

Cueing Strategies for Different Grammatical Class of Words in Broca's Aphasia

Archana Rao R¹, Deepak P²

¹Assistant Professor, Naseema Institute of Speech and Hearing, Bangalore-560034.

²Junior Research Fellow, Dept. of Speech Language Pathology, AIISH, Mysuru-570006.

Corresponding Author: Archana Rao R

ABSTRACT

Cueing techniques are often utilized in the treatment of aphasic naming deficits. Cueing technique includes repetition, sentence completion, semantic cueing and phonemic cueing, which helps in eliciting responses from aphasic subjects to stimuli they cannot name. Previous studies have recognized the viability of cueing as a technique for helping the aphasic patient, but they have presented little systematic research to support the effectiveness of various cues. Hence the current investigation was designed to study the effects of two cueing techniques, semantic cueing and phonologic cueing, on persons with Broca's Aphasia who represented different levels of lexical - semantic processing impairment. Fifteen participants aged between 40-70 years and diagnosed with Broca's Aphasia were selected for the study. Stimuli included 20 black-and-white line drawings of both nouns and verbs. Pictures of nouns were taken from Boston Naming Test and verbs from Action Naming Battery. The procedure was divided into 2 phases based on the cueing strategy used. These phases were carried out for both nouns and verbs. In phase 1, phonemic cueing was used for five words related to nouns and five words related to verbs were used. In phase 2, semantic cueing was used for a set of different five words were used for each nouns and verbs. Results of the study revealed phonemic cueing were better than semantic cues and interestingly there was no difference noticed across different grammatical class of words.

Keywords: Broca's Aphasia, Phonemic Cueing, Semantic Cueing, Verb and Noun Naming, Word Retrieval.

INTRODUCTION

Word retrieval difficulty is the most common problem encountered in persons with aphasia (PWA). This difficulty is expressed through a variety of errors, such as circumlocutions, semantic paraphasias, phonemic paraphasias, neologisms, negations, and perseverations. The term 'word retrieval difficulty' covers a wide range of clinical phenomena and it signifies a plethora of pathophysiological processes. Linguistic processing plays a pivotal role in naming. Primary word retrieval difficulty may occur as an isolated language

disturbance or may co-occur with cognitive or behavioural deficits. Secondary word retrieval difficulty occurs when a deficit within another cognitive domain interferes with the function of a more or less intact language system.

However, naming of different semantic and grammatical categories differ in their lexical semantic properties and linguistic explanations have been put forth to explain the word class effects in aphasia. The lexical account claims that nouns and verbs are stored separately in the mental lexicon and the noun-verb dissociation

results from selective damage to accessing either the noun or the verb lexicon at the lexical stage of word production. [1-3] The semantic account proposes that verbs are more difficult because they are semantically more complex. Verbs tend to be lower in imageability (the degree to which a word can generate a mental image and/or sensory experience) than nouns, and have less perceptual features. [4,5] The syntactic account suggests that greater verb deficits are a consequence of the syntactic complexity of verbs given their syntactic role in sentences. [6] Lastly, the morphological account suggests that verbs are more difficult to process because they are morphologically more complex, as they carry a greater number of inflectional morphemes in most languages have distinct neuroanatomical substrates. [7,8]

In similar line several studies have been conducted on the differences between naming of nouns and verbs in aphasic subjects. Authors have investigated naming of both nouns and verbs in large groups of participants with aphasia and found no significant difference between naming of verbs and nouns. [9,10] However, a study done by highlighted the relationship between noun and verb picture naming in different types of aphasics and author reported that non-fluent aphasic speakers showed a tendency to perform more poorly with verbs than nouns, while the same pattern was not observed with fluent aphasics. [11]

