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Facilitation of word retrieval in aphasia

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Introduction

The late John C. Ogilvie, Professor of Psychology and Statistics at the University of Toronto, had a sign in his office which read: 'If you torture the data long enough, they will confess anything'. Some people might use much the same description to characterize the intentions and/or techniques of experimental psychologists who work with aphasic patients: 'If you torture the patients long enough, they will provide data to support your theory'. Of course, this is in jest: the patients who provided the present data were tested therapeutically, and they enjoyed participating in the study. More apposite here, however, is the fact that the results obtained disprove the maxim: the patients, though tested long enough, did not confess the answers that were sought.

The main question asked, motivated both by its therapeutic and its theoretical implications, was this: If an aphasic patient has difficulty (as almost all patients do, with some degree of severity) in finding a word or name for something, can one demonstrate the effectiveness of techniques intended to ameliorate this diffieulty? In particular we were concerned with relatively long-term benefits to word retrieval. From the available literature as well as from observations of our own and of our speech therapist colleagues, it was expected that various techniques would facilitate immediate word retrieval. Pease Myers and Goodglass (1978), for example, evaluated phonemic cueing (or 'first sounds', as they label this technique, e.g. providing the patient with the spoken cue 'la' when he is trying to name a picture of a ladder); all diagnostic categories of aphasic patients showed significant facilitation in naming given this type of cue. Having received the cue and successfully named the object, however, will the patient show an increased probability of correctly naming a ladder if asked to do so ten minutes or half an hour later? This question, the answer to which is much less apparent from the literature, was the focus of this research.

There are, as always, at least some published data germane to the present study. The discussion of these data will be delayed until later in the chapter, when the present methods and results will have been described and can more easily be compared with previous findings.

Two studies will be reported here, one each to evaluate repetition and phonemic cueing as techniques with potential long-term beneficial effects on word retrieval. Picture naming constituted the experimental task in both studies. Although

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naming may be a limited aspect of language, it is also a prominent one whose disruption is (as every therapist knows) enormously frustrating to patients. The therapeutic implications of the research thus need no justification or even explication. Theoretically, naming performance by aphasic patients can provide important input to our understanding of certain cognitive and linguistic processes both in their normal and their impaired modes of operation.

Subjects

Since patients of the same type (and in some cases the same patients) participated in Experiments 1 and 2, this section refers to both studies. The subjects were all adult neurological patients (typically with vascular aetiology) obtained through the services of one of the speech-therapy departments in East Anglia, the majority through Addenbrooke's Hospital, Cambridge. The primary criterion for inclusion in the sample was that the patient should demonstrate a significant naming or word-finding deficit, defined as at least 15 per cent failures on a screening test of picture naming. Additional criteria, some rather intuitively assessed, included the facts that the patient should (a) be at least three months post CVA; (b) have no severe visual problems; (c) be able to understand and follow the experimental instructions; (d) have no notable difficulty in repetition of single words; and (e) have no difficulty in recognizing and understanding drawings of common objects. By this final criterion, it was intended to restrict the phenomenon being studied to deficits of naming or word retrieval rather than agnosic difficulties. On any particular occasion that a patient fails to name an object, it may of course be difficult to know whether the failure is one of recognition or naming. There are however empirical means to enable basic discrimination between these problems (see Caramazza and Berndt 1978, and Saffran 1982, for discussions of this question); and in practice the nature of the patient's error response often provides the basis for an informed judgement (Lesser 1978, 75–6).

Application of the above criteria, plus the requirement that the patients be regularly available for the weeks needed for assessment and full testing, yielded a total sample of 14 patients for Experiment 1 and 11 for Experiment 2. By the Boston Diagnostic Aphasia Examination (Goodglass and Kaplan 1972), the patient sample could be roughly characterized as about one-half anomic aphasics and one-quarter each Broca's and Wernicke's aphasics.

