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SYNTACTIC AND SEMANTIC ERRORS IN PARALEXIA

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Abstract—A case of selective dysphasic impairment resulting from gunshot injury is reported. The numerous paralexic errors made to different parts of speech are analysed. The preponderance of semantic errors and specific facilitation of noun responses are discussed.

1. INTRODUCTION

IN 1878, HUGHLINGS JACKSON [1] drew attention to the positive and negative aspects of "speech affection" (dysphasia). He pointed out that the patient who says "chair" for "table" shows both loss and retention: "it is the best speech under the circumstances, and is owing to the activity of healthy (except perhaps slightly unstable) nervous elements".

Since then, there have been many references in the literature to paraphasic errors in naming tests (LOTMAR [2]), in object naming during cortical stimulation (PENFIELD and ROBERTS [3]) and in oral repetition (GOLDSTEIN [4]). Clinical studies, such as those of HEAD [5] and WEISENBERG and MCBRIDE [6], have provided examples of paraphasia in several aspects of language function but there have been comparatively few studies of paralexia. GOLDSTEIN [4] (p .310) published a relevant case report and CONRAD [7] drew attention to reading errors drawn from the same "semantic sphere" as the stimulus word. However, no quantitative linguistic studies are known to us. We, therefore, began an investigation of a case in which the linguistic aspect of paralexia was of interest.

2. CASE REPORT

This patient (G.R.) received an accidental, severe, through and through injury in 1944 when he was twenty years old and on active service. As he fell from a lorry, a bullet from his own sten gun entered the brain in front of the left ear, ploughed up the left temporal and parietal cortex and the vessels of the Sylvian fissure and emerged in the superior parietal region. The injury received minor surgical treatment on the same day and was debrided five days later. The surgeon (H.C.) reported that "the bone was shattered in many places; there was a large dural tear about 6 cm dia. in connection with the exit wound and another tear about 4 cm. dia. in connection with the entry wound, and between the two a bridge of intact dura about 3 cm wide. The brain was bulging out and had numerous small areas of clot in it and a few bone chips in the lower part". Complete aphasia and a right hemiplegia were observed. Five days later the patient was "apparently fully alert", able to grunt and imitate simple movements (closing eyes and opening mouth) but was not responding to verbal instructions. A strong perseverative tendency was noted in motor responses. Five weeks after injury, the wound was healed but the patient had a "practically complete aphasia". He used grunts with different inflexions for "yes" and "no" but could not repeat any words. He could not read or write but held a pencil appropriately and used a spoon and feeding cup without difficulty.

The data available on the subsequent case history suggest a slow improvement in spontaneous speech and in the understanding of language but a persistent and severe difficulty in reading and writing. His personal life was unsettled. He was divorced, usually unemployed and was eventually summonsed after a drinking bout. He occasionally worked as a night watchman or factory cleaner but had epileptic fits and was often on the sick list. His previous trade had been that of a painter. He had had only an elementary school education up to the age of fourteen but had been a keen reader. His post-war interests seem to have been limited to football pools, television, two pints of beer at the local public house in the evening and fruitless attempts to read paperback books of the Cowboy and Indian genre.

In 1963, he was re-examined in the course of a follow-up study of the effects of penetrating missile injury to the brain, under the supervision of Dr. W. Ritchie Russell in the Department of Neurology of Churchill Hospital, Oxford. In psychological examination he obtained at least average scores in non-verbal tests: Progressive Matrices (1958), I.Q. equiv. = 114; Wechsler Adult Intelligence Scale, performance I.Q. = 96; Graham and Kendall Memory-for-Designs Test, raw error score = 0. He passed the Weigl Sorting test and had no difficulty with Talland's card test of sequential memory (TALLAND [8]) which entails the ability to predict the occurrence of red or black cards after observation of repeated sequences (RBBRRB). No selective impairment was found in tests of drawing, construction, right/left orientation and finger order sense.