To treat the naming deficits in PWA, numerous therapy approaches have been studied and formulated. Cueing techniques are often utilized in the treatment of aphasic naming deficits. The most commonly used are semantic based approach, phonological based approach and cueing approach. Using these approaches, researchers have found positive results for several deficit-oriented naming treatments. [12-14] Cueing technique includes repetition, sentence completion, semantic cueing and phonemic cueing, which helps in eliciting responses from aphasic subjects to stimuli they cannot

name. Theoretically, the cue 'de-blocks' the stimulus which the patient finds difficult to name [15] or aids naming 'at the time' the patient fails to retrieve the target word [16,17] and advocated that successfully cued responses leave traces in cerebral structures that aid later volitional production of words when the cues are not present. Few studies have showed that both phonological cues and semantic cues were potent in facilitating word retrieval. [18,19]

Authors have theorized that limited semantic field and weak semantic networks in fluent aphasics causes reduced naming ability. [20] A study concluded that "a disturbance of lexical retrieval and not "an absolute loss of information from the lexical store" accounted for naming deficit in aphasics. [21] Based on the model of lexical retrieval, it was predicted that enhancing the first level of processing, i.e. the semantic level will increase the chances of activating the correct phonologic nodes in the 2nd level of processing, thus increasing naming accuracy and semantic cueing will be more effective than phonemic cueing. [22] In contradiction, it was found the phonemic cue was most effective among the six types of cues they studied for eliciting picture naming responses from Broca's, Wernicke's, and anomic patients. [23] Whereas few studies have found both lexical-semantic oriented and lexical-phonologic oriented cueing treatments to have positive effects on naming behaviour with aphasic. [24,25] Other studies reported the results of cueing procedures with 32 adults diagnosed as nominal aphasics. The cues of word association, rhyming, and spelling the word were found to be equally effective, while the cue of describing objects by their use i.e. semantic cue was not as effective as other cueing techniques. [26] When compared the effects of semantic and phonological cueing on later naming success and found significant improvement in persons with aphasics. [27]

Many studies have highlighted that phonemic cues were more effective for Broca's than Wernicke's patients when

naming severity was controlled. [28-30] These aphasiologists have recognized the viability of cueing as a technique for helping the aphasic patient, but they have presented little systematic research to support the effectiveness of various cues. Hence the current investigation was designed to study the effects of two cueing techniques, semantic cueing and phonologic cueing, on persons with Broca's Aphasia who represented different levels of lexical - semantic processing impairment. Cueing treatments, in which the therapist presents stimuli of increasing power contingent upon the participant's error responses, were chosen in the study for several reasons such as using cueing approach in PWA, naming performance had increased drastically. One significant difference between phonological and semantic techniques is in the element of choice available. Generally, in phonological cueing, cues are easily accessible in contrast to semantic cueing where the choices are provided which limits the easy access of the target word. So it could be that the element of choice affects the nature of language processing. Along with this difference, it is interesting to know how two different grammatical classes of words (nouns and verbs) differ when provided with phonemic and semantic cues. Therefore, this study compares the effect of both phonemic cue and semantic cue on naming of verbs and nouns.

The development and evaluation of effective treatments for naming deficits continues to be an important issue in the treatment of PWA. Prior studies comparing the effects of word retrieval treatment for nouns versus verbs were reported using either of the cues i.e. either phonemic or semantic and have considered one form of grammatical classes' i.e. nouns or verbs. Although, few studies have incorporated both the cueing strategies, they have failed in counterbalancing and selecting appropriate stimuli for the study using cueing strategies. Also little focus is given on why one cueing strategy is superior than other and why the performance of different

grammatical classes varies while using cueing strategies. Since previous studies have employed multiple baseline designs with semantic cueing and phonemic cueing, direct comparison of the treatment approaches haven't been done till date. Keeping all the lacunae of the previous studies, present study was designed to examine the efficiency of semantic and phonemic cueing strategies with respect to retrieval of nouns and verbs in person with Broca's Aphasia.

Aim of the study

To compare the effect of cueing strategies on naming verbs and nouns in persons with Broca's Aphasia.

Objectives of the study

1. To compare the effect of phonemic and semantic cueing strategies on naming (verbs and nouns) in person with Broca's Aphasia.
2. To compare the effect of phonemic cueing strategies and semantic cueing strategies in naming of nouns in person with Broca's Aphasia.
3. To compare the effect of phonemic cueing strategies and semantic cueing strategies in naming of verbs in person with Broca's Aphasia.

