Verbal noise and linguistic constraints¹

HERMAN BUSCHKE, DIVISION OF NEUROLOGY,
STANFORD UNIVERSITY, Palo Alto, Calif. 94304

Repeated interjection of a single irrelevant word into sentences, anomalous word-strings, anagrammatic word-strings, and word-lists provides a kind of verbal noise which may amplify the effects of linguistic constraints in immediate memory. In 15 normal Ss such verbal noise significantly decreased immediate recall of word-strings lacking syntactic structure or semantic coherence or both, but had no significant effect on recall of sentences.

Linguistic constraints in perception and learning of sentences are well known. Miller & Isard (1963) have shown that grammatical sentences are more intelligible when heard in masking noise than semantically anomalous sentences which follow syntactic rules, while ungrammatical strings of words are least accurately perceived. Marks & Miller (1964) demonstrated that learning by free recall over five trials was greatest for normal sentences; less for anomalous sentences and for anagram strings without grammatical structure; and least for word-lists without either syntactic structure or semantic coherence.

Broadbent (1952) has shown that alternating different irrelevant words with relevant words in short auditory messages about visual displays increases the difficulty in giving correct yes-no responses about the visual display. This report describes the effect of a similar kind of verbal noise on immediate recall of word strings with or without semantic or syntactic constraints. The verbal noise used here simply involves the repeated sequential interjection of a single extraneous word (known to S) in a string of other relevant words. For example, the sentence: "Large cars cost many dollars" when presented in verbal noise (using "fish" as the extraneous word) becomes: "Fish large fish cars fish cost fish many fish dollars fish." Ss are instructed to recall only the relevant words in order of presentation immediately after they have heard the string (excluding the extraneous word "fish").

This use of verbal noise was initially developed for clinical evaluation of linguistic function in patients with cerebral disease. Normal sentences, anomalous strings, anagram strings and word-lists were presented verbally, both with and without verbal noise. While patients with cerebral disease may show severe decrement in recall of all kinds of strings in verbal noise, recall of normal sentences usually is greater than recall of word-lists, even in verbal noise. However, in some patients, when verbal noise was added, the recall of normal sentences was no better than recall of word-lists, revealing linguistic dysfunction not apparent without verbal noise. This method may also be useful in developmental studies of language acquisition since the use of verbal noise may provide a means for making the processing of linguistic strings more difficult without altering the relevant strings themselves.

The present study was undertaken to show that even with verbal noise semantic and syntactic constraints normally facilitate immediate recall of short word-strings which are within the capacity of short-term memory, so that immediate recall of sentences is still better than recall of word-lists.

Subjects

The 15 Ss were college students, paid for their participation. They were tested individually in one 30-min session.

Materials

The word strings used were Set II provided by Marks & Miller (1964, pp. 4-5). There are five words in each string. The five normal sentences and the anomalous sentences have the following syntactic structure: adjective-plural noun-verb-adjective-plural noun. The five anomalous strings were constructed by using the first word of the first normal sentence, the second word of the second normal sentence, etc. The five anagram strings were constructed by randomizing the order of words in each normal sentence. The five word-lists were constructed by randomizing the order of words in the anomalous sentences. Normal sentences have both syntactic structure and semantic coherence, anomalous

strings have syntactic structure without semantic coherence, anagram strings have semantic coherence without syntactic structure, and word-lists have neither syntactic structure nor semantic coherence.

Each of the 20 strings was presented twice; once with verbal noise and once without verbal noise. The entire series of 40 strings consisted of 10 blocks; each block of four strings consisting of a normal sentence, an anomalous string, an anagram string, a word-list, in that order. The first block was presented without verbal noise, the next block with verbal noise, so that presentation with or without verbal noise alternated from block to block through the whole series. The two occurrences of each string were approximately counterbalanced within the entire series so that for about half, presentation with verbal noise occurred first; and so that for the related normal sentences and anagram strings about half of each occurred first.

Procedure

The strings were read aloud to each S at about one word per second. When verbal noise was used, the word "fish" was presented first and repeated after each relevant word in the string. The Ss were instructed to recall verbally all of the relevant words in each string in order of presentation (except for the word "fish," which was not to be reported), immediately after presentation of each string. They were allowed 15 sec for their recall, which was recorded by the experimenter. Scoring was in terms of number of words recalled regardless of order and number of perfect strings (all words recalled in correct order).