Materials

The stimulus materials for both experiments consisted of a set of 265 unambiguous pen and ink drawings of objects, each on a $3\frac{1}{2}$" × $5\frac{1}{2}$" white card. The pictures were selected from a much larger set on the basis that, in a pre-test, at least 90 per cent of a group of 40 normal subjects provided the same name for each of these 265 drawings.

The names of the objects covered a wide range of frequency of occurrence in written English (Kučera and Francis 1967). Wherever subsets of words were

subjected to different experimental treatment, care was taken to balance the subsets for frequency since it is well known that this variable can influence success in object naming (e.g. Rochford and Williams 1965; Wiegel-Crump and Koenigsknecht 1973).

Experiment 1: repetition

The general issue of interest, whether difficult words become easier to retrieve as a result of repetition, was translated into several experimental questions. Firstly, the expectation was that repetition of a word would facilitate an immediately subsequent attempt to retrieve that name in response to a picture. Secondly, it is logical that this beneficial influence should decrease with time and/or other events intervening between repetition and naming; but how rapidly does it decrease and, most importantly, does measurable facilitation remain after some 'sensible' period of time? For example, would it be possible (in a speech therapy session) to return to a difficult word which had been repeated 15 or 30 minutes earlier, and expect to find some residual effect upon which to build? Thirdly, do multiple repetitions produce a stronger or more lasting effect than a single repetition? And finally, if multiple repetitions are given, are they differentially effective as a function of their spacing, e.g. five repetitions of a particular word in immediate succession compared with five repetitions spread out by intervening events?

Design

For each patient, certain words were selected as target (difficult) words on the basis of naming performance on a pre-test with the 265 pictures. Five target words were assigned to condition R + N (Repetition plus Naming) and five to condition N (Naming alone); for six consecutive trials of an identical pattern, naming performance was compared for these two conditions. The pattern of a trial is displayed in Table 6.1 using a sample set of picture names. In the first phase of the trial, the patient engaged in one repetition each of 26 words, only five of which (those labelled R + N) are pertinent for the moment. In the second phase of the trial, the patient was tested on naming 26 pictures. The last five picture names, targets $N_1 - N_5$, had received no repetition in the first phase, and the patient's performance on these targets is to be compared with performance on the R + N target words which *were* repeated in phase 1. Furthermore, note from Table 1 that the R + N words in the naming phase were tested in the reverse order to their occurrence in the repetition phase. Since the naming test followed the repetition phase immediately, this means that nothing intervened between repetition of word $R + N_5$ and the naming test on picture $R + N_5$; ten events (five repetitions and five naming attempts on other words) intervened between repetition and naming of $R + N_4$; 40 events intervened between repetition and naming of $R + N_1$. The words in Table 1 printed in lower case were filler items serving two purposes. Firstly, they allowed us to space the R + N target items to achieve lags of 0, 10, 20, 30 and 40 items intervening between repetition and naming. Secondly, these filler items were

Table 6.1 A sample of the basic pattern for trials 1–6 in Experiment 1

REPETITION		*NAMING TEST*		
$R-SP_1$	ROCKET	$R+N_5$	GATEPOST	(lag 0)
$R-SP_2$	MAYOR		boy	
$R-SP_3$	SUITCASE		goat	
$R-SP_4$	COW		eggs	
$R-SP_5$	BLOUSE		Indian	
$R+N_1$	BOW	$R+N_4$	TOE	(lag 10)
	boy		teeth	
	goat		king	
	eggs		watch	
	Indian		duck	
$R+N_2$	TABLE	$R+N_3$	STETHOSCOPE	(lag 20)
	teeth		butter	
	king		thermometer	
	watch		crab	
	duck		shoe	
$R+N_3$	STETHOSCOPE	$R+N_2$	TABLE	(lag 30)
	butter		dice	
	thermometer		igloo	
	crab		face	
	shoe		tea	
$R+N_4$	TOE	$R+N_1$	BOW	(lag 40)
	dice	N_1	SKIRT	
	igloo	N_2	PROPELLOR	
	face	N_3	TANK	
	tea	N_4	PATH	
$R+N_5$	GATEPOST	N_5	GLOBE	

names which the patient had successfully retrieved on the pre-test; since they were probably somewhat easier for the patient than the target items, their inclusion should ensure that the naming test on each trial consisted of many successes as well as some failures.

