Journal of Psycholinguistic Research, Vol. 16, No. 3, 1987

Formal Relationships Among Words and the Organization of the Mental Lexicon[1]

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Accepted September 29, 1986

A series of experiments investigated the role of orthography in the organization of the mental lexicon. A pilot experiment had found no effect of formal overlap between words on a repetition priming task at a lag of 56 intervening items. The first two experiments reported here used a lag of zero and varied SOA. Formal priming was found at SOAs of 1,650 milliseconds and less. However, reducing the proportion of related primes and targets in the experiment reduced formal priming. Moreover, it did so not by affecting response times to formally related primes and targets but by reducing response times to comparison trials in which primes and targets were unrelated. This led to a hypothesis that the formal priming we had observed was only apparent and due to strategic inhibition of responses to unrelated prime-target pairs. The final experiment reduced the proportion of responses to related targets further and examined formal priming at lags of 0, 1, 3, and 10. No formal priming was found under these conditions. Across all experiments, where formal priming occurred, it was due to changes in levels of inhibitory priming in comparison conditions. The conclusion is drawn that convincing evidence for an orthographic or phonological organization of the lexicon is not obtainable using priming procedures.

There are reasons to expect the language-user's lexicon to have an organizational dimension based on the formal (phonological or orthographic) properties of words. One reason derives from the requirements of reading and listening (cf. Fay & Cutler, 1977). A reader identifies words on the

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0090-6905/87/0500-0257$05.00/0

printed page on the basis of their orthographic forms; correspondingly, the listener identifies spoken words on the basis of their phonological forms. A lexicon organized by form would seem to facilitate lexical access. Other reasons are derived from experimental evidence. In certain word-substitution errors committed by talkers (called "malapropism" errors by Fay & Cutler, 1977), substituted and substituting words (e.g., *appetite—accident*) are similar in number of syllables, stress pattern, and, to a degree, their component phonological segments. "Tip-of-the-tongue" errors have similar properties (Brown & McNeill, 1966; Browman, 1979). These errors can be explained by supposing that talkers mistakenly select a lexical neighbor for the word they intend to say.

Compatibly, McClelland and Rumelhart (1981; see also Dell & Reich, 1981; Stemberger, 1983; Glushko, 1979) propose a pair of lexicon-like structures of word labels, one organized by spelling and one by phonological form. The structures, spreading-activation networks, can explain a variety of evidence obtained in word-recognition and word-production paradigms, including, for example, the word-superiority effect in reading (McClelland & Rumelhart) and word and sound errors produced using the SLIP technique (Dell, 1981).

Despite this evidence, not all theories of the lexicon include a formal dimension of organization. One notable example is Morton's logogen model (Morton, 1969, 1981). In that model, lexical entries, called logogens, are unorganized. However, each logogen collects evidence for the occurrence in either print or speech of a particular class of words, rather than just one word. The words to which a logogen responds share a root morpheme and are related by general rules of affixation (e.g., Kempley & Morton, 1982). The evidence on which development of the logogen model is based has largely been obtained in tests of perceptual recognition. In Morton's procedure, a study list of words is presented either auditorily or visually. Later some of the study list words and other words are presented under degraded listening or viewing conditions. Some of the new words are morphologically related to study-list items (for example, *cars* might be a test item if *car* were a study-list item); some are formally related to study-list items (in the example, *card*); some are unrelated. Subjects attempt to identify the words and a measure of performance level is taken (e.g., Murrell & Morton, 1974; Kempley & Morton, 1982). Findings are that if study and test items are presented in the same modality, identification of words morphologically related to study-list items is facilitated as much or nearly as much as repeated study-list items themselves; identification of words formally related to study-list items is not facilitated.