Results and Discussion

The present findings indicate that verbal noise does affect immediate recall of short word strings by normal Ss and that recall of short sentences is better than recall of other word strings when presented with verbal noise. Table 1 shows the total number of words recalled (regardless of order). Table 2 shows the total number of correct strings with all words recalled in correct order. The results in both Tables 1 and 2 are similar, and were evaluated by Sign tests applied to recall by each S (Siegal, 1956).

The overall effect of verbal noise is shown by decreased total recall of words, $p < .002$, and of (perfect) strings $p < .001$. As indicated in Table 1, verbal noise decreased recall of words in anomalous strings, $p = .011$, anagrammatic strings, $p = .001$, and word-lists, $p = .003$, but not of sentences. Recall of strings (Table 2) was decreased by verbal noise for anomalous strings, $p = .011$, anagrammatic strings, $p = .006$, and word-lists, $p = .002$, but not for sentences. Recall of sentences which have both syntactic structure and semantic coherence was not found to be significantly decreased by verbal noise, but recall of other kinds of word strings lacking either syntactic structure or semantic coherence or both was decreased by presentation in verbal noise.

Without verbal noise, recall of words in sentences and anagrammatic strings was greater than recall of words in word-lists, $p = .002$ and $p = .02$. With verbal noise more words were recalled from sentences than from anomalous strings, $p = .002$, anagrammatic strings, $p < .006$, and word-lists, $p < .001$. Recall of words from anomalous strings was greater than recall from word-lists in verbal noise, $p = .011$, but recall of words from anagrammatic strings was not significantly different than of those in anomalous strings or word-lists.

Without verbal noise, recall of perfect strings was greater for sentences than for anagrammatic strings, $p = .016$, or word-lists, p

Table 1
Number of Words Recalled (Regardless of Order) for Presentation with and without Verbal Noise

Presentation	Sentences	Anomalous Strings	Anagrammatic Strings	Word-Lists
No Noise	375	371	368	357
Verbal Noise	373	349*	346*	339*

* Significant difference with and without verbal noise.

Table 2
Number of Perfect Strings with All Words Recalled in Correct Order for
Presentation with and without Verbal Noise

Presentation	Sentences	Anomalous Strings	Anagrammatic Strings	Word- Lists
No Noise	75	71	61	56
Verbal Noise	72	53*	42*	40*

* Significant difference with and without verbal noise.

= .002. With verbal noise, recall of *strings* was greater for sentences than for anomalous strings, $p = .002$, anagrammatic strings, $p = .001$, or word-lists, $p = .001$, and recall of anomalous *strings* was greater than of word-list *strings*, $p = .019$.

The present results do not show unambiguous differences in recall of anomalous strings and anagrammatic strings. The *decreases* in recall of either words or perfect strings for anomalous, anagrammatic and word-lists were not significantly different from each other. However, the *decrease* in recall of *words* in verbal noise from each of these types was greater than that from sentences: word-lists, $p = .019$; anagrammatic, $p = .011$; anomalous, $p < .02$, Wilcoxon. This was also found for *strings*:

word-lists, $p = .004$; anagrammatic, $p = .046$; anomalous, $p < .05$, Wilcoxon.

The present results confirm that syntactic and semantic constraints increase the immediate recall of even short strings of words presented aurally. The use of verbal noise in presentation, decreases recall of anomalous strings, anagrammatic strings, and word-lists, but such verbal noise does not appear to significantly decrease the normal recall of short sentences where both syntactic and semantic constraints are present.

REFERENCES

- BROADBENT, D. E. Failures of attention in selective listening. *J. exp. Psychol.*, 1952, 44, 428-433.
- MARKS, L. E., & MILLER, G. A. The role of semantic and syntactic constraints in the memorization of English sentences. *J. verbal Learn. verbal Behav.*, 1964, 3, 1-5.
- MILLER, G. A., & ISARD, S. Some perceptual consequences of linguistic rules. *J. verbal Learn. verbal Behav.*, 1963, 2, 217-228.
- SIEGEL, S. *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill, 1956.

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