# Determining the loci of homophonic repetition effects.

# DETERMINING THE LOCI OF HOMOPHONIC REPETITION EFFECTS

A Thesis Presented

by

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# ABSTRACT


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Chumbley, Halliday, and Reichle (1992) found homophonic repetition effects (e.g., "pail" facilitated "pale") using pronunciation, but not lexical decision. One explanation for this finding is that the effects stemmed from residual lexical activation of the homophone logogens caused by using assembled phonology and/or hearing the words articulated, which suggests that homophonic repetition is largely a lexical--rather than episodic--phenomenon. This hypothesis was tested and confirmed in the present experiment by using a task that minimized episodic contributions to repetition priming, word fragment completion. Furthermore, by using measures that encouraged the use of assembled or the use of addressed phonology, the present results indicate that lexical activation of the homophone logogens does not stem from hearing the words articulated, but instead originates from checking each word's phonology against the contents of lexical memory.

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CHAPTER 1

INTRODUCTION

Repetition priming is the phenomenon that the processing of a given word is facilitated by having previously processed that word. Tasks traditionally used to measure "priming" include lexical decision (Scarborough, Cortese, & Scarborough, 1977), pronunciation (Masson & Freedman, 1990), word identification (Fuestel, Shiffrin, & Salasoo, 1983), categorization (Durso & Johnston, 1979), recognition (Durso & O'Sullivan, 1983), and word fragment completion (Hayman & Tulving, 1989). Thus, the repetition effect is a robust phenomenon that has been demonstrated by numerous experimenters using a variety of tasks.

Despite the wealth of repetition priming literature, one point that remains controversial concerns the origin(s) of repetition effects. As Scarborough et al. (1977) observed, repetition priming may stem from processes involved in (a) stimulus encoding, (b) search of lexical memory, or (c) postlexical procedures. In addition, several researchers (e.g., Fuestel et al., 1983; Masson & Freedman, 1990) have maintained that repetition effects originate primarily from episodic memory.

This paper addresses the strengths and weaknesses of each of the aforementioned explanations: prelexical, lexical, postlexical, and episodic. The results of this discussion are used to interpret the findings of an experiment in which repetition priming was found between homophones (Chumbley, Halliday, & Reichle, 1992). Finally, an experiment is described that provides additional data concerning the origin(s) of homophonic repetition effects.

One possible source of repetition priming is the prelexical processes that occur during stimulus encoding. Facilitation of the processing of repeated words could stem from an heightened ability to encode the orthographic forms of repeated stimuli (i.e., perceptual fluency: Jacoby & Dallas, 1981). For example, encoding low-level featural information (e.g., angles and line segments comprising letters) or higher-level orthographic codes (e.g., "templates" representing individual letter or word shapes) might leave residual activation in either an orthographic buffer (Brown, 1991) or processing pathway (Seidenberg & McClelland, 1989; Seidenberg, 1990) that would decrease the information necessary to encode repeated stimuli.

Although plausible, the available evidence instead suggests that facilitated prelexical processing plays only a minor role in repetition priming. For instance, Masson and Freedman (1990) manipulated the modality in which stimuli were presented and found shorter pronunciation latencies for visually displayed words that had first been presented auditorily as compared to visually presented words that had not first been presented auditorily. Although such cross-modal repetition effects are typically smaller than withinmode effects (i.e., visual presentation followed by visual presentation; Roediger & Blaxton, 1987; Kirsner, Dunn, & Standen, 1989), cross-modal priming nonetheless suggests that repetition priming is not modality-specific and thus not entirely dependent on prelexical encoding processes.

Similarly, several researchers (e.g., Scarborough et al., 1977; Fuestel et al., 1983; Forster & Davis, 1984) have found that changing the letter case in which stimuli are displayed across presentations only slightly reduced the amount of observed priming. Moreover, repetition effects have been found across typefonts (Jacoby & Hayman, 1987) and alphabets (Brown, Sharma, & Kirsner, 1984), and from pictures to words (Brown, Neblett, Jones, & Mitchell, 1991). These latter studies are particularly noteworthy in that they eliminate the possibility that repetition effects originate entirely from prelexical processes occurring after the normalization of orthographic codes.