Just as Morton's model fails to handle evidence favoring a dimension of formal similarity in lexical organization, McClelland and Rumelhart's model (1981) fails to handle morphological priming as found by Morton and others. Accordingly, the two models are essentially complementary in representing or failing to represent morphological and formal dimensions of similarity among words. As the models taken together imply, it is possible that word-labels have two or more independent modes of storage in memory, one similar to Morton's logogen system that represents morphological relations and one similar to McClelland and Rumelhart's that represents formal relations.

However, if so, it should be possible to state the conditions under which the one or the other storage system is accessed in reading and listening; yet it is not obvious what the conditions are. An alternative is that the models capture different aspects of a single memory store.

Possibly, for example, logogens themselves are organized by form or else morphological structure is captured by a level of representation between the word and letter or phonological levels in a network model (cf. Dell, 1986). Murrell and Morton may have failed to find evidence for formal priming because the lag between study and test was too long. Their lag (estimated by Kempley & Morton, 1982, to vary between 10 and 45 minutes) exceeds that over which semantic priming is observed (e.g., Dannenbring & Briand, 1982; Davelaar & Coltheart, 1975; Gough, Alford, & Holley-Wilcox, 1981; Meyer, Schvaneveldt, & Ruddy, 1972); perhaps it also exceeds that over which formal priming is observed. If formal and morphological relationships reflect different aspects of one lexicon, we must explain why Murrell and Morton find strong repetition priming among morphological relatives, but none among formal relatives. One possibility is that formal priming is present, but weak, because formally related words are associated along just one dimension, whereas most morphological relatives are associated both in meaning and in form.

In a pilot experiment, using lexical decision, we failed to find formal priming with a lag between prime and target of 56 intervening trials, or approximately 5 minutes. In the same study, priming effects were robust for morphologically related primes and targets.

The studies we report here are designed to look for facilitation in lexical decision due to formal priming at very short intervals between prime and target. As in our pilot research (see also Fowler, Napps, & Feldman, 1985; Stanners, Neiser, Hernon, & Hall, 1979), we use a lexical decision procedure to study "repetition priming" rather than Morton's perceptual-recognition procedure for two reasons. First, we can examine priming at shorter intervals or shorter lags between prime and target than is possible with Morton's procedure. Second, we can obtain response-time measures, which may be more sensitive than the accuracy measures used in Morton's research.

EXPERIMENT 1

Experiment 1 was conducted to compare priming by words morphologically related to their targets with priming by words related to their targets only formally. The study was designed to determine whether, in contrast to the findings of Murrell and Morton and Napps and Fowler, formal priming would be observed if relatively brief intervals intervened between prime and target. In the present experiment, our lag was zero (i.e., no trials intervened between prime and target) and we manipulated the time lag between prime and target (that is, the "stimulus onset asynchrony" or SOA). We assumed that with short intervals between prime and target any weak priming due to orthographic or phonological overlap between prime and target would be observable.

A problem associated with using short delays in the present studies is that a short interval between related primes and targets makes the experimental manipulations salient and may invite priming effects that are "strategic" and nonlexical in origin. Strategic priming is created by the special circumstances of an experiment that allow the subject occasionally to guess the target given the prime. Correct guesses may lead to facilitatory priming that does not reflect organization of words in memory; likewise, incorrect guesses on baseline unrelated prime-target pairs may spuriously inflate reaction times in comparison conditions.

Such effects on priming have been observed by other investigators. Tweedy, Lapinski, and Schvaneveldt (1977) found more semantic priming with higher proportions of related items. Similarly, deGroot (1984) found increasing inhibition of targets unrelated to their primes and increasing facilitation of targets semantically related to their primes as the proportion of semantically related items increased.[5] She also found more inhibition and facilitation with longer prime-target SOAs in the range from 240 to 1,040 msec. Both increasing the proportion of related items

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[5]DeGroot, Thomassen, and Hudson (1982) have suggested that conditions previously used as baselines against which to measure facilitation and inhibition may be invalid. For instance, deGroot et al. found that the prime "XXXXX" and a prime unrelated to the target caused inhibition to its following target *relative* to the prime "blanco." (This is the Dutch word *blank*; deGroot's subjects were native speakers of Dutch.)

and increasing SOA provide opportunities for subjects to engage in guessing strategies.

