

Lexical Parameters Affecting Sentence  
Recall by Adult Aphasic Patients

Craig E. Buckley  
Shapiro Developmental Center, Kankakee, Illinois

J. Douglas Noll  
Purdue University, Lafayette, Indiana

In an effort to understand the nature of the language deficit and to find an efficient means of facilitating recovery in aphasia, researchers have attempted to identify the linguistic parameters which affect language processing for these patients. Two lexical variables which have been found to be significant are "operativity" of nouns and "semantic field" of verbs. Operative nouns are classified as such on the basis of their manipulability (especially by the hands), hard surface, separateness and independence from the environment, frequent use in everyday activities, ability to be experienced through several sensory modalities, and usually have a small size relative to the human body. Figurative nouns, on the other hand, refer to things which are not readily manipulable either because of their size, location or general spatial configuration (e.g., a "forest" is pictureable but not manipulable), in some cases not firm to the touch, continuous with the surroundings by nature of their size (e.g., "building") or substance (e.g., "river"), and are not frequently perceived through sensory modalities other than the visual. In a confrontation naming task, Gardner (1973) observed that aphasic subjects tended to retrieve operative nouns more easily than figurative nouns. Regarding verb form, Seff (1979) noted that motion verbs are more easily processed by the aphasic patient than contact and communication verbs.

Clinical treatment programs for aphasic patients are de-emphasizing the confrontation naming noun-centered orientation and emphasizing preservation of whole concept formulation within the context of the verb phrase and sentences (c.f., Beyn and Shokhor-Trotskaya, 1966; West, 1978; Loverso, Selinger, and Prescott, 1979). The present study focused primarily on the effects of three linguistic parameters in a sentence recall task: operativity, overt action in verbs, and "semantic connectedness" of the verb and object noun.

#### METHOD

Twelve aphasic subjects were presented with tape recorded sentence pairs, and they were instructed to repeat aloud, in any order, the sentence pair content. The sentence pairs were counterbalanced and randomized from a corpus of 48 sentences. The Appendix contains the sentences used in this study. The sentences were simple affirmative declarative of the basic form subject noun (man, woman, boy, girl) plus past tense verb plus object noun. The verbs and object nouns were high frequency (either "A," at least 50 occurrences per million words, or "AA," 100 per million) according to the Thorndike-Lorge (1944) word count.

There were 24 object nouns classified as operative and 24 object nouns classified as figurative. These nouns were independently classified by a panel of judges with at least two-thirds agreement as to determination of operativity or figurativity.

The verbs were selected by the authors to represent two general types--dynamic and stative. Dynamic verbs represent an overt action of "contact" (e.g., hit, struck) and "motion" (e.g., climbed, turned). Stative verbs represent nonobservable states (e.g., needed, wants) and possession (e.g., owned, had).

Sentences were constructed in pairs such that the only varying element of each pair was the object noun; one sentence contained an operative and the other a figurative object noun. For example, "The girl saw the book" contains an operative object noun, and its matched counterpart, "The girl saw the cloud," contains a figurative object noun. In this way, the influence of sentence context was controlled, and the effects of object noun type on recall could be isolated. Twenty-four such sentence pairs were constructed. Likewise, there were 12 dynamic verbs and 12 stative verbs. It was presumed that the verb types would interact with the object nouns such that dynamic-operative (D-O) sentence recall would be better than dynamic-figurative (D-F) and that stative-operative (S-O) sentence recall would be better than stative-figurative (S-F) sentences.

The tape recorded sentences were presented to the aphasic subjects in paired fashion. Sentences were randomly selected from each of the above four sentence types and paired. Thus, the subject might hear the two sentences, "The woman cut the cloth - The boy smelled the river." No two sentences were paired from the same sentence type. There were two seconds of silence between the first and second sentence of a sentence pair. After the pair, the tape recorder was stopped to allow the subjects as much time as they wanted to repeat the sentences. The sentence pairs were never replayed a second time for subjects. The following instructions were read to the subjects:

You are going to hear some sentence pairs through the headphones. After two sentences are played, say them back to me. Try your best to remember anything you can about the sentences. Again, two sentences in a row will be played. Wait until both sentences have been played, then say them back to me. Try to remember anything you can about the sentences, in any order it comes to mind.