METHODS

Participants: 15 participants diagnosed with Broca's Aphasia were selected for the study. All the participants were aged between 40-70 years. The diagnosis was made based upon administration of the Western Aphasia Battery -K. [31] The participants were receiving speech-language therapy and physiotherapeutic services at the time of the study. PWA greater than three months' post onset were considered for the study. Furthermore, it was ensured that there were no signs of Dementia at the time of data collection with no history or post-morbid condition of psychiatric disorders. Participants with pre-morbidly right handed having Kannada as their native language and with minimal motor ability of pointing and holding objects using their dominant or

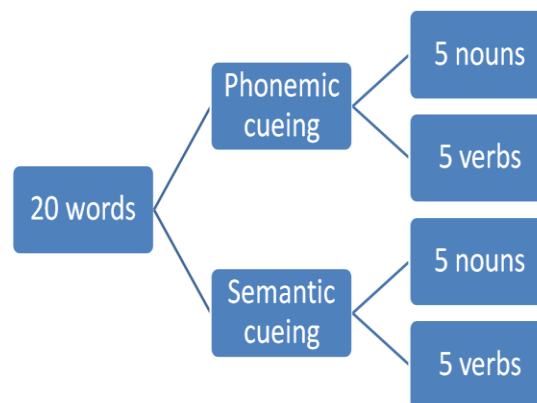
non-dominant hand based on their post morbid motor skills were included in the study. Informed consent was obtained along with all relevant medical and demographic information such as details of stroke, medical, therapeutic, and personal details as reported by PWA or caregivers was documented. All subjects evidenced a prominent word retrieval deficit in the presence of relatively well preserved auditory comprehension. WHO disability screening questionnaire [32] was administered to rule out any other associated visual and hearing impairment in the participants.

Stimuli: Test materials were developed to elicit the naming responses. Twenty black-and-white line drawings were used for the naming task, it included both nouns and verbs. Pictures of nouns were taken from Boston Naming Test [33] and verbs from Action Naming Battery. [34]

Procedure: The procedure was divided into two phases based on the cueing strategy used. In phase one, participants were presented with a single target picture to name. If they were unable to name a picture within five seconds, they were provided with a phonemic cue and naming response was recorded (Eg: Noun Target word = /kannu/, Cue: the word starts with /k/; Verb Target word= /allu/, cue the word starts with sound /a/). If the participants still failed to respond with the cueing, the response was marked incorrect and moved to the next stimuli. Similarly, it was done for other set of stimuli. In the second phase semantic cueing was used along with next set of pictures. When the participant failed to name the picture, they were provided with a semantic cue to elicit the naming response. (Eg: Noun Target word= /hasu/, Cueing= animal that says /ambhaaa/; Verb Target word=/toll/, cueing = if you have any stain in your cloth what will you do).

These phases were carried out for both nouns and verbs. In phase one, five words related to nouns and five words related to verbs were used and they were assessed using phonemic cue. In phase two set of

different five words were used for each nouns and verbs and they were assessed using semantic cue.



Scoring responses: All responses were recorded and scored as correct or incorrect. Responses scored as errors included semantic paraphasias, neologisms, circumlocutory responses, perseverative responses, and unintelligible responses. Similarly, response scored as correct even if client exhibited articulatory or syntactic errors.

RESULTS AND DISCUSSION

The study aimed to compare the effect of different cueing strategies on naming nouns and verbs in persons with Broca's Aphasia. The primary objective of the study was to compare the effect of phonemic and semantic cueing strategies on naming verbs and nouns in persons with Broca's Aphasia.