To determine the extent to which any formal priming we might observe is strategic, rather than lexical, in origin, we manipulated the proportion of morphologically or formally related items in two experiments, reported here as Experiments 1-75 and 1-25. In Experiment 1-75, the proportion of related items is 75%; in Experiment 1-25, it is 25%. In both experiments, we varied prime-target SOAs between 350 and 1,650 msec. If formal priming is wholly strategic in origin, then it should be very small or absent with 25% related items and larger with 75% related items. If formal priming is strategic and if adoption of a guessing strategy takes measurable time, then increasing the SOA should increase formal priming with 75% related items. Alternatively, if formal priming is not strategic but instead reflects weak associations among lexical items, priming may decrease with SOA as the priming effect dissipates.

Method

Subjects. Sixty-five subjects participated in Experiment 1-75 and 65 different subjects participated in Experiment 1-25. All subjects were native speakers of English and had normal or corrected vision. Accuracy criteria of 80% and 75% were established for Experiment 1-75 and 1-25, respectively.[6] The data of five subjects in each experiment were excluded from data analysis because those subjects failed to reach the accuracy criterion.

Stimulus Materials. The stimuli were 84 English words and 84 nonwords serving as targets. Nonwords were orthographically and phonemically regular. For each target word there were four primes, including the target (or base word) itself. The other three primes were (1) an inflected relative of the target (i.e., with suffix "-s", "-ed", or "-ing"), (2) a "pseudoinflected" word that was graphemically identical to the target's root morpheme but had a following "pseudosuffix" (i.e., letters extending beyond the target itself) that made the word semantically unrelated to the target, and (3) a word semantically and graphemically

[6]The accuracy criterion was lowered from 80% in Experiment 1-75 to 75% in Experiment 1-25; it was lowered even further (63%) in Experiment 2. This was necessary since the increases in the number of trials due to filler items made the task extremely tiresome, and subjects had a difficult time maintaining accuracy levels for so many responses. We felt it would be inappropriate to have a higher cutoff because such a significant proportion of the population would have been deleted as to make the results less generalizable.

unrelated to the target. For instance, for the target *rib*, the respective primes were *rib*, *ribbed*, *ribbon*, and *gauge*. Frequency (Kucera & Francis, 1967) and mean length in letters were equated among the inflected, pseudoinflected, and unrelated type primes. Real-word pseudoinflected and base forms are listed in the Appendix.

Nonword targets were primed by real words from each of the prime categories used with word targets. For instance, for the target *sant*, prime words were *sand*, *sanded*, *sandal*, and *cowered*.

The SOAs between prime and target were 350, 650, 1,050, 1,350, and 1,650 msec. A pilot study suggested that when SOA was treated as a within-subjects factor, the data might be subject to some kind of averaging effect, in which subjects expected, and were therefore most prepared for, the average SOA. Therefore, SOA was treated as a between-subjects factor in Experiments 1-75 and 1-25.

A Latin Square design was used to assign prime types to groups of four subjects. Across items and subjects, every prime type appeared at every SOA. Prime-target pairs were presented in one of five random orders.

In Experiment 1-25, enough filler items were added to reduce the proportion of related pairs from 75% (as in Experiment 1-75) to 25%. Percentage of related items refers to the percentage of stimuli related either morphologically or formally to other stimuli. Fillers were matched to critical items on length and frequency. Filler primes and targets were not related semantically, formally, or morphologically. Each subject saw the same filler items.