The subjects were selected from a variety of rehabilitation facilities. There were no subject requirements concerning type of aphasia, age, sex, handedness or etiology. Time post-onset ranged from 5 months to 4 years 10 months, with a mean of 1 year 9 months. To be included in the study, subjects had to pass an audiometric screening test and demonstrate a short term memory span of at least three digits (DeRenzi and Nichelli, 1975). In an attempt to exclude aphasic patients with very minimal, or conversely, very profound auditory verbal comprehension deficits, the abbreviated version of the Token Test was administered (DeRenzi and Faglioni, 1979). No patient who scored less than 5 correct or greater than or equal to their respective cutting score was included as a subject. A final screening measure consisted of a tape recorded presentation of three sentence pairs (6 sentences) similar in structure to those of the actual experimental task, but containing different high frequency object nouns and verbs. Patients

who recalled at least two but no more than 10 of the 12 contentive verbs and object-nouns were included as subjects.

The subject nouns, articles and prepositions were of no particular significance to this study, and hence were not included in the analysis of results. That is, only the subjects' attempts at producing the verbs and object nouns were considered. The subject's utterance was judged to be correct if it consisted of less than or equal to the number of syllables in the target word and the stressed vowel was retained. Literal paraphasias were counted as correct if the phoneme substitutions did not produce a different word and the correct stressed vowel was produced, e.g., "toin" for "coin," or "rimer" for "river." All semantic paraphasias were scored as incorrect since they resulted in words which were different from those presented in a particular sentence, e.g., "mow" for "cut," or "desk" for "dust."

In order to assess interjudge reliability, the two authors independently scored the tape recorded samples of the subjects' utterances, yielding 92% agreement. The senior author (CEB) rescored all subject responses from the tape recordings and compared the results to his original scoring for a 98% intrajudge agreement.

## RESULTS

Table 1 shows a comparison of total operative versus figurative object nouns correctly recalled, using a directional t-test. Eight of the twelve subjects recalled more operative than figurative nouns, and as noted in Table 1, the mean correct recall of operative nouns (16.83) was greater than the figurative object nouns (15.75). However, this difference was not statistically significant.

Table 1. Number of correct object nouns recalled.

---

	<u>OPERATIVE NOUNS</u>	<u>FIGURATIVE NOUNS</u>
Mean (score)	16.83	15.75
Range	8-22	5-23
S.D.	6.71	5.70

$t=1.38, p<0.10$

(Maximum Score is 24)

---

It was predicted that more dynamic than stative verbs would be recalled by the aphasic subjects. A significant difference between means for these categories was obtained using a directional t-test, as seen in Table 2. This finding is in agreement with the results of Seff (1979) who also found a similar difference in ease of processing verbs. In a picture-word matching task, she found that aphasic subjects made fewest errors on motion verbs and most errors on contact verbs. The explanation Seff gave for the increased ability of aphasic patients to process action verbs over other verbs is that the former are highly "imageable." Furthermore, many learning researchers have demonstrated that verbal recall is facilitated by dynamic action imagery, as opposed to static imagery or rote rehearsal, in both stimuli and rehearsal strategies.

Table 2. Number of correct verbs recalled.

	<u>DYNAMIC VERBS</u>	<u>STATIVE VERBS</u>
Mean (score)	14.67	13.17
Range	3-24	4-21
S.D.	6.71	5.70

$t=2.46, p<0.025$

(Maximum Score is 24)

Halpern (1965) and Holmes, Marshall, and Newcombe (1971) and others have noted that among aphasic patients, nouns are easier to process than verbs. In the present study, correct nouns were recalled significantly more than verbs, as shown in Table 3.

Table 3. Numbers of verbs and object nouns correctly recalled.

