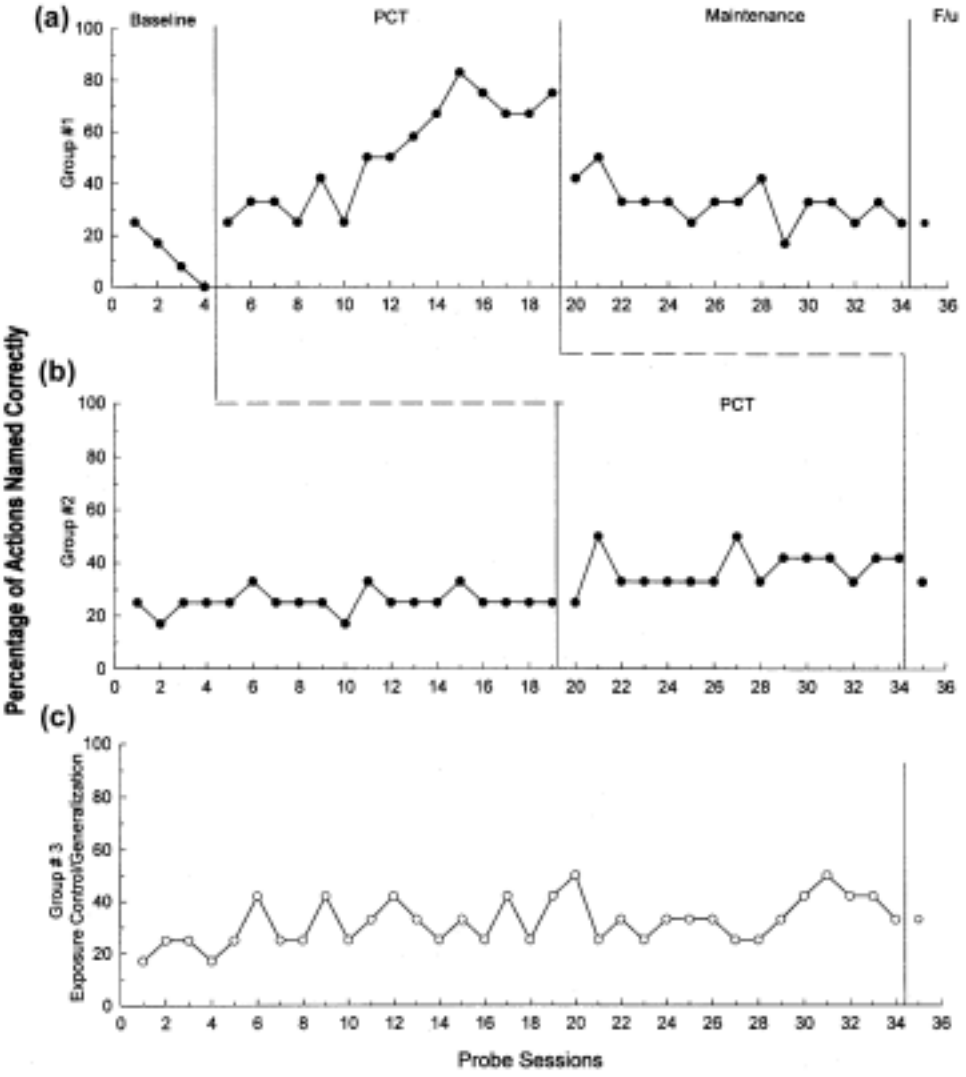

Figure 2.
Percentage of actions named correctly in probes by Speaker 2. **(a)** and **(b)** Responses to groups of actions that were submitted sequentially to PCT. **(c)** Responses to Exposure Control and Generalization Group of actions. F/u = follow-up.

Specifically, he reached criterion rapidly, demonstrated little generalization to unexposed generalization items (Group 2, during SCT-1), and moderate generalization to exposed generalization items (Group 3).

Speaker 2's response to PCT applied to verbs differed somewhat from his response to PCT applied to nouns [14]. With nouns, Speaker 2 reached criterion levels of correct responding within 15 to 18 sessions for both groups treated with PCT. In the current study, Speaker 2 failed to reach criterion with either group of treated verbs. Furthermore, he showed negligible improvement with the second group of verbs, despite having achieved gains of 50 to 60 percent with the first group of verbs. Note that Speaker 2's baseline levels of performance were much higher for nouns (40 to 60 percent) than for verbs (0 to 25 percent). These baseline findings indicate that naming of the experimental verb stimuli was initially more difficult than naming of the experimental noun stimuli. Consequently, treatment gains should be considered relative to initial performance as well as to terminal performance. Although Speaker 2 did not achieve criterion with Group 1 verbs, his improvements with Group 1 items (relative to baseline) may be similar to his performance with nouns. However, his minimal improvement with Group 2 items (increases