Procedure. Subjects were run individually. Experiment 1-75 was run on a time-sharing computer interfaced with a Polytronics response timer. Stimuli were presented in upper case on a cathode ray tube. On each trial the following sequence of events occurred: (1) a fixation string (+ + + + + + + +) came on in the center of the screen and the terminal bell sounded 500 msec before the fixation string went off, (2) the first letter-string came on for 250 msec, (3) the second letter-string came on after the appropriate SOA and remained on until the subject responded. A subject read the prime silently and pushed one of two buttons to make a lexical decision to the target. Each subject completed five blocks of 42 trials each, the first of which was a block of practice trials. Feedback was given after each block of trials. Subjects were told that speed and accuracy were important.

The procedure of Experiment 1-25 was similar to that of Experiment 1-75 except for minor equipment and instruction modifications. The experiment was run on a time-sharing computer interfaced with a microprocessor.[7] Because this experiment included filler trials, it took much longer to complete an experimental session than in the other experiments; thus, subjects were required to take three 5-minute breaks at equal intervals during the experiment. Each subject completed 13 blocks of 42 trials each, the first of which was a block of practice trials. Subjects received feedback after each response rather than after every block of trials.

Design. Independent variables were prime type and SOA; prime type was a within-subjects variable and SOA was a between-subjects variable. The main dependent measure was response time to the target.

Results

Errors and extreme reaction times (less than 200 msec or greater than 2,000 msec) were excluded from analyses. Reaction times and accuracy scores are shown in Table I. All analyses were subjected to *min F'* analyses (see Clark, 1973).

Experiment 1-75. With 75% related pairs, analysis of the words revealed a significant effect of type of prime on response time to the target word ($min\ F'(3, 412) = 40.90, p < .001$). Average reaction times to targets increased in the following order: base prime, inflected prime, pseudoinflected prime, unrelated prime. Scheffé tests showed that the base prime and inflected prime conditions did not differ, but all other pairwise comparisons were significant. Thus, Experiment 1-75 did reveal more rapid responses to targets preceded by pseudoinflected primes than preceded by unrelated primes. The main effect of SOA and the prime type by SOA interaction were not significant (both *min F'*s < 1). Error analyses showed the same pattern of results as response times.

Nonword data are also listed in Table I. For purposes of data analysis of nonwords, the base, inflected, and pseudoinflected prime conditions were collapsed and compared with the unrelated condition. This was done because primes for nonwords were invariably words. Therefore, there was no exact-repetition condition, and the orthographic and phonological relationships between the prime and the nonword base (or target) were essentially the same for the base, inflected, and pseudoinflected primes.

[7]Microprocessor developed by Mike Layton, AGS Corporation, Box 64, Hanover, New Hampshire 03755.

Table I. Response Times (in Milliseconds) and Proportions Correct for Words and Nonwords in Experiments 1–75 and 1–25

	Words			
Prime-target pair	RT (Exp. 1–75)	Proportion correct	RT (Exp. 1–25)	Proportion correct
Base-base	478	.96	530	.95
Inflected-base	500	.96	545	.94
Pseudoinflected-base	582	.90	589	.87
Unrelated-base	658	.85	617	.86
	Nonwords			
Prime-target pair	RT (Exp. 1–75)	Proportion correct	RT (Exp. 1–25)	Proportion correct
Base-base	674	.94	701	.85
Inflected-base	671	.95	699	.84
Pseudoinflected-base	675	.95	700	.86
Unrelated-base	703	.94	682	.89

All three were more or less analogous to the relationship between the pseudoinflected prime and the base word target for words. Comparison of reaction times of the base, inflected, and pseudoinflected type primes with the unrelated type prime showed a marginally significant difference (*min* F' (3, 412) = 2.44, p = .0628). No other reaction time effects were significant and no error analyses were significant.

Experiment 1-25. With 25% related pairs, analysis of words revealed a significant effect of type of prime (*min* F' (3, 405) = 20.53, $p < .001$), with the mean response times ordered as in Experiment 1-75. Scheffé tests revealed the same differences as in Experiment 1-75; however, with 25% related pairs, the difference between the pseudoinflected and unrelated type primes was marginal (*min* F' (3, 401) = 2.52, p = .0566). Neither the main effect of SOA nor the prime type by SOA interaction was significant. Error analyses showed the same pattern of results. The data are shown in Table I.