	<u>NOUNS</u>	<u>VERBS</u>
Mean (score)	32.58	27.58
Range	16-43	7-38
S. D.	10.26	11.98

$t=3.45, p<.005$

(Maximum Score is 48)

Considering the sentence recall task from a different perspective, it was predicted that subjects would tend to recall both of the scorable substantives (verb and object noun of a sentence) more often than just one or the other substantive alone. This prediction was based on the research of Brent (1969), Marschark and Paivio (1977), and Hanson (1976). All found that the unit of memory is the "unitary idea" or meaning of a sentence and not the discrete verbal elements themselves; that is, sentences are remembered as whole semantic units. A comparison between mean recall of sentences in which both substantives versus only one substantive was recalled using a directional (both contentives > one) t-test revealed a significant difference between mean recall of these characteristics ( $t=3.88, p<0.005$ ).

Another statistical analysis focused on the sentence level to determine if there was an interaction between verb type and noun type on sentence recall. In this analysis only those sentences in which both the verb and object noun were recalled were scored as correct. In this way, the dependent variable is the sentence. Sentences in which either the verb or object noun was recalled were disregarded, because these sentences were only partially recalled and could not be included in the analysis. For example, suppose the stimulus sentence was "The man turned the key." This

sentence happens to have a dynamic verb and operative noun and is therefore labeled a D-O sentence. Given that both the verb and object noun are recalled correctly, it is impossible to say that one caused recall of the other. One can, however, say that in this instance recall of the dynamic verb was associated with recall of the operative object noun. This associational analysis is only valid, though, if performance on the four sentence types (D-O, D-F, S-O and S-F) is compared. If there is an interaction between types of verbs and types of nouns, it could be detected by comparing recall for these four sentence types. If, however, the subject only recalls either the verb or the object noun, e.g., "turn" or "key," then we have no way of saying that the dynamic verb was interacting with the operative object noun. That is, interaction in this study is an inter-sentence phenomenon. Therefore, sentences in which only the verb or object noun were recalled were disregarded when analyzing subject responses. The mean number of correctly recalled sentences according to sentence type are presented in Table 4. A repeated-measures one-way analysis of variance was conducted with the four levels of sentence type being D-O, D-F, S-O and S-F. The results ( $n = 12$ ,  $F = .577$ ) indicated that there was no significant difference between mean recall of the four sentence types and hence no interaction between type of verb and object noun. However, the differences were in the expected direction with mean recall of D-O > D-F > S-O > S-F sentence types. As more D-F than S-O sentences were recalled, perhaps dynamic verbs had a slightly greater effect in facilitating recall than operative nouns did.

Table 4. Mean number of correctly recalled sentence types.

	<u>SENTENCE TYPES</u>			
	S-O	S-F	D-O	D-F
Mean	6.09	5.67	7.33	6.5
S.D.	2.84	3.26	3.50	3.45

All the sentence stimuli used in this study are plausible, but some of them are less probable and acceptable than others based upon the "semantic connection" between the verb and the object noun. This concept of semantic connection between verb and object noun can be viewed by asking how predictable the object noun is, given the subject noun phrase and the verb. Taking the sentence "The girl kicked the ball" as an example, one can easily predict from among a small number of possibilities, the object noun "ball," when given "The girl kicked...". On the contrary, one would be unlikely to predict the object noun "dust" in the sentence "The girl kicked the dust." Similarly, in the sentence "The boy smelled the river," although one can imagine a situation in which this sentence would be appropriate and sensible, the semantic connection of the verb and object noun is weak and uncommon.

Another way of looking at the individual semantic connection or "semantic value" of a sentence is to consider its hypothetical frequency of occurrence in ordinary life situations. In this light, the sentence "The woman passed the milk" probably represents a more frequently occurring event than that represented by the sentence "The man owned a forest."

In order to test for the possible influence of "semantic value" on sentence recall, the authors selected ten sentences each from two groups of sentences classified as either high or low probability. Examples of high and low probability sentences are shown on Table 5.

Table 5. Examples of high and low probability sentence stimuli.

---

<u>HIGH PROBABILITY</u>	<u>LOW PROBABILITY</u>
The girl climbed the hill.	The boy wants some air.
The girl kicked the ball.	The girl kicked the dust.
The woman cut the cloth.	The man owned a forest.
The boy smelled the flower.	The woman needed a coin.