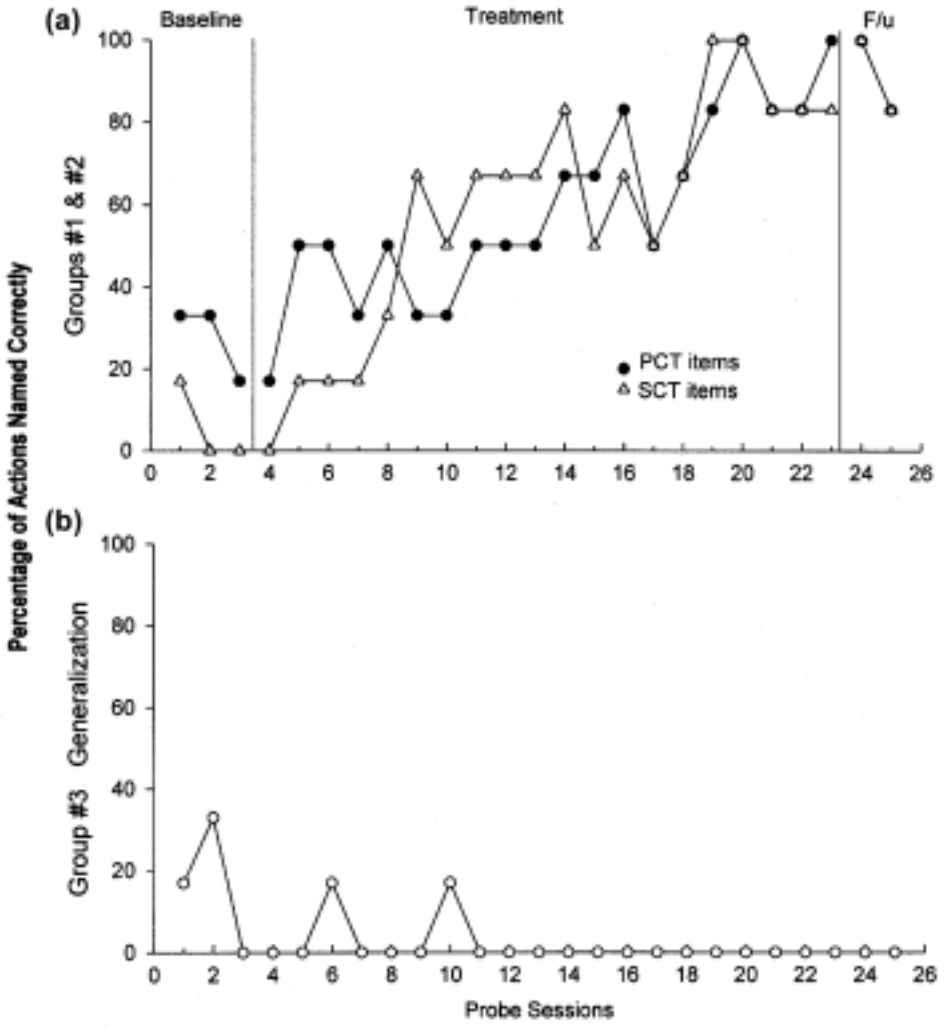

Figure 3.
Percentage of actions named correctly in probes by Speaker 3. **(a)** Responses to Groups 1 and 2 actions that were submitted to PCT and SCT, respectively. **(b)** Responses to Generalization Group of actions. F/u = follow-up.

of correct naming of only one or two items) is problematic and dissimilar to his performance with nouns.

Speaker 2's gains with Group 1 items were not maintained during Group 2 training. This finding of poor maintenance is quite different from his performance with nouns; that is, he maintained correct naming of PCT-treated nouns at high levels (during subsequent treatments and in 2 and 6 weeks follow-up probes). Speaker 2 demonstrated minimal changes in exposed and unexposed generalization verbs, which is consistent with effects of his noun treatment.

Speaker 3's performance with PCT and SCT applied to verbs was also different from his performance with nouns [14]. Speaker 3 had shown a strong positive response to SCT during noun treatment. He had shown clinically significant, but variable gains in response to PCT applied to nouns (i.e., he achieved high levels of correct responding, but performance was not consistent). In the current investigation, Speaker 3 demonstrated consistent, positive improvements with both treatments. That is, he did not exhibit a treatment preference for PCT or SCT applied to verbs as he had with nouns.