The remaining upper-case words in Table 1, labelled R-SP (Repetition—Spaced), represent one of three other types of target word conditions. The five R-SP words were repeated once each at the beginning of trials 1–5, but no naming test was given for these words until trial 6. R-SP target words thus received five repetitions, spaced out over the test session, prior to the presentation of the appropriate pictures for naming. For the two remaining target conditions, all repetition and naming components occurred entirely within trial 6. At the *beginning* of trial 6, prior to the normal pattern of events displayed in Table 1, five target words in condition MR-DEL (Massed Repetition—Delayed) were repeated. Each word was repeated five times in immediate succession (hence, Massed); the naming test on these words came at the end of trial 6 (hence, Delayed). *After* the basic unit of events on trial 6, five target words in condition MR-IMM (Massed Repetition

—Immediate) were first repeated five times each and then tested immediately by asking for the relevant pictures to be named.

Trials 1–6 constituted a single test session, involving 25 target words (five each in five target conditions) and 16 filler words. Each patient participated in a total of three such test sessions, with a new set of target and filler words for each session.

Procedure

In the pre-test session, each patient attempted to name the 265 stimulus pictures. Pictures correctly named within 5 sec. were assigned to the pool of items from which that patient's filler words would be drawn; pictures not correctly named within 5 sec. became target items. A period of approximately one week elapsed before the first experimental session and also before each subsequent session. Each of the three experimental sessions consisted of six trials, each trial with repetition and naming phases as described previously. During repetition phases, the patient was simply asked to repeat the appropriate words after the speech threapist; during the naming phases, the patient was given 5 sec., without any assistance, to name each picture. All responses were written down by the therapist and tape recorded as well in case of ambiguity.

Results

Consider first the general contrast between performance on N words (which the patient simply attempted to name for six trials) and on R + N words (which the patient repeated and then attempted to name for six trials. The two main data functions for trials 1–6 in Figure 6.1 present the relevant observations, combined over the three sessions per patient and (for the moment) over the varying lags between repetition and naming in condition R + N. The short-term beneficial effect of repetition is immediately apparent: probability of correct naming was consistently higher in condition R + N than in condition N. However it is also clear that this effect showed no increment with successive trials: although the same words were repeated and named six times, the advantage of R + N over N was no greater on trial 6 than on trial 1.

Figure 6.1 also shows the results on trial 6 for the three other target conditions, where five repetitions of the target words occurred before the appropriate naming tests. These conditions assessed both the spacing of the repetitions and the delay between repetitions and test; the results suggest that only the latter factor is critical. Five massed repetitions substantially facilitated naming performance when the naming test occurred immediately after the repetitions. Given any appreciable delay between repetition and naming, however, (a) the massed-spaced variable had no significant effect; and (b) for both conditions, performance was no better (in fact slightly worse) than naming after a single repetition (e.g. R + N on trial 1).

Returning to the R + N results, the data function in Figure 6.1 is a composite of different lags between repetition and naming on each trial. The analysis as a function of lag appears in Figure 6.2, combined over trials 1–6 since (as is obvious from