The patient was re-examined in 1964 and in 1965. There was still no evidence of specific intellectual deficit outside the field of language. On the contrary, non-verbal tasks were often performed at well above average level: Mooney Closure Faces (Lansdell's revision), 35 correct responses of a possible maximum of 40, control group $\bar{X}$=30·9, S.D.=4·3; McGill Picture Anomalies Test M, score=30; McGill Non-Verbal Visual Recurring Figures Test, score=44; Cube Analysis (Terman and Merrill Binet Form M), visual score=13 of the maximum 14, control group $\bar{X}$=13·2, tactile score=9, control group $\bar{X}$=9·8; a stylus maze task, score=22 (i.e., 3 successive error-free runs in 4 trials), control group $\bar{X}$=18·2 (i.e., the criterion was reached in approximately 7 trials). The patient was also able to deal with some problems involving verbal mediation; sorting and generating random numbers and letters. In the Wisconsin Card Sorting test (GRANT and COST [9]), he grasped the instructions immediately ("Oh . . . I see . . . ca . . . ca . . . category") and achieved a score of 5. His good visual and topographical memory was shown by his recognition of hospital layout and by his spontaneous references to the location or transfer of offices within the Department. In general, the findings were consistent with the severe but focal brain damage; they showed a remarkable preservation of intellectual skills despite severe dysphasic impairment.

The most recent neurological examination (August 1965) revealed the following abnormalities: right anosmia; right homonymous hemianopia more marked in the upper quadrant; mild right facial weakness of the upper motor neurone type; weakness of the right trapezius and left sterno-mastoid muscles; a profound right spastic hemiplegia with relative sparing of the leg and with flexion contractures in the arm; and all sensory modalities moderately depressed in the right limbs.

3. SELECTIVE LANGUAGE IMPAIRMENT

(1) The patient's spontaneous speech shows some loss of function words (telegrammatic speech) but is always coherent and devoid of jargon or gross syntactic distortion. A speech therapist's report described his articulation as "within normal bounds".

(2) He repeats without error auditorally presented verbal stimuli (words, numbers, individual phonemes and foreign words). But recitation of some familiar lists (the alphabet, months of the year) is impaired. He can however count correctly from one to fifty, and recite the days of the week.

(3) The patient is fairly good at naming objects (real objects, model objects and simple line drawings of objects). In a naming test given to matched samples of dysphasics (with left hemisphere lesions) and non-dysphasic head injury cases (NEWCOMBE, OLDFIELD and WINGFIELD [10]), the patient showed the longer latency characteristic of the dysphasic group but was relatively successful in finding object-names. He has considerable difficulty in naming familiar colours. In a long series of trials, over a period of time, his pattern of response showed little consistency or improvement (see FRANZ [11], for a similar study).

(4) A slight loss of the ability to understand speech is inferred from the occasional need to paraphrase instructions and from failures in stage five of the De Renzi token test (DE RENZI and VIGNOLO [12]–failure to carry out commands e.g., "after picking up the green rectangle, touch the white circle").

(5) His short term memory span for words, numbers and letters is consistently low (three items). His ability to reproduce (immediately or after a short delay) narrative material is very poor. But there is no *generalized* memory loss (see § 2).

(6) The patient shows severe dyslexia and dysgraphia. He can name twelve to fourteen letters of the alphabet and can write seven to nine letters to dictation. He can write his own name and a few simple words. He can correctly copy paragraphs from a newspaper and can "transcribe" sentences in capitals into cursive script and *vice versa.*

4. PARAPHASIA

One of the most striking and consistent features of the patient's language impairment has been the occurrence of paralexic errors, noted in the first examination three years ago. The patient read ANTIQUE as "vase", CANARY as "parrot" and GNOME as "pixie". In order to investigate the occurrence of paraphasic phenomena in other tasks, five lists of twelve words (drawn from a wide range of frequency of occurrence in the language) were presented (in counterbalanced order) *auditorally*, for oral repetition and dictation, and *visually*, for copying, reading and immediate written recall (after a three-second presentation per word). Fifty-three line drawings of objects were presented for naming.