---

High probability sentences were defined as those which contain semantically connected verbs and object nouns, occur with high frequency in ordinary life situations, and allow relatively easy prediction of the object noun, given the subject noun phrase and verb. Low probability sentences are less likely to occur in ordinary life situations and contain object nouns which are not easily predictable given the subject noun phrase and verb. A sentence was scored as correct only if both the verb and object noun were recalled. Subjects recalled the 10 high probability sentences significantly more easily than the 10 low probability sentences, as shown on Table 6.

Table 6. Number of high and low probability sentences correctly recalled.

---

	<u>HIGH PROBABILITY</u>	<u>LOW PROBABILITY</u>
Mean (score)	6.25	4.17
Range	1-10	0-9
S.D.	2.90	2.66

$t=4.61, p<.0005$

(Maximum Score is 10)

---

## DISCUSSION

The recall performance of the aphasic subjects in this study for object noun type was nonsignificant. However, these results were in the predicted direction--more operative than figurative object nouns were recalled. The lack of statistical significance may have been because the task used in this study was not sensitive enough to detect differences among the sample of subjects. Operative nouns are far more conducive to methods of cuing which emphasize function and they represent objects which are frequently manipulated in activities of everyday life. Since word-finding is a problem common to all aphasic patients, functionally relevant, easily cued words, such as operative nouns, should be stressed in therapy.

Implicit in the functions of everyday life and the inherent manipulation involved is action. This provides support for inclusion of action verbs within the format of aphasic language therapy. Many researchers have demonstrated that verbal recall is enhanced by dynamic action as opposed to stative imagery, in both the stimuli and rehearsal strategies (Wapner and Werner, 1957; Paivio, 1971, 1975; Bower, 1972; West, 1977). With this in mind, Helm and Benson (1978) have developed a program of "Visual Action Therapy" (VAT) for global aphasic patients. The goal of this therapy is to train patients to produce representational gestures in symbolizing small line drawings. The Visual Action Therapy program uses a series of eight objects and line drawings of those objects which are easily manipulated in one hand and can be symbolized by a distinct gesture. Patients trained in this approach significantly improved their language skills, yet verbal language was never used during the sessions. The authors concluded that "training of alternative visual and gestural pathways permitted access to intact language knowledge."

Beyn and Shokhor-Trotskaya (1966) proposed that telegrammatism in aphasics' speech could be avoided if language therapy emphasized whole cognitive units, including, in particular, verbs and verb phrases. Recently, Helm (in West, 1978) has devised a syntax stimulation program for aphasic patients which is based on progressive development of the verb phrase. The results of the present study elaborate on this concept by demonstrating that the semantic field of verbs is an important consideration; that is, action or dynamic verbs have a distinct advantage in ease of processing over stative verbs.

In agreement with previous research, it was found that nouns are easier to recall or process than verbs. Indeed, the natural tendency of the Broca's aphasic patient is to develop telegraphic speech which relies on nouns as its prime content. For this reason, Beyn and Shokhor-Trotskaya (1966) developed their preventive method of aphasia speech rehabilitation, which shifted the focus of therapy toward development of a more normal grammatical system. The tendency of these patients to rely on telegraphic noun-centered speech is avoided by the early introduction of a predicative vocabulary, even in initial stages when speech may be completely absent. Further justification for development of a therapy program based on predication is provided by the present finding that whole concept or sentence recall is a natural tendency. Moreover, it follows that whole concepts are easier to recall when they contain constituents which are "semantically connected."

In general, guidelines of function and relevance stand out as central in the development of language rehabilitation programs. Semantically connected high probability sentences which contain operative nouns and dynamic verbs are influential in facilitating linguistic processing for aphasic patients.

APPENDIX

OPERATIVE OBJECT NOUN

STATIVE VERB

The boy had an apple.  
The girl saw the book.  
The man owned a car.  
The woman held a pen.  
The boy wants a cup.  
The girl heard the watch.  
The man felt the brush.  
The woman needed a coin.  
The boy smelled the flower.  
The girl looked at the paper.  
The man liked the shoes.  
The woman sat on the egg.