There are many potential explanations for the differences seen in responses to PCT verb versus PCT noun treatment for Speakers 2 and 3. Methodological differences across investigations may have impacted findings,

particularly for Speaker 3, whose verb treatments were applied in the context of a different design than his noun treatments. In particular, Speaker 3 received treatment applied to only 6 verbs, as compared to 12 nouns (i.e., fewer items were used with each treatment in Speaker 3's design to allow for application of both PCT and SCT on a given treatment day). Although Speaker 3 did not receive more treatment trials per verb (i.e., three trials per item, per session, were conducted for verbs and nouns in the different investigations), the focus on fewer items may have facilitated more stability in responding for verbs receiving PCT than for nouns receiving PCT. Stability of responding was not an issue for Speaker 3 with SCT. Speaker 2's verb treatment multiple baseline design was very similar to his noun treatment design. However, in his original noun treatment, we altered PCT with SCT across design phases. That is, he never received two PCT phases of treatment sequentially. It is conceivable that the relative novelty of switching treatments in the noun investigation promoted motivation. If we were to consider that Speaker 2's verb treatment followed four applications of noun treatment, boredom with the treatment may have been a contributing factor to his relatively poor performance with PCT verb treatment. Of course Speaker 1 was vulnerable to this same situation and responded positively. However, his gains in treatment were rapid and did not require prolonged treatment.

Recent investigations of verb processing (i.e., investigations not involving treatment) have provided information concerning processing that may have ramifications for treatment of action naming. Several properties of the verb stimulus have been found to influence how readily a verb is retrieved. Grammatical factors such as transitivity [21], argument structure [5], and inflection [22] have been shown to influence retrieval. In addition, factors such as homophonous noun root, familiarity, image agreement, and name agreement have been found to be moderately correlated with correct action naming [3]. Such factors should be considered in future evaluations of treatment for action naming. Unfortunately, these factors complicate comparisons of treatments applied to nouns and verbs (i.e., equating difficulty of retrieval of action names versus object names is problematic).

The result of this investigation must be interpreted cautiously, because this investigation was not designed to directly compare the effects of verb and noun treatment with PCT and SCT. Such comparisons would require that the different grammatical form classes be studied within the same experimental design. This investigation represents an initial examination of the effects of PCT and SCT applied to the retrieval of action names and suggests that both treatments may have potential. Additionally, these findings highlight the need for investigations comparing the effects of treatments across grammatical form classes.

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APPENDIX A

Experimental Stimuli

Speaker 1

Group 1: SCT 1	Group 2: SCT 2	Exposure Control and/or Generalization Group
Dive	Pour	Clear
Deliver	Play	Fall
Wash	Pick	Carry
Mix	Shoot	Pull
Lick	Shave	Drink
Read	Yawn	Dribble
Erase	Wink	Climb
Walk	Weigh	Chase
Leave	Thread	Lock
Jump	Slap	Bathe
Wipe	Ride	Sharpen
File	Dig	Shake

Speaker 2

Group 1: PCT 1	Group 2: PCT 2	Exposure Control and/or Generalization Group
Dive	Pull	Pour
Walk	Fall	Play
Jump	Carry	Pick
Mix	Erase	Crawl
Deliver	Weigh	Brush
Slap	Dribble	Wipe
Write	Chase	Blow
Lock	Leave	Crash
Thread	Pack	Ride
Shoot	Lick	Mail
Sleep	Read	Climb
Dig	Plug	Pray

Speaker 3

Group 1: PCT	Group 2: SCT	Generalization Group
Write	Shave	Sweep
Shake	Pour	Pack
Knit	Fish	Rake
Plug	Plant	Peel
Walk	Dance	Run
Smile	Sneeze	Watch

SCT = Semantic Cueing Treatment
PCT = Phonological Cueing Treatment

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APPENDIX B

Description of Cueing Treatment

SEMANTIC CUEING TREATMENT (SCT)

Prestimulation

The target item was presented in picture form with three picture foils (two semantically related, one unrelated). The examiner provided a verbal phrase corresponding to the item and asked the participant to point to the correct picture.

Cueing Hierarchy

The application of the steps of the hierarchy was response-contingent. The steps were applied sequentially until a correct naming response was elicited. Then, the order of the steps was *reversed* to elicit correct responses at each of the preceding steps. If an incorrect response occurred during the hierarchy reversal, the order of hierarchy steps was again reversed until a correct response was obtained.