The present study employed single group design with counter balancing of the stimuli presentation. The dependent variables were naming of nouns and verbs and independent variables were cueing strategies i.e. phonemic and semantic cueing strategies. The results of the study are discussed under following sections

- A. Comparison of performance across different cueing strategies.
- B. Comparison of performance across different grammatical class of words i.e. nouns vs. verbs

Initially the data was subjected to test of normality. On administration of

Kolmogorov-Smirnov and Shapiro-Wilk tests, the results revealed that for semantic noun naming, semantic verb naming, phonemic noun naming and phonemic verb naming were not normally distributed ($p < 0.05$) and hence, non-parametric tests were applied for all the conditions mentioned above.

To study which cueing strategy among semantic and phonemic had significant effect on naming the nouns and verbs, the median values of the data were considered. The result revealed highest median value for phonemic cueing strategies in both noun and verb naming than semantic cueing strategy as show in the table 1.

Table 1: Median and Standard deviation of semantic noun naming, semantic verb naming, phonemic noun naming and phonemic verb naming

	SNN	PNN	SVN	PVN
Median	1.00	3.00	0.00	5.00
S.D	0.86	1.53	1.37	2.23

Note: SNN- Semantic noun naming; PNN- Phonemic noun naming; SVN- Semantic verb naming; PVN-Phonemic verb naming. On observing the median values of different cueing strategies, it was noted that values for phonemic verb naming was higher than phonemic noun naming, followed by semantic noun naming and semantic verb naming.

Further, to find the significant difference among the conditions such as semantic noun naming versus phonemic noun naming, semantic verb naming versus phonemic verb naming, semantic noun naming versus semantic verb naming, phonemic noun naming versus phonemic verb naming, non-parametric tests were applied (since the data was not normally distributed, $p < 0.05$). Friedman test was applied to check the differences within these conditions mentioned above, and the result revealed significant difference between tasks of the cueing strategies with respect to both the grammatical classes. ($\chi^2=27.40$, $df=3$, $p=0.00$). Further, pair wise comparison was done to check the effect of different cueing strategies on the grammatical classes (nouns and verbs) and significant differences were

found between semantic noun naming and phonemic noun naming ($|Z|=3.27$, $p < 0.005$), semantic verb naming and phonemic verb naming ($|Z|=2.99$, $p < 0.005$). But there was no significant difference found within the cueing strategies for different grammatical classes. The results are depicted in table 2.

Table 2: Results of Wilcoxon Signed Rank Test for different cueing strategies

Cueing strategies	Z	p Value
Semantic noun naming vs. Semantic verb naming	4.40	0.66
Phonemic noun Naming vs. phonemic verb naming	1.16	0.24
Semantic noun Naming vs. Phonemic noun naming	3.27	0.01*
Semantic verb naming vs. Phonemic verb Naming	2.99	0.03*

*Note= $p < 0.05$

The participants in the study, performed well with phonemic cueing than semantic cueing irrespective of naming nouns and verbs, this could be attributed to deficit in retrieval of words and intact storage in persons with Broca's aphasia. Also, semantic cueing requires intact storage and good retrieval abilities so performance on semantic cueing was poorer compare to phonemic cueing because this type of cueing strategies requires good retrieval skills. Results of the present study are in agreement with other studies. [35,15] It is also highlighted that phonemic pre stimulation cue can facilitate word retrieval of the target word. In addition, phonemic cue might act as a trigger or booster that might activate the motor commands for articulation of particular sound more easily when compare to semantic cue.

- **To compare the naming of nouns and verbs within the semantic and phonemic cueing strategy in persons with Broca's Aphasia.**

Descriptive statistics was applied to the above condition and based on the results revealed median value (as shown in Table 1) of the following conditions, Wilcoxon Signed Rank Test was further applied to check the statistical difference between semantic noun naming versus semantic verb naming, phonemic noun naming versus phonemic verb naming. The results revealed

that semantic cueing strategies did not have a significant effect between naming of nouns and verbs. ($Z=4.40$, $p>0.05$). Similar results were seen for naming of nouns and verbs using phonemic cueing strategy. The same is depicted in Table 3.