Nonword data are also shown in Table I. There were no significant nonword effects.

Comparison of Experiments 1-75 and 1-25. In two analyses, we compared responses to target words in Experiment 1-75 with those in Experiment 1-25. One analysis with factors prime type, SOA, and experiment revealed a significant prime type by experiment interaction (*min F'* $(3, 493) = 7.76, p < .01$), reflecting the overall smaller priming effects of Experiment 1-25. Base-base and inflection-base times were slower, pseudoinflection-base reaction times did not change, and unrelated-base reaction times were faster when the proportion of related items was decreased from 75% to 25%. There was no interaction between SOA and experiment.

In a second analysis, with factors SOA and experiment, a direct comparison was made of pseudoinflection word priming in Experiments 1-75 and 1-25. The analysis was performed on difference scores obtained by subtracting pseudoinflection-base reaction times from unrelated-base reaction times. The drop in pseudoword priming from 76 msec in Experiment 1-75 to 28 msec in Experiment 1-25 was highly significant in the subjects analysis ($F(1, 110) = 12.47, p < .001$) and marginal in the items analysis ($F(1, 83) = 2.89, p = .089$). There was no effect of SOA and no interaction.

Among nonwords, there was an interaction between prime type and experiment (*min F'*$(3, 536) = 4.04, p < .01$). This is reflected in a reversal from the unrelated-base pairs' being responded to more slowly than the other prime-target pairs in Experiment 1-75 to their being responded to more quickly in Experiment 1-25.

Discussion

The experiments provide some evidence for formal priming. However, comparison of Experiments 1-75 and 1-25 suggests that it may be due, at least in part, to strategic rather than lexical factors. In particular, the comparison shows that there is an effect of proportion of related items on priming, such that facilitatory and inhibitory effects are reduced as the proportion of related items is reduced from 75% to 25%. The loss of inhibition in the unrelated-base condition is compatible with deGroot's (1984) findings and with her interpretation that primes may inhibit responses to unrelated targets.

An interesting finding in these experiments was that responses to the formally primed targets were the only responses to undergo no change at all from Experiment 1-75 to Experiment 1-25. The reduction in formal priming was effected not by a change in response time to formally related prime-target pairs but by a change in response time in the comparison unrelated-base condition. The lack of change in response time to formally related prime-target pairs suggests that they may be classified neither with morphologically related prime-target pairs and subject to facilitation nor with unrelated pairs and subject to inhibition. We see this same unresponsiveness to factors that presumably affect availability of strategic processes in Experiment 2.

This collection of findings suggests that strategic, possibly nonlexical, factors did influence measures of priming in Experiment 1-75. These factors may or may not account fully for the "formal priming" present in Experiment 1-75 and marginally present in Experiment 1-25. Experiment 2 is designed to reduce the possibilities for strategic effects further in an effort to eliminate any formal priming that may be strategic in origin.

In view of the positive evidence for operation of strategic guessing in Experiment 1-75, the absence of a change in priming with SOA is surprising. We must conclude that if priming is strategic in that experiment, it can be implemented as effectively at an SOA of 350 msec as at longer SOAs out to 1,650 msec.

EXPERIMENT 2

In this experiment, we attempted to eliminate strategic influences on repetition priming by reducing the proportion of related prime-target pairs to 12.5%. We made an additional change in procedure. In Experiments 1-75 and 1-25 we found differences in responding to targets related formally to their primes and to targets unrelated to their primes at SOAs as long as 1,650 msec. In our pilot research, we failed to find such evidence of formal priming at a lag of 56 items intervening between prime and target. In Experiment 2 we examined priming at lags of 0, 1, 3, and 10 intervening items. (A lag of 0 intervening items is approximately 2,600 msec in duration; however, it includes a response to the prime in the interval.)