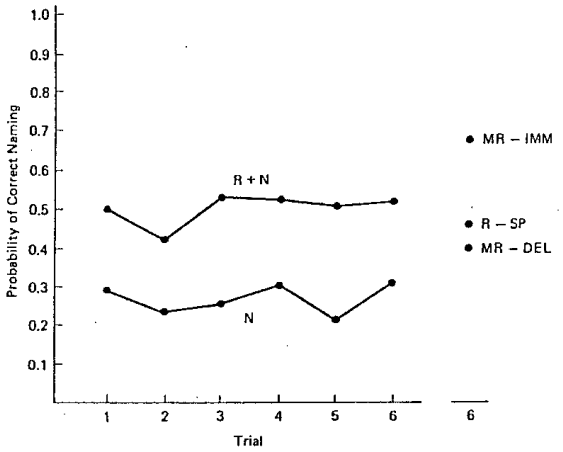

Figure 6.1 The mean probability of a patient correctly naming a drawing in the various conditions. N—Control naming condition; R + N—prior repetition of the name; MR–IMM—massed name repetition with immediate naming trial; MR–DEL—massed name repetition with delayed naming trial; R–SP—spaced repetition practice with subsequent naming trial.

Figure 6.1) no significant changes occurred over trials. Figure 6.2 demonstrates what one might have guessed from the absence of cumulative effects in Figure 6.1: the benefit from repetition was a decreasing function of delay. When no events intervened between repetition and naming, performance was greatly enhanced (about .70 correct naming as contrasted with about .30 in condition N). Measurable benefit was still present after 10 or 20 intervening events; but by the time that 30 intervening events had elapsed, the probability of correct naming (about .40) was only slightly higher than naming in the absence of repetition. Given the design of the experiment, the results are properly analysed in terms of number of intervening events rather than time. To give a rough impression of the time scale, however (and with the caveat that time varied from patient to patient, from trial to trial, and even within a trial), lag 30 perhaps represents a delay of about four or five minutes.

The results across various target conditions were surprisingly consistent, and can be summarized as follows. For this group of patients and this set of target words, naming in the absence of any facilitating technique has a probability of success of around .30 (condition N). Given one or more repetitions *immediately* before naming, this probability rises to around .70 (condition R + N lag 0 and condition

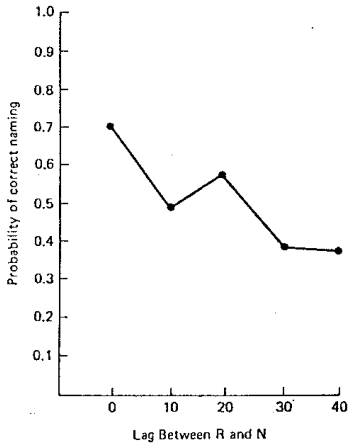

Figure 6.2 The effects of the lag between the repetition trial and the naming trial on naming performance.

MR-IMM). Given any appreciable delay between the repetition(s) and naming, the probability of success returns to around .40 (condition R + N lags 30 and 40, condition MR-DEL and condition R-SP). While these values are not quite back to the baseline value of .30, neither do they represent a notable advantage. Furthermore, the absence of cumulative effects or 'learning' is particularly disappointing. For specific R + N words, this can be shown by the conditional probability that a particular word will be named correctly on a particular trial given that it was failed on the preceding trial. On trial 2 (the first one, obviously, where such an analysis is possible), the probability of correct naming for words failed on trial 1 was .07 for condition N and .24 for condition R + N. (Performance for R + N was of course higher than N because the R + N words had just been repeated). If repetition produced some lasting and cumulative effect, then over trials one would expect this conditional probability to rise for condition R + N while remaining unchanged for condition N. The probability of correct naming on trial 5 for words failed on trial 4, however, was .08 for condition N and .27 for condition R + N. Although the R + N words had by this point been repeated five times, they were no more likely to move from failed to successful status than at the beginning of the session.

Experiment 2: phonemic cueing

As for repetition in the first study, the expectation was that a phonemic cue for a

difficult-to-retrieve word would facilitate the patient's immediate attempt at naming. The primary question was whether word retrieval would still show measurable benefit some time after the phonemic cueing procedure. In addition the effects of two different forms of phonemic cueing were also assessed.