A second potential locus of repetition effects is the postlexical, task-specific processes which are necessary for making overt responses to stimuli. Pronunciation, for example, requires subjects to retrieve and use articulatory programs (Balota & Chumbley, 1985). Because these programs may be easier to find and/or execute if they have recently been used, shorter pronunciation latencies for repeated words could simply stem from the recent use of the same articulatory programs. Similarly, the lexical decision task may also benefit from strategy-based facilitation. As responses become associated with particular letter strings, for instance, lexical decisions may be made, at least in part, on previous responses to the items rather than strictly on lexical status. These responses need not be consciously remembered, but could instead reflect an implicit feeling of "familiarity" (Balota & Chumbley, 1984) or "knowing" (Gardiner, 1988). (Note that a similar explanation based on conscious recollection of the stimuli is discussed later).

As with the prelexical explanation, however, the evidence suggests that repetition priming cannot stem entirely from postlexical sources. For example, Scarborough et al. (1977) varied response probability[1] in lexical decision and found that this manipulation did not interact with the repetition effect. Because additive effects typically reflect distinct processing stages (Sternberg, 1969), the failure to find an interaction between repetition and response probability suggests that repetition priming does not originate from procedures involved in response production.

Similarly, Fowler, Napps, and Feldman (1985) examined possible strategic effects on repetition priming by decreasing the proportion of repeated word pairs in lexical decision. They reasoned that the associative relationships between words would be less noticeable and less useful to postlexical strategic processes when the pairs were repeated. Because this manipulation had no effect, Fowler et al. concluded that repetition effects are not dependent upon postlexical strategies.

Finally, repetition effects cannot arise exclusively from having recently used the same articulatory programs because the phenomenon has been demonstrated using a variety of tasks that do not require verbal responses (e.g., lexical decision: Scarborough et al., 1977; recognition: Durgunoglu, 1988; categorization: Durso & Johnston, 1979). The robustness of these findings leave little doubt that articulation is not necessary for repetition priming.

A third viable source of repetition priming is processes associated with search of lexical memory. Although there are several ways in which this explanation might be instantiated, a lexical account of repetition effects can probably best be illustrated in terms of Morton's (1969) logogen model. According to this model, the orthographic forms of words are represented in lexical memory by a type of node called a "logogen." Each logogen has a resting threshold which must be exceeded in order to trigger activation of that word's phonological, semantic, and syntactic attributes. Once a logogen has been triggered, however, the activation tends to linger, thereby lowering that logogen's resting threshold. In this manner, residual activation makes it easier to reactivate the logogens of repeated words, and thus leads to facilitation through repetition.

Unlike previous explanations, a lexical account of repetition priming has received considerable support. Several researchers (e.g., Scarborough et al., 1977; Norris, 1984; Forster & Davis, 1984; Chumbley et al., 1992) have found interactions between word frequency and repetition priming. Because word frequency effects are generally thought to originate from lexical sources (Morton, 1969; Forster, 1990), the method of additive factors (Sternberg, 1969) suggests that repetition effects also originate from lexical processes.

Furthermore, Fowler et al. (1985) found that, whereas inflections (e.g., "managed") fully primed their root morphemes ("manage") in lexical decision, derivations ("manager") only partially primed their root morphemes. This discovery demonstrates the importance of morphology--over simple orthography--in repetition priming. Furthermore, because morphology presumably reflects lexical structure, the Fowler et al. results suggest that repetition effects also originate from within the lexicon.

Finally, a fourth possible locus of repetition priming is episodic memory. Unlike the previous explanations of repetition effects, this final account does not attribute the facilitation produced by repetition to priming of pre-existing structures such as encoding pathways or logogens.

Instead, facilitation is thought to occur whenever conscious recollection of a word's earlier presentation makes it easier to respond to that word's subsequent presentations. Thus, the distinction between the episodic and earlier explanations hinges upon the fact that, whereas the former account implies conscious remembrance of earlier encounters with a stimulus, the latter explanations do not.

With the lexical decision task, for example, the lexical status of repeated letter stings could be determined by explicitly remembering previous responses to the stimuli. As a result, the decision latencies for repeated items would be shortened relative to new items because lexicality in the former case can be determined via two independent means, either by searching the lexicon, or by remembering past responses. Similarly, in the pronunciation task, the latencies for repeated words might be shortened relative to new words because words in the former case can be pronounced either via normal means, or by remembering how the words were recently pronounced.