DYNAMIC VERB

The boy struck the table.  
The girl climbed the chair.  
The man hit the dog.  
The boy fell onto his arm.  
The girl left the coat.  
The man turned the key.  
The woman passed the milk.  
The boy crossed his legs.  
The girl kicked the ball.  
The man cleaned the plate.  
The woman cut the cloth.

FIGURATIVE OBJECT NOUN

STATIVE VERB

The boy had a party.  
The girl saw the cloud.  
The man owned the forest.  
The woman held some soil.  
The boy wants some air.  
The girl heard the storm.  
The man felt the rain.  
The woman needed a kitchen.  
The boy smelled the river.  
The girl looked at the sky.  
The man liked the ocean.  
The woman sat on the bridge.

DYNAMIC VERB

The boy struck the path.  
The girl climbed the hill.  
The man hit the wall.  
The boy fell onto the road.  
The girl left the city.  
The man turned the corner.  
The woman passed the lake.  
The boy crossed the field.  
The girl kicked the dust.  
The man cleaned the building.  
The woman cut the grass.

REFERENCES

- Beyn, E.S. and Shokhor-Trotskaya, M.K. The preventive method of speech rehabilitation in aphasia. Cortex, 2, 96-108, 1966.
- Bower, G.H. Mental imagery and associative learning. In L.W. Gregg (Ed.), Cognition in Learning and Memory. New York: Wiley, 1972.
- Brent, S.B. Linguistic unity, list length, and rate of presentation in serial anticipation learning. Journal of Verbal Learning and Verbal Behavior, 8, 70-79, 1969.
- DeRenzi, E. and Faglioni, P. (Translated by J.R. Solomon) Examination for aphasic disturbances of oral comprehension by means of an abbreviated version of the Token Test. Aphasia-Apraxia-Agnosia, 1, 12-24, 1979.
- Gardner, H. The contribution of operativity to naming capacity in aphasic patients. Neuropsychologia, 11, 213-220, 1973.
- Halpern, H. Effect of stimulus variables on dysphasic verbal errors. Perceptual and Motor Skills, 21, 291-298, 1965.
- Hanson, B.R. Recall of sentence meaning in aphasic and nonaphasic adults. Journal of Communication Disorders, 9, 235-246, 1976.



- Helm, N.A. and Benson, D.F. Visual action therapy for global aphasia. Paper presented to Academy of Aphasia, Chicago, October, 1978.
- Holmes, J.M., Marshall, J.C. and Newcombe, F. Syntactic class as a determinant of word-retrieval in normal and dyslexic subjects. Nature, 234, 416, 1971.
- Loverso, P., Selinger, M. and Prescott, T. Applications of verbing strategies to aphasia treatment. In R.H. Brookshire (Ed.), Clinical Aphasiology. Minneapolis, MN: BRK Publishers, 1979.
- Marschark, M. and Paivio, A. Integrative processing of concrete and abstract sentences. Journal of Verbal Learning and Verbal Behavior, 16, 217-231, 1977.
- Paivio, A. Imagery and Verbal Processes. New York: Holt, Rinehart, and Winston, 1971.
- Paivio, A. Imagery and long-term memory. In A. Kennedy and A. Wilkes (Eds), Studies in Long Term Memory. New York: John Wiley and Sons, 1975.
- Seff, J. A visual half field examination of normal and aphasic processing of three groups of verbs. Unpublished M.A. Thesis, Hunter College, CUNY, 1979.
- Thorndike, E.L. and Lorge, I. The Teacher's Word Book of 30,000 Words. New York: Teacher's College, 1944.
- Wapner, S. and Werner, H. Perceptual Development. Boston: Clark University Press, 1957.
- West, J.F. Imaging and aphasia. In R.H. Brookshire (Ed.), Clinical Aphasiology. Minneapolis, MN: BRK Publishers, 1977.
- West, J.F. Heightening the action imagery of materials used in aphasia treatment. In R.H. Brookshire (Ed.), Clinical Aphasiology. Minneapolis, MN: BRK Publishers, 1978.