[7] Wolf, K., Quimby, M. C., and Carlson, C. P., *J. Fish. Res. Board Canad.*, **25**, 383 (1968).
[8] Wolf, K., Quimby, M. C., and Bradford, A. D., *Virology*, **21**, 317 (1963).
[9] Vestergaard Jørgenser, P. E., and Bregnballe, F., *Nordisk Veterinaermedian*, **21**, 142 (1969).

Syntactic Class as a Determinant of Word-retrieval in Normal and Dyslexic Subjects

SUBJECTS with dyslexia following brain lesions may read concrete nouns significantly better than other parts of speech[1]. There may be a normal analogue in tachistoscopic recognition thresholds for different parts of speech. The only study in which this has been investigated[2], however, was conducted with German adolescents, and the results may have been biased by a difference in the relative usage of concrete nouns by adolescents and adults.

We have conducted similar experiments on syntactic class effects in English, and have investigated the reading performance, on the same material, of a small group of subjects with residual acquired dyslexia. A list of sixty words, consisting of twenty concrete nouns, twenty adjectives and twenty verbs, was used. The words vary in length between four and seven letters, and are divided into five frequency ranges (Thorndike and Lorge[3]). All words are matched for length and frequency across the three syntactic classes; there are equal numbers of words in all frequency ranges and at all lengths.

In the first experiment, these stimuli, typed in lower case (Delegate typeface) letters, were presented individually in a three-channel tachistoscope (Scientific Prototype, MFG Corp, model GB). The subject fixated a central cross in the pre-exposure field, and, after a "ready" signal, the stimulus was presented centrally, followed by a blank post-exposure field. An ascending method of limits was used; the first exposure was 10 ms and on each successive exposure the duration was increased by 5 ms until the subject correctly reported the stimulus on two consecutive trials. Order of presentation of the sixty stimuli was randomized anew for each subject. Practice trials were given to familiarize the subject with his task. The subjects were twenty students, technical and academic staff of the University of Edinburgh (mean age 24 yr). The results are shown in Table 1. Friedman two-way analysis of variance shows that the effects of syntactic class, length and frequency are significant at beyond the 0.001 level. The difference between nouns and verbs is significant (Wilcoxon matched-pairs signed-ranks test, $T=2$; $P<0.001$, two-tailed), as is the difference between nouns and adjectives ($T=40.5$; $P<0.02$, two-tailed) and adjectives and verbs ($T=27$; $P<0.01$, two-tailed).

To check that these results are not due to uncontrolled (and at present uncontrollable) variation in the purely visual properties of the stimuli, a second experiment was conducted using the same words in upper case (Delegate) letters. Seven subjects from the same population as before (mean age 20 yr) were tested. The initial exposure was 10 ms, increasing by 10 ms on each trial. In all other respects, the experimental method was the same as in experiment 1. The mean recognition thresholds for the syntactic classes were: nouns, 37.0 ms; adjectives, 41.4 ms; verbs, 45.2 ms. Friedman two-way analysis of variance shows that these values are not drawn from the same population ($Xr^2=7.36$; $P<0.05$). The difference between nouns and verbs is significant at the 0.05 level ($T=0$). With such a small number of subjects, the noun/adjective and the adjective/verb differences fail to reach significance. The upper case means are higher than lower case, as is customarily found, but the effect of syntactic class is still demonstrable.

Table 1 Mean Recognition Thresholds in Milliseconds

Syntactic class	Nouns 30.3		Adjectives 33.3		Verbs 35.8	Xr^2 21.63*
Length (in letters)	Four 39.5		Five 31.7	Six 32.1	Seven 29.9	57.8*
Frequency	AA 27.5	A 27.1	37–17 30.0	18–8 39.4	8–1 41.6	40.9*

* $P<0.001$.

The same words, in lower case, were presented for reading aloud, to five dyslexic subjects, mean age 48 yr. All five men received penetrating missile injuries to the left hemisphere during the Second World War. All have residual language impairment with a disorder of reading being one of the predominant features (for further details of these cases, see Marshall and Newcombe[4]). The words were presented, individually typed, on plain white cards. No time pressure was imposed. The subjects read correctly eighty-one nouns (out of 100; twenty nouns, five subjects), fifty-five adjectives and fifty-four verbs ($Xr^2=6.3$; $P<0.05$). The effects of length and frequency are significant at beyond the 0.01 level. Thus a number of stimulus variables which affect tachistoscopic recognition thresholds are also correlated with dyslexic performance.

The order of difficulty in syntactic class (verb > noun) and over the frequency ranges (infrequent > frequent) is the same in both the dyslexic and the normal subjects; but increasing length (between four and seven letters), which is correlated with a lowering of threshold in the normal subjects, resulted in increased difficulty for the dyslexic subjects. A further difference is that thresholds for adjectives for the normal subjects are intermediate between nouns and verbs, while for the dyslexic subjects reading-performance on adjectives is indistinguishable from that on verbs. (Halpern[1] has also reported this latter result.)

The next task is to discover how and why the observed facilitation of nouns takes place.

JANE M. HOLMES
JOHN C. MARSHALL

MRC Speech and Communication Unit, University of Edinburgh

FREDA NEWCOMBE

Department of Neurology, The Churchill Hospital, Oxford

Received July 14, 1971.

[1] Halpern, H., *Percept. Motor Skills*, **21**, 291 (1965).
[2] Riegel, K. F., and Riegel, R. M., *Language and Speech*, **4**, 157 (1961).
[3] Thorndike, E. L., and Lorge, I., *The Teacher's Word Book of 30,000 Words* (Teachers College, New York, 1944).
[4] Marshall, J. C., and Newcombe, F., *Patterns of Paralexia*, MRC Report, SCU 5/71 (1971).

Lateral Thinking about Lateral Inhibition

IT has recently been asserted[1] that the well known apparent expansion of acute angles is due not to the lateral inhibition proposed by Blakemore *et al.*[2], but to an adaptation effect similar to the Gibson tilt after-effect[3,4]. The arguments by which Coltheart arrives at this conclusion, however, seem to us to be based on a complete misreading, and hence misrepresentation, of our article, which we should like to correct.

The strongest reason for rejecting adaptation as an explanation for angle expansion is, as Coltheart correctly adduces, the fact that disinhibition (that is, partial cancellation of angle expansion) may be produced by introducing a third line into the figure. Coltheart proceeds to discuss the special case in which the disinhibiting line lies outside the angle in question,