As with the lexical explanation of repetition priming, the episodic explanation is supported by considerable evidence. For example, several researchers (e.g., Fuestel et al.,1983; Scarborough et al., 1977; Fowler et al., 1985), have demonstrated repetition priming of nonwords. Because nonwords, by definition, are not represented in the lexicon, this finding requires one to posit either that a single presentation is sufficient to create a new logogen, or that a component of repetition priming stems from episodic, as well as lexical, sources.

Additional support for an episodic locus of repetition priming comes from studies that have failed to find interactions between repetition effects and other "lexical" variables. Fuestel et al. (1983), for example, found no interaction between lexicality and repetition. Similarly, Wilding (1984) and Durgunoglu (1988) failed to find interactions between repetition effects and semantic priming. Thus, such results suggest that repetition priming does not originate from within the lexicon. Through the process of elimination, therefore, these findings are instead interpreted as evidence favoring an episodic locus of repetition priming.

Finally, by pairing homographs with context words (e.g., "organ-piano") that biased either identical ("organ-piano"), similar ("organ-music"), or entirely different ("organ-heart") interpretations across presentations, Masson and Freedman (1990) found that repetition priming did not occur when homographs were biased towards different interpretations. Moreover, priming was reduced for homographs biased towards similar as compared to identical interpretations. These findings therefore indicate that simple repetition of orthography is not sufficient to produce repetition effects; instead, the repetition phenomenon is affected by the consistency with which the conceptual (episodic) representations assigned to words are repeated across presentations. (It is noteworthy that similar results reported by Kinoshita (1989) have been interpreted as evidence supporting the lexical explanation of repetition priming; the Masson and Freedman results could also support the lexical account if it is assumed that homographs have separate lexical representations for their different meanings.)

The available evidence thus suggests that repetition priming stems from either lexical or episodic sources. It is not surprising, therefore, that a chasm has separated proponents of the lexical (viz., Scarborough et al., 1977; Scarborough, Gerard, & Cortese, 1979; Fowler et al., 1983; Kinoshita, 1989) and episodic (viz., Fuestel, 1983, 1985; Durgunoglu, 1988; Masson & Freedman, 1990) explanations. Despite this division, however, a few researchers (e.g., Forster & Davis, 1984; Whitlow, 1990) have argued that repetition priming stems from both lexical and episodic loci. According to the "dual locus" model of repetition, priming normally stems from both residual lexical activation and episodic memory traces.

Forster and Davis (1984) used a lexical decision paradigm in which the first presentation of each stimulus was masked in order to reduce the accessibility of episodic memory traces of those stimuli. Despite this precaution, however, repetition priming was still observed. The effect was short-lived (lasting only a few seconds) and was attributed largely to residual lexical activation. The effect did not interact with word frequency, and Forster and Davis therefore made the ad hoc argument that "frequency attenuation"[2] occurs only when episodic traces are used to aid stimulus processing. Masking inhibits access to these traces, and the resulting priming thus reflects only residual lexical activation. Forster and Davis thus maintain that the robust effects found with normal presentation of the stimuli (e.g., two days: Scarborough et al., 1977) reflect the contributions of both lexical activation and episodic memory.

Whitlow (1990) found that the number of stimulus presentations only differentially affected repetition priming if subjects expected to later be tested for stimulus recall. When subjects did not expect such a test (as is typical for repetition priming experiments; Schacter, Bowers, & Booker, 1989) the number of stimulus presentations did not affect the size of the repetition effects. Priming in this latter condition, like the effects reported by Forster and Davis (1984), was thought to reflect only residual lexical activation. Whitlow thus argued that subjects expecting a memory test constructed more useful and/or elaborate episodic representations of the stimuli, which in turn lead to larger repetition effects. The interaction between subject expectations and number of repetitions was therefore interpreted as supporting both lexical and episodic loci of the repetition phenomenon.