No paraphasic substitutions were found in tests of oral repetition, copying and written recall.* Six occurred in object-naming of which all but one were spontaneously corrected by the patient.

Of the sixty words dictated to the patient he attempted to write forty-six. Ten paraphasic errors could be detected, some mis-spelt (e.g., COUSIN was written as "Nephil", PARROT as "Canisty").

Seventeen occurred in reading, of which four were spontaneously corrected. Paraphasic errors were also observed when the patient read sentences which he had first copied (e.g., PUT FIVE SHILLINGS ON A *GOOD* HORSE was read as "Five bob . . . *best* horse").

While there were, then, paraphasic errors in naming and in writing to dictation, paralexic errors clearly predominated. It was therefore decided to focus the investigation on reading.

5. PARALEXIA

5.1. *Introduction*

Approximately two thousand individual words, in upper case letters, drawn from *A General Service List of English words* (WEST [13]) were presented for reading in frequent short sessions over a period of two weeks. Verbatim responses were recorded and errors were analysed into the categories: Semantic (LIBERTY read as "freedom"); visual (NEXT read as "exit"); visual completion (GENTLE read as "gentleman"); visual+semantic (SYMPATHY read as "orchestra", presumably perceived as "symphony") and indeterminate (less than 6 per cent of the error sample).

5.2. *Major grammatical classes*

It was apparent that the grammatical category of the stimulus word was a major variable in determining success. Therefore, the patient's responses to a sample of approximately one thousand words for which the grammatical class was unambiguous were

* Furthermore the patient could identify an auditorally presented stimulus word when embedded in a list, also auditorally presented, of semantically similar words including some of his own substitutions.

analysed in detail. Table 1 shows the proportion of correct responses and outright failures (no attempt to read the word) for nouns, verbs and adjectives. It is clear that the patient has more difficulty in reading adjectives and verbs than nouns.

Table 1. Percentages of correct responses, failures to attempt the word and erroneous responses

	Noun (n=465) (%)	Adjective (n=197) (%)	Verb (n=284) (%)
Correct	45	16	6
Fail	19	47	65
Errors	36	37	29

Table 2 shows the relative proportions of the different types of errors. Semantic errors clearly predominate for nouns whereas visual errors are relatively predominant for adjectives and verbs.

Table 2. Percentages of different error-types

	Noun (n=169) (%)	Adjective (n=73) (%)	Verb (n=83) (%)
Semantic	69	49	37
Visual	9·5	36	35
Visual completion	9·5	5·5	18
Visual+semantic	5	4	5
Indeterminate	7	5·5	5

5.3. *Other grammatical categories*

The patient can read almost no examples of form-classes apart from the major ones we have described. No prepositions (n=20), adverbs (n=20), or words from the determiner system (n=18) were correctly read. Of the seven personal pronouns (in subject form) the patient could read only one ("I"). No question markers ("where", "when", "why", for example) were read correctly (n=8). Of the simple and correlative conjunctions only one ("and") was read correctly (n=8).

Only one semantic error was made in the responses noted above (ABROAD was read as "overseas"). FOR, ME, BEFORE, UP and OTHER were *all* read as "and". Both HER and HIS were read as "she".

5.4. *Relationship between the grammatical category of stimulus and error*

It was noticed that the likelihood of a semantic error standing in a paradigmatic (same grammatical category) relationship to the stimulus word varied considerably between nouns, adjectives and verbs as stimuli. This is shown in Table 3.