Table 3: Results of Wilcoxon Signed Rank Test for different cueing strategies

Cueing strategies	Z	p Value
Semantic noun naming vs. Semantic verb naming	4.40	0.66
Phonemic noun Naming vs. phonemic verb naming	1.16	0.24

In comparing the performance of Persons with Broca's aphasia on semantic noun naming versus semantic verb naming, we found there was no statistical difference between these two task, this might be attributed to overlapping networks of nouns and verbs, secondly it might be due to involvement of argument structure associated with semantic naming and semantic verb naming as well as phonemic noun naming versus phonemic verb naming. Thirdly, it could be due to use of words instead of sentences, because sentences make use of contextual cue and helps to perform better, but in our study we have used words, where contextual cue would have not present and PWA should tell the accurate name of the particular word without any contextual cue this might be difficult, which might have made the response poorer in the following tasks mentioned above. Also, it might be due to use of less number of stimuli of nouns and verbs i.e.5 in our study. Hence, we might to fail to identify statistical difference between phonemic noun naming versus phonemic verb naming as well as semantic noun naming versus semantic verb naming.

- **To compare the naming of nouns and verbs between phonemic cueing strategies and semantic cueing strategies in persons with Broca's aphasia.**

Descriptive statistics was applied to the above conditions and based on the result revealed median value (as shown in Table 1) of the following conditions, further

Wilcoxon Signed Rank Test was applied to check the statistical difference between semantic noun naming and phonemic noun naming. Similarly, statistical difference found between semantic verb naming and phonemic verb naming. The results revealed that different cueing strategies have a significant effect on naming of nouns. ($Z=3.27$, $p<0.05$), ($Z=2.99$, $p<0.05$) respectively. The same is depicted in Table 4 and Table 5.

Table 4: Results of Wilcoxon Signed Rank Test for different cueing strategies

Cueing strategies	Z	p value
Semantic noun Naming vs. Phonemic noun naming	3.27	0.01*

*Note= $p < 0.05$

Table 5: Results of Wilcoxon Signed Rank Test for different cueing strategies

Cueing strategies	Z	p value
Semantic verb naming vs. Phonemic verb naming	2.99	0.03*

*Note= $p < 0.05$

From the above table, it was indicated that the response of semantic noun naming versus phonemic noun naming and semantic verb naming versus phonemic verb naming, there was a statistical difference between these condition, this could be attributed to neural network associated with the semantic cueing is more and this make the persons with aphasia difficult to retrieve the words. When semantic cueing strategies is applied because of its extensive neural network, persons with aphasia find difficult to select appropriate words and inhibit the inappropriate word, hence the retrieval of word become difficult with semantic cueing than phonemic cueing. Wherein phonemic cueing strategies directly activate phonological node of the particular words will be activated, thus inturn make retrieval easy. Secondly this could be attributed to processing of cueing strategies, whereas phonemic cueing strategies might have processed peripherally but semantic cueing involves central processing. Hence it is difficult to use semantic cueing for retrieval of words but it will have long lasting effects. This study is in accordance with the results of other studies. [36]

CONCLUSIONS

The present study aimed at knowing what type of cueing strategies helps persons with Broca's aphasia, and the study results showed phonemic cueing strategies was superior compared to semantic cueing strategies. This might be due to complexity involved in processing of semantic cue compared to phonemic cue, in addition, semantic cueing makes persons with aphasia to simultaneously activate several neural network associated with the particular word and which in turn makes persons with aphasia difficult to inhibit several neural network associated with the particular word, which makes persons with aphasia to have error in naming such as circumlocutory or perseveratory error. In nutshell, this study gives insight about cueing strategies that can be used with respect to different grammatical class of words and also this information might be useful while planning the therapeutic goal for persons with aphasia in terms of selecting appropriate cueing strategies and the type of grammatical class of word can be used, along with the results of the present study further it can be compared with the other cueing strategies and check for the superiority or strength of the particular cueing strategies. However, on the other hand, they were large corpus of cues might facilitate persons with aphasia in terms of assessment and rehabilitation further researcher needs to incorporate maximum number of cues and see the efficacy of these cues.

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