Design

Unlike Experiment 1 where target words were identified in a separate pre-test session, Experiment 2 involved a sort of on-line procedure whereby failed words in the naming test were immediately (that is, after 5 sec.) assigned to one of three conditions. In the Control condition, to provide a baseline for the additional time and effort that would be devoted to words in the two experimental cueing conditions, patients were simply encouraged to go on trying to retrieve the name for the picture, for a total of 20 sec., without any direct assistance from the therapist. In the Repeated Cue condition, the therapist produced the initial sound or phoneme of the word (e.g. /tɔ/ for 'telephone') and repeated this single cue up to three times, once every 5 sec., if the patient continued to be unable to retrieve the object name. In the Progressive Cue condition, the initial cue gave the first sound only, exactly as in the Repeated condition; but each subsequent cue added additional phonemic information (e.g. for 'telephone': (1) /tə/, (2) /te/, (3) /tel/). Approximately one-third of the words that each patient failed to name were assigned to each of the three conditions in rotation. Thirty minutes after the end of the cueing phase, the entire set of pictures was re-presented for naming to allow comparison between previously cued and non-cued words.

Procedure

Each patient was in fact tested on the set of picture names three times in the experiment, twice on the day of the cueing procedure (as described above) and once three weeks earlier for a general assessment of performance. On the first and third of these tests, the patient was simply presented with each picture for 5 sec.; if the patient named it, the speech therapist proceeded to the next picture; if the patient failed to name it, the therapist said the name and then went on to the next picture. On the second test, which incorporated the cueing procedure, the patient was instructed that assistance would be given on some of the difficult words. For failed words assigned to the Control condition, the patient was merely encouraged to continue efforts to retrieve the picture name. For failed words assigned to one of the cueing conditions, the appropriate cues were presented. If the patient produced the correct name at any point, the therapist went on to the next item; otherwise the cueing proceeded to the third and final one. There then followed a 30-minute interval which was filled with general chat and a cup of coffee, following which the entire set of pictures were re-presented for naming. In all cases, the speech therapist both wrote and tape-recorded all responses.

Results

The total proportions of pictures correctly named within 5 sec. and without assistance on the three occasions were as follows: three weeks before the cueing procedure, .42; during the cueing procedure (that is, before any cues were offered), .43; half an hour after the cueing procedure, .45. These values are indicative both of the severity and the stability of the patients' naming deficits. These overall values also provide a hint that the cueing procedure had no long-term effect; however this question must be evaluated in terms of specific words subjected to specific treatments.

For an assessment, first, of the immediate effectiveness of phonemic cueing, the centre section of Table 6.2 shows performance on Control and Cued words. All of these words of course failed to be produced in the first 5 sec. of the picture's presentation. In a total of 20 sec., without assistance, .20 of the Control words were successfully retrieved. Thus further time and effort by the patient did yield success on a small proportion of items. By contrast, the cueing procedure was dramatically effective: given a single cue and only 5 sec. additional time (thus, after 10 sec.), naming performance had achieved twice the rate of the Control words after 20 sec.; given two or three cues at successive 5-sec. intervals, the advantage of Cued words over the Control words was even more impressive.

Table 6.2 also reveals the large expected difference between Repeated and Progressive cueing. The patients clearly could make effective use of the additional phonemic information provided in the Progressive condition; by the time that a cue containing three phonemes of the target word had been offered, the patients were able to produce the majority of names. It is interesting to note that, in the Repeated condition, a second repetition of the same single-phoneme cue produced at least a small advantage over just one presentation, though there was little further increment between two and three repetitions of the same cue. For a person with unimpaired naming skills, 5 sec. would be a very long period of time either as a naming latency or as a time required for some manipulation to produce its effect. For aphasic patients, however, even when a procedure like cueing does benefit word retrieval, it seems that the patient may require an abnormal length of time to take advantage of the cue.