1. Picture of target item presented, naming response requested, and verbal feedback provided for correct or incorrect responses (7- to 8-second response time allowed—same for following steps).
2. Picture of target item presented along with a verbal description of the target, naming response requested, and verbal feedback provided for correct or incorrect responses (e.g., target = dig, "When you move dirt to make a hole.").
3. Picture of target item presented along with a semantically completion phrase of a nonspecific sentence, naming response requested, and verbal feedback provided for correct or incorrect responses (e.g., "Dogs love to . . .")
4. Picture of target item presented along with a semantically loaded sentence completion phrase, naming response requested, and verbal feedback provided for correct or incorrect responses (e.g., "You use a shovel to . . .")
5. Picture of target item presented along with a verbal model of the target word and repetition of target word requested.

PHONOLOGIC CUEING TREATMENT (PCT)

Prestimulation

The target item was presented in picture form with three picture foils (two phonetically related, one unrelated). The examiner provided a verbal phrase corresponding to the item and asked the participant to point to the correct picture.

Cueing Hierarchy

The application of the steps of the hierarchy was the same as above.

1. Picture of target item presented, naming response requested, and verbal feedback provided for correct or incorrect responses (7- to 8-second response time allowed—same for following steps).
2. Picture of target item presented along with a verbal production of a nonreal word that rhymed with the target (e.g., target = licking, "It rhymes with micking").
3. Picture of target item presented along with a verbal first sound cue (e.g., "It starts with /l/.").
4. Picture of target item presented along with a sentence completion phrase that included the rhyme and the sound cue, naming response requested, and verbal feedback provided for correct or incorrect responses (e.g., "What she's doing rhymes with micking; she is /l/ . . .").
5. Picture of target item presented along with a verbal model of target word and repetition of target word request.

APPENDIX C

Description of Experimental Designs

MULTIPLE BASELINE DESIGN ACROSS BEHAVIORS: SPEAKER 1

Initial Baseline Phase

Four probes of naming of action pictures were conducted. The 36 experimental pictures were presented in random order for naming on 4 separate days.

First Treatment Phase (SCT 1)

SCT was applied to Group 1 items only (see **Appendix A** for group descriptions). Group 3 items were exposed during treatment, but received no treatment. Probes of naming of the 36 action pictures were conducted before each treatment session. Therefore, probes measured production of trained items (Group 1) and untrained items (Groups 2 and 3). Five probes and five treatment sessions were conducted.

Second Treatment Phase (SCT 2)

SCT was applied to Group 2 items and discontinued with Group 1 items. Group 3 items were exposed during treatment, but received no treatment. Probes of naming of the 36 action pictures were conducted before each treatment session. Probes measured production of previously trained items (maintenance—Group 1), production of currently trained items (Group 2), and generalization to untrained items (Group 3). Six probe and treatment sessions were conducted.

Follow-up

Probe of naming of the 36 action pictures was conducted at 8 weeks following completion of treatment.

MULTIPLE BASELINE DESIGN ACROSS BEHAVIORS: SPEAKER 2

Initial Baseline Phase

Four probes of naming of action pictures were conducted. The 36 experimental pictures were presented in random order for naming on 4 separate days.

First Treatment Phase (PCT 1)

PCT was applied to Group 1 items only. Group 3 items were exposed during treatment, but received no treatment. Probes of naming of the 36 action pictures were conducted before each treatment session. Probes measured production of trained items (Group 1) and untrained items (Groups 2 and 3). Fifteen probes and five treatment sessions were conducted.

Second Treatment Phase (PCT 2)

PCT was applied to Group 2 items and discontinued with Group 1 items. Group 3 items were exposed during treatment, but received no treatment. Probes of naming of the 36 action pictures were conducted before each treatment session. Probes measured production of previously trained items (maintenance—Group 1), production of currently trained items (Group 2), and generalization to untrained items (Group 3). Fifteen probe and treatment sessions were completed.

Follow-up

Probe of naming of the 36 action pictures was conducted at 12 weeks following completion of treatment.

ALTERNATING TREATMENTS DESIGN: SPEAKER 3

Baseline Phase

Four probes of naming of action pictures were conducted. The 18 experimental pictures were presented in random order for naming on 3 separate days.

Treatment Phase

PCT was applied to Group 1 items and SCT was applied to Group 2 items. Group 3 items were *not* exposed during treatment. Each treatment was applied on a given day with treatment orders being alternated across days. Probes of naming of the 18 action pictures were conducted before the initiation of any treatment on each treatment day. Probes measured production of trained items (Groups 1 and 2) and generalization to untrained items (Group 3). Twenty applications of each treatment and twenty probes were completed.

Follow-up

Probes of naming of the 18 action pictures were conducted at 2 and 6 weeks following completion of treatment.

PCT = Phonological Cueing Treatment

SCT = Semantic Cueing Treatment

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