Despite the conclusions that might be drawn from the Forster and Davis (1984) and Whitlow (1990) studies, the large number of discrepancies among repetition priming studies (see Lewandowsky, Dunn, & Kirsner, 1989) makes it unclear whether the source(s) of repetition effects can be unequivocally located. Additional data are needed to determine the extent to which each of the aforementioned sources are necessary and/or sufficient to produce the repetition phenomenon.

To accomplish this end, it may prove beneficial to examine the results of an experiment by Chumbley et al. (1992). Using pronunciation, Chumbley et al. found shorter latencies for words whose homophonic mates had been recently named than for words whose homophonic mates had not been named. For example, pronouncing "pale" was facilitated by having pronounced "pail" several minutes earlier. A "homophonic" repetition effect[3] was not found using lexical decision, however.

Because homophones have identical pronunciations but different spellings and meanings, the simplest explanation of the Chumbley et al. (1992) results is that facilitation in naming "repeated" homophones stemmed from using the same post-lexical processes to generate pronunciations for both members of each homophone pair. Retrieving and/or executing the articulatory program /payl/ to pronounce "pail," for instance, may have facilitated use of the same program when later pronouncing "pale." Because the homophones did not need to be articulated for lexical decision, less, if any, priming would be expected.

Another interpretation of the Chumbley et al. (1992) results focuses on the shared orthographic similarity between members of homophone pairs. Although spelled differently, members of a pair of homophones nonetheless are more orthographically similar than a random pair of words. Consequently, repetition priming may have stemmed from the relative ease in encoding the orthographic features of the repeated, as opposed to new, homophones.

Given the evidence against prelexical sources of repetition priming discussed earlier (e.g., Scarborough et al., 1977; Fuestel et al., 1983; Masson & Freedman, 1990), however, it is unlikely that orthographic similarity contributed significantly to repetition effects between homophones. Moreover, this interpretation of the Chumbley et al. results requires the additional assumption that the manner in which the stimuli were encoded varied as a function of the experimental task used; otherwise, repetition effects would have also been observed with lexical decision.

A third explanation of the Chumbley et al. (1992) results is that homophonic repetition stemmed from lexical sources. Pronouncing the homophones may have activated the logogens for those words' sound-alike mates which, in turn, would have lead to residual lexical activation and the normal benefit associated with such activation. How could both homophone logogens have been activated? Activation may have occurred in several ways: (a) via deliberate processing strategies; (b) through hearing the word pronounced; or (c) by using assembled phonology to access the lexicon. Each of these accounts will be discussed at length below.

The first manner whereby both homophone logogens may have been activated is through a deliberate processing strategy. Because all of the words in the Chumbley et al. (1992) study were homophones, subjects may have become aware of the nature of the stimuli and may have adopted a strategy of actively trying to think of each word's sound-alike mate. Both logogens might have thus been activated, and any resulting residual activation would have facilitated the processing of homophones that were later repeated. However, unless one posits that the inclusion of nonwords discouraged this strategy, this explanation fails to explain the absence of priming with lexical decision.

The second way that both homophone logogens may have been activated is via hearing the words articulated. The mechanisms that allow one to understand both meanings of the spoken word /payl/ (i.e., "pail" and "pale"), for instance, may have automatically activated both homophone logogens. This hypothesis is supported in that it is clearly possible to access both meanings of a spoken homophone. Also, there is evidence suggesting that, initially, both meanings of auditorily presented homophones are automatically activated (Warren & Warren, 1976). Moreover, because lexical decision does not require articulation of the stimuli, the absence of homophonic priming using this task (Chumbley et al., 1992) would be expected.

The third manner that both homophone logogens could have been activated is through using assembled phonology to access lexical memory. Generating the phonological code /payl/ for the word "pail," for instance, may have triggered both the "pail" and "pale" logogens. This possibility is interesting because it rests on the assumption that word recognition is "phonologically mediated" (i.e., word recognition proceeds by first converting letters to sound codes and then using these sound codes to access the lexicon). This assumption is currently the focus of considerable debate (e.g., Van Orden, 1987, 1991; Van Orden, Stone, & Pennington, 1990; Henderson, 1985; Paap & Noel, 1991; Lukatela & Turvey, 1991; Lesch & Pollatsek, 1992); however, given that phonological processes are involved in lexical access, then this final explanation is plausible. Such an account has difficulty explaining the absence of homophonic priming using lexical decision (Chumbley et al., 1992), however, because assembled phonology would presumably be used in both pronunciation and lexical decision.