Method

Subjects. Seventy-two subjects participated in this experiment. An accuracy criterion of 63% (see footnote 6) was set for the experiment; the cut-off was established to be significantly above chance (50%) at the .05 alpha level. Nine subjects failed to reach the accuracy criterion, so their data were excluded from analysis. The data of three additional subjects were lost owing to equipment failure. Seventy subjects came from the same subject pool used in previous experiments. Two subjects were Dartmouth undergraduates who were paid for their participation.

Stimulus Materials. Stimuli were 63 of the 84 word and nonword critical stimuli used in Experiments 1-75 and 1-25, from which the inflection-prime condition was deleted. Thus, there were three critical prime types in Experiment 2: exact repetition (base-base), formally related to the target (pseudoinflected-base), and unrelated (unrelated-base). However, the use of lags creates a fourth response to each target item that we will examine as well. In the base-base condition, the response to the prime is essentially a response to a target in the unrelated condition. The response to the prime will be referred to as the "base-first" condition.

There were 63 word items and 63 nonword items that served as targets for the relevant priming conditions. These items will be called "critical" or "related" items, to distinguish them from the fillers.

In this experiment, the proportion of trials on which responses could be affected by the subject's recognizing a relationship between prime and target differs from the proportion of stimuli actually related to other stimuli. This occurs because primes and targets are presented on different, rather than the same, trials (as with SOAs). One-eighth (12.5%) of the prime-target pairs are related to each other either morphologically or formally; however, since half of these stimuli are primes and are thus responded to without knowledge of the forthcoming target, only 6.25% of a subject's responses should be affected by knowledge of these relationships.

Filler items were matched to critical items in frequency and length. Subjects saw equal numbers of each type of prime, and they saw each base word only once as a target. A Latin Square design was used to assign critical primes to groups of three subjects. Across items and subjects, every prime type appeared at every lag. A new random order of stimuli (both critical items and fillers) was used for each group of three subjects.

Procedure. Subjects were run with the same equipment that was used in Experiment 1-25. The procedure was essentially the same as that used in Experiment 1-25. For a given subject, the test stimuli were divided in half and the subject saw half of them in one session and then took a minimum 3-hour break before the second half of trials was completed. Altogether, subjects completed 23 blocks of 61 trials each, the first block of each session being either practice or all filler items.

Design. Independent variables were prime type (a within-subjects factor) and lag (a between-subjects factor). The main dependent measure was response time to the target.

APPENDIX

Experiments 1-75 and 1-25

Base and Pseudoinflected Items

accord	accordion	ape	apex	bar	bard
bat	battle	bill	billow	blank	blanket
bread	breadth	bush	bushel	butt	butter
buzz	buzzard	cap	capital	cart	carton
con	condor	cop	copy	deter	determine
draw	drawl	fair	fairy	flow	flown
fur	furl	gag	gaggle	garb	garble
gas	gasket	gob	gobble	halt	halter
hare	harem	harm	harmony	hum	humble
iron	irony	jar	jargon	ledge	ledger
lob	lobster	miss	missile	mite	miter
neigh	neighbor	net	nettle	new	newt
numb	number	pop	popular	pump	pumpkin
rat	rattle	rave	raven	rib	ribbon
rock	rocket	scar	scarf	sea	seam
shoo	shoot	sigh	sight	slur	slurp
spar	spark	spur	spurt	star	start
stew	steward	stir	stirrup	sum	summer
tack	tackle	tan	tangent	tar	tarp
wad	waddle	wall	wallet	war	wart
blur	blurt	can	candle	cape	caper
char	chart	die	diet	earl	early
free	freeze	gum	gumbo	jam	jamboree
law	lawn	mark	market	monk	monkey
need	needle	pick	pickle	pock	pocket
pro	prose	pull	pullet	rack	racket
ram	ramp	rub	rubbish	see	seed
trump	trumpet	vow	vowel	win	window