Table 6.2 Probability of correct naming in the various conditions of Experiment 2

3 weeks earlier		*During Cueing*				*30 min. later*
		within 5	within 10	within 15	within 20 sec	
Control	.11	.00			.20	.25
Cued	.28	.00	.40	.53 .70	.58 Rep .87 Prog	.25
			(1st)	(2nd)	(3rd) Cue	

The next question is whether the impressive short-term facilitation from phonemic cueing survives any delay between cueing and naming. Table 6.2 provides two contrasts germane to this issue. Firstly, if the cueing procedure produced some durable trace, then 30 minutes later, naming performance on the *Cued* words should have been superior to that on *Control* words. Performance on these specific subsets of words in the delayed test, shown at the right-hand side of Table 6.2, reveals no hint of such an effect. Secondly, if cueing produced any lasting effect, then performance on the *Cued* words 30 minutes after cueing should have been superior to performance on the *same* subset of words within the whole set tested three weeks earlier. Table 6.2 reveals that for these words, performance on the delayed test after cueing (.25) showed no hint of benefit relative to the test several weeks before cueing (.28). Thus, while confirming that phonemic cueing is effective at the time of its administration, no evidence has been obtained for its longer-term efficacy.

General discussion

The results must now be interpreted in terms of other relevant research on this issue, as well as therapeutic and theoretical implications. As noted in our introduction, there is not a great deal in the existing literature on aphasia to indicate whether one ought to expect the kind of lasting facilitation which was sought but failed to emerge. There are however at least three studies showing improvements in naming performance under somewhat different conditions, from which positive results in the current study might have been predicted.

Hatfield, Howard, Barber, Jones and Morton (1977) studied naming by aphasic patients of real objects and line drawings. Hatfield *et al.* obtained an effect of repeated occurrence of the same object for naming. On three successive tests on a small set of objects, the proportion of correct naming rose from .51 to .60 to .67. This rise in performance with successive tests or trials is what conspicuously failed to emerge in Experiment 1. Several differences between the two studies may account for the apparent discrepancy in results. Most importantly, in the previous study the average lag between two successive tests on a given object was 6 intervening items. With lags of 0 or 10 items between repetition and naming, the present study also found facilitation of naming. It is therefore predicted that in a procedure virtually identical to that used by Hatfield *et al.* but with increased spacing between successive tests, their incremental effect would disappear.

Weigl (1961, 1970) described the phenomenon of deblocking of responses in an impaired modality by use of a different modality which is either intact or at least less severely impaired. Translated into the present context, this might mean that the patient's ability to repeat a word (Experiment 1) or use a phonemic cue to retrieve a word (Experiment 2) should have facilitated any subsequent attempt to produce that word in response to a picture. Two crucial factors may explain why this is not in fact a justified prediction from Weigl's results to the present one. Firstly, there is once again the issue of the time course of such effects: note that Weigl (1961) called it 'the phenomenon of temporary deblocking'. Both of our techniques were

notably successful on a temporary basis. Secondly, as Lesser (1978, 87) points out, Weigl's interpretation of deblocking (1970) is in terms of semantics or comprehension. The response failure is thought to derive from a comprehension problem which can then be overcome because a different modality does enable comprehension of the relevant word. In the present study, the impression was gained that the patients' failures in picture naming were not primarily attributable to comprehension deficits (partly of course because any patient for whom this did appear to be a major feature was excluded from the sample). There is a controversy (which cannot be entered into here) regarding the existence of *pure* anomia, with perfectly normal intact comprehension (see Lesser 1978, chapter 5 for discussion). It is not possible to insist that the patients used in the present study should be thus characterized; it is only possible to claim that, relatively speaking, their problem was more one of achieving access to the object's name than of access to the semantics of the object. Thus the phenomenon of deblocking may not be especially relevant here.