Table 3. Syntactic class of the false responses

		Stimulus word		
		Noun (n=50) (%)	Adjective (n=25) (%)	Verb (n=20) (%)
False response	Noun	90	24	90
	Adjective	8	72	10
	Verb	2	4	0

The strong tendency (shown in Table 3) for response errors to be nouns is further indicated by the Visual Completion errors (see WARRINGTON and ZANGWILL [14]) for verbs and adjectives. Of the fourteen visual completion errors made to verbs, 86 per cent were noun responses (e.g., BEG read as "beggar", ENTERTAIN read as "entertainment"). All four visual completion errors made to adjectives were noun responses (e.g., POLITICAL read as "politician"). A very small number (perhaps ten in the total sample of two thousand words) of "sequential" or syntagmatic errors were made (e.g., WRIST read as "watch", BRASS read as "band").

5.5. *Examples of semantic errors*

It was noted that the semantic errors ranged from almost pure synonymity to cases where the stimulus word and the response error had only one or two semantic markers in common. The range is illustrated in Table 4.

Table 4. Range of "likeness of meaning" between stimulus and false response

ILL	→	"sick" *
ANCIENT	→	"historic"
CITY	→	"town"
BUSH	→	"tree"
CATTLE	→	"animals"
CHEER	→	"laugh"
BAD	→	"liar"

* X → "y" indicates X was read as "y".

At least two clearly delimited areas of widespread semantic confusion emerged. These related to kinship and measurement terms. The patient's attempts to read various words drawn from these areas are shown in Table 5.

5.6. *Reliability and facilitation*

A selection of 100 words previously read correctly was presented again after an interval of one week. Sixty-one were correctly re-read, one was not attempted and, of the 28 errors, 21 (75 per cent) were semantic.

Table 5. Semantic complexes in false responses

COUSIN	—→	"relations" *
DAUGHTER	—→	"sister"
NIECE	—→	"aunty"
NEPHEW	—→	"uncle"
NEPHEW	—→	"cousin"
UNCLE	—→	"nephew"
WIFE	—→	"woman"
LARGE	—→	"long"
LENGTH	—→	"long"
SHORT	—→	"small"
TALL	—→	"long"
LITTLE	—→	"short"

* X → "y" indicates X was read as "y".

A selection of 100 words to which semantic errors had previously been made was also presented for re-reading after a week's interval. Eighteen per cent were correctly read, 37 per cent elicited the same semantic error made the previous week and 27 per cent evoked semantic errors different from those made previously.

The patient was also asked to read the 56 nouns which he himself had previously produced (as semantic errors) and which were not included in West's list. Of these nouns, he correctly read 30 (54 per cent). The slight increase in percentage of correct responses to his own nouns may indicate a small measure of "specific response facilitation".

The fluctations in performance support Jackson's suggestion that the process is unstable; the same response patterns do not rigidly persist.

6. DISCUSSION

We wish to stress that the patient fully comprehended that the task was *reading*. In no sense did he imagine that we wanted him to "free-associate" or to define the words we presented. Before making a response the patient would sometimes say "I'm not sure" or "I know it" (e.g., Given PURPLE the patient responded "What colour? I'm not quite sure, mauve"). Given TOUR he said "I know that word—coach"). Having made an error he would sometimes say "Not quite right" or "No, it can't be". Some of the patient's direct circumlocutory utterances indicate the "effort" he is making to retrieve the correct word. Given AGENT, he responded "Not a spy, a firm's —". Given COLLEGE, he responded "school . . . not ordinary". Presented with CANAL, he replied "not river . . . small river". Further evidence against any "free-association" hypothesis is given by the preponderence of synonym or partial synonym responses and the total absence of antonym responses (a highly frequent occurrence in free-association tasks).

The patient's introspections concerning his attempts to read are interesting in this connection—"Sometimes I know, a little wrong . . . sometimes I'm not sure. I just pick out one or two pieces and try to come back all of them together".

It seems unlikely that the patient has motor (articulatory) difficulties with those words that he fails to read correctly. There are many examples where he produced (in another context) a word which he had read erroneously (e.g., THUNDER read as "storm" and STORM read as "thunder"). The disturbance is clearly more "central" than an articulatory difficulty.