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Table II. Response Times (in Milliseconds) and Proportions Correct for Words and Nonwords in Experiment 2

Prime-target pair	Reaction Time	Proportion Correct
	Words	
Base-base	540	.97
Pseudoinflected-base	596	.92
Unrelated-base	585	.93
Base first	601	.90
	Nonwords[a]	
Base-base	709	.88
Pseudoinflected-base	713	.89
Unrelated-base	697	.93

[a]There is no "base first" condition for nonwords since the prime is always a word.

Results and Discussion

Errors and extreme reaction times were excluded from analysis. If a subject's response was incorrect on a prime (target), the response time for the corresponding target (prime) was not included in the analysis. Mean reaction times and percentages of correct responses are presented in Table II.

For mean response times, the main effect of prime type was significant ($min\ F'$ (3, 347) = 13.88, $p < .001$). Scheffé tests showed that the base-base condition was different from base-first ($min\ F'$ (3, 348) = 11.42, $p < .001$) and from unrelated-base ($min\ F'$ (3, 348) = 6.18, $p < .001$), but neither the pseudoinflected-base nor unrelated-base prime types differed from the base-first condition. Analysis of accuracy scores showed a similar pattern. In neither analysis was the main effect of lag or the prime type by lag interaction significant.

There were no significant effects for nonword response times. The only significant effect for nonword accuracy was a prime type effect, due to the difference between the base-base and unrelated-base conditions.

In the present experiment, we find no evidence of pseudoinflection-base priming. Moreover, we find confirming evidence that the significant formal priming in Experiment 1-75 and the marginally significant formal priming in Experiment 1-25 is only apparent and is due to strategic inhibition in the unrelated condition. In Experiment 2, response times to formally primed words fall midway between our two unprimed conditions (unrelated-base and base-first) and differ from neither condition significantly. A cross-experiment comparison of corresponding conditions leads to the same conclusion. In the present experiment, base-base response times are slower than those in Experiment 1-25, which, in turn, were slower than those in Experiment 1-75. Response times in the unrelated-base condition (see also base-first) are faster than those in Experiment 1-25, which, in turn, were faster than those in Experiment 1-75. Response times to bases primed by pseudoinflections are stable across the three experiments.

GENERAL DISCUSSION

We began by noting evidence for a formal dimension of organization among words in memory. The evidence derives from a variety of research paradigms and implicates phonological word labels accessed in speaking, reading, and listening and orthographic word labels accessed in word reading. In contrast, evidence from repetition priming identifies morphological, but not solely formal, relations as salient in lexical organization.

We asked whether evidence could be found for lexical neighborhoods based on formal properties of words using procedures sensitive to morphological dimensions of lexical organization. Our studies uncovered no convincing evidence for formal priming due to lexical organization.

It remains possible that formal priming is weak, having decayed already in the approximately 2,600 msec between prime and target in our zero lag condition. Indeed, a reason for its weakness as compared to morphological priming could be that formally related primes and targets are similar on one (orthographic) or two (orthographic and phonological) dimensions, whereas morphologically related words are related both formally and semantically. The possibility that formal priming occurs but is weak cannot be ruled out; however, it is not fully satisfactory on at least two grounds. First, we found no effects of SOA between 350 and 1,650 msec in Experiment 1. Second, other research has shown convincingly that the longevity of morphological priming cannot be explained as a combination of semantic and formal priming (Henderson, Wallis, & Knight, 1984), because neither semantic nor formal priming extends beyond very short lags, whereas morphological priming extends across lags of 48 or more items.

An alternative, more likely, conclusion is that the neighborhoods accessed by the procedures of McClelland and Rumelhart (1981), for example, are not accessed by repetition priming procedures. It remains to determine why they are not and whether the same conclusion must be drawn about neighborhoods of phonological word names.