Wiegel-Crump and Koenigsknecht (1973) gave extensive practice (18 therapy sessions) on subsets of words which four aphasic patients had failed to name in a pre-test. After each block of six therapy sessions, picture naming was measured both on the practised items and on previously failed items which had received no training. All four patients showed dramatic improvements in naming of both trained and untrained items; from the data presented by Wiegel-Crump and Koenigsknecht (Table II, p. 416) it appears that the gains in proportion correct were greater on practised than on unpractised items, but the authors do not in fact report that this was a significant difference. Their therapy techniques were varied and multi-dimensional and included both of the procedures studied here (repetition and phonemic cueing) plus additional methods (e.g. supplying gestures, associated words and synonyms). Of the possible reasons for the discrepancy between this study and the present one, the richness and complexity of their therapeutic programme is the most likely. As with the Weigl studies, the involvement of 'central' factors contrasts starkly with the purely phonological techniques which have been evaluated here.

The finding of Wiegel-Crump and Koenigsknecht of substantial improvement on *untrained* items addresses an important theoretical issue. To what extent are the various deficits observed in aphasia specific to certain *items*, or characteristics of *processes* (and thus observable on any words or items)? The results of the Wiegel-Crump and Koenigsknecht study, if replicable, imply that at least for certain combinations of deficit and remedial programme, it is possible to facilitate not just the retrieval of specific items but the retrieval process itself. Such a conclusion would narrow the possible interpretations of the functional locus for anomia. A naming impairment which results from a deficit at the level of particular semantic representations should be restricted to individual items or groups of items (Warrington 1975). Improvements in the *general* retrievability of items then would argue against a semantic locus for the deficit. A naming impairment resulting from either (a) a prevailing impediment to the transmission of information from the semantic system to the output system, or (b) universally augmented thresholds on

output devices, would give rise to non-specific effects, spanning all items (Morton and Patterson 1980a). It is far from clear by what mechanism(s) therapy would, respectively, (a) facilitate the transmission process or (b) reduce thresholds for the whole output system. But supposing such mechanisms do exist, the general improvement claimed by Wiegel-Crump and Koenigsknecht would be consistent with deficits of these sorts.

In the present study, of course, no persisting improvement was found even for practised items; our results thus require a different theoretical interpretation, to account for exclusively temporary changes in retrievability. There seem to be two options available. The first is that the short-term facilitation observed is due to changes in the availability of phonological output devices—termed the output logogen system in Morton and Patterson (1980a). For a variety of reasons, such facilitation would be expected to be relatively short-lived, unlike the results found with the equivalent input devices. The latter show modality-specific facilitation effects at least 45 minutes after a first presentation of an item—word or picture (Murrell and Morton 1974; Warren and Morton 1982). The current findings, then, could be seen as indicating directly the duration of output-facilitation effects. The alternative account is that the data should be seen as reflecting short-term episodic memory for a particular phonological code. This form of memory is probably not especially tenable beyond a minute or so, nor would it be easily convertible into a more lasting representation.

In concluding, the disappointing but unambiguous nature of the present findings must be emphasized. There is no doubt about the efficacy of the techniques evaluated here if one means *immediate* efficacy. To give a very rough summary of the results across all conditions of both experiments: for a set of difficult-to-retrieve names, the probability of our patients correctly producing such names was about .25 in the absence of assistance, but about .55 after a minimal phonemic cue, about .85 after an extensive phonemic cue and about .70 after one or more repetitions of the word. At the time of word-finding difficulty, these cueing techniques are highly effective. The testimony sought from our patients was evidence that some of this facilitation might survive beyond the immediate situation, but this they would not confess.

One final note: by no means can it be concluded that these techniques, successful in the short term, are without utility or should be abandoned. Dimensions which are considerably more difficult to measure than simple probability correct, such as the patient's self-confidence or release from frustration, may well benefit significantly from these procedures. As yet, however, no evidence has been obtained for their specific effectiveness in facilitating word retrieval.

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