We may logically hypothesize that the process of reading an individual word (with understanding) involves the retrieval of the full lexical entry associated with the particular visual stimulus. KATZ and FODOR [15] suggest that the normal form for dictionary entries should be that shown in Fig. 1.

BUSH
noun
(plant)
(with branches)
[arising from or near the ground]

FIG. 1. A dictionary entry for "bush"

The entry is characterized by a part of speech classification, by a (set of) SEMANTIC MARKERS (enclosed in parentheses) which indicate those general properties of the semantic structure of the language instanced by the word, and by a DISTINGUISHER (enclosed in a square bracket) which indicates whatever is idiosyncratic about the meaning of the lexical item. The process of reading aloud may thus be seen as retrieving the full dictionary entry associated with the visual configuration and encoding this specification into the appropriate phonological form. As the patient we have described has very little difficulty in "understanding" language, what we are apparently seeing in this case is a breakdown of the encoding process. The patient reads BUSH as "tree" having thus encoded the lexical entry as far as the distinguisher (i.e., the phonological shape corresponding to "noun"+(plant)+(with branches) is "tree").

When either of two phonological shapes may be appropriately associated with a given dictionary entry the patient may select the wrong one, that is, he produces a "pure" synonym (e.g., ILL read as "sick"). Sometimes he may only succeed in encoding the form class of the stimulus. He reads UP as "and", thus encoding a very primitive "function-word" marker. (Although the patient cannot read prepositions aloud he had no difficulty in correctly selecting pictures on the basis of descriptions containing prepositions. Given, for example, the sentence "The cup is under the table" he could point to the correct picture of a pair with a cup under and on the table).

One important question posed by the data we have presented is "Why should there be such pronounced facilitation of noun encoding?" CHOMSKY [16] has shown that the theory of syntax can be significantly simplified (that is, *ad hoc* rules can be avoided) if nouns are inserted into generalised phrase-markers by context-free rules and then verbs and adjectives selected in accordance with the features of the previously selected nouns. The arguments in support of noun priority in the theory of the lexicon are, of course, drawn solely from considerations relating to the selection of lexical morphemes *in sentences*. The theory is not intended to elucidate the highly unnatural process of single-word production. However, if the lexicon is organized as Chomsky suggests, this structure may well be reflected in "single-word situations". The data we have presented are at least consistent with such a hypothesis. (We also note that GOLDSTEIN [4], p. 238, reports a case in which "Repetition of (auditorally presented) adjectives and verbs was worse than that of nouns".)

Furthermore, when the form class of the stimulus word is ambiguous, the patient's reading error usually indicates that he selected the noun form of the word. For example, FLAT was read as "houses", and NICE (surely the most frequent adjective in the English language) elicited the circumlocution "Name . . . in France . . . South of France".

Not much would appear to be gained by attempting to fit this case into any simple taxonomy of dysphasic disorder. We note, however, that Jakobson's description of a "contiguity disorder" (JAKOBSON [17]) resembles, in some respects, the pattern of impairment we have discussed.

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Résumé—Un cas de trouble dysphasique sélectif déterminé par une blessure par balle est présenté. Les nombreuses erreurs paralexiques se manifestant dans les différentes parties du langage sont analysées et la prépondérance des erreurs sémantiques de même que la facilitation spécifique des réponses par substantif discutées.

Zusammenfassung—Es wird von einem Kopfschussverletzten berichtet, der einen selektiven aphasischen Symptomenkomplex bot. Die in verschiedenen Sprechsituationen auftretenden zahllosen paraphasischen Entgleisungen wurden analysiert. Nach den Ergebnissen herrschten semantische Fehler vor und es bestand eine besondere Erleichterung für das Zustandekommen substantivischer Antworten. Die Resultate wurden diskutiert.