Finally, one additional interpretation of the Chumbley et al. (1992) results needs to be addressed: Facilitation in naming repeated homophones may have stemmed, in part, from remembering the pronunciations of homophones presented earlier. As was mentioned previously, memory traces of how a word was recently pronounced might aid later pronunciation of that word in that it can be pronounced through both normal (i.e., generating and/or retrieving the articulatory program) and episodic (i.e., remembering how the word was previously pronounced) means. In addition, an episodic trace of a homophone's "earlier" pronunciation may reduce the information necessary to reach a criterion that is normally set to avoid mispronunciations generated lexically or phonologically.

Thus, from the preceding discussion it is clear that homophonic repetition effects (Chumbley et al., 1992) could originate from multiple sources: (a) residual activation of both homophone logogens stemming from hearing the words articulated; (b) residual activation of both logogens due to using assembled phonology; and (c) episodic memory traces of how the homophones' mates had been previously pronounced. It remains unclear, therefore, which of the aforementioned explanations is the correct interpretation of the Chumbley et al. findings. The experiment that follows was intended to identify the relevant source(s) of homophonic repetition effects. It was intended that the experiment not only provide insight into the cause(s) of homophonic priming, but also into the origin(s) of repetition effects in general.

# CHAPTER 2

# EXPERIMENT

The present experiment was designed to determine whether homophonic repetition effects stem from the residual activation of both homophone logogens. In addition, the experiment served to indicate whether this lexical activation (if present) originates from using assembled phonology and/or hearing the stimuli articulated. A demonstration of repetition priming via either process would support the hypothesis that homophonic priming stems from residual lexical activation. Moreover, demonstrating that this lexical activation is contingent upon the use of assembled phonology would have important implications for models of word recognition. To fully understand the methodology of this experiment, however, a brief digression into the nature of the word fragment completion task is first necessary.

The word fragment completion paradigm is an indirect or implicit memory task that has been widely used as a measure of repetition priming (Hayman & Tulving, 1989; Forster, Booker, Schacter, & Davis, 1989; Weldon & Roediger, 1987; Durgunoglu & Roediger, 1987). The basic paradigm consists of two parts. First, a set of priming stimuli is presented in some type of preliminary task (e.g., lexical decision: Forster et al., 1989). Upon completion of the "priming task," subjects are presented with a set of word fragments--

some constructed from words presented in the priming task--and asked to complete the fragments with the first correct solution (of the two or more) that occurs to them. Repetition priming is indicated by an increased proportion of fragments completed as words presented in the priming task instead of as the unpresented alternatives.

Two facets of the word fragment completion task make it especially useful for studying repetition priming. First, the task provides an indirect measure of memory because it does not require the use of--although it may nevertheless tap--episodic memory (Schacter, Bowers, & Booker, 1989). Use of this task, therefore, should diminish the possibility that any observed homophonic repetition effects originate from episodic sources.

Second, because the task uses word fragments as stimuli, the orthographic similarity between different presentations of the same stimulus can be minimized (e.g., "hand" vs. "ha--"). Furthermore, the orthographic overlap between homophones and fragments derived from their mates can be virtually eliminated (e.g., "pale" vs. "--il," the fragment constructed from "pail"). Use of this task should also reduce the chance that any observed homophonic priming is due to orthographic similarity between the words.

The priming task in the present experiment was pronunciation, which served to prime a set of stimuli consisting of both homophones and nonhomophones. Different filler stimuli were included to encourage either the use of addressed or of assembled phonology in pronouncing the priming stimuli. For the former case, the filler stimuli consisted of exception words (e.g., "cello"). For the latter case, the filler stimuli consisted of pseudowords ("burd"). Because pseudowords can only be pronounced via using assembled phonology, inclusion of these items should encourage the use of assembled phonology in naming the entire set of stimuli. Conversely, because exception words can only be pronounced by retrieving their phonology from "addresses" in the lexicon, inclusion of these words should discourage the use of assembled phonology in pronouncing the priming stimuli.

The naming task was followed immediately by a word fragment completion task. In this task, one-fourth of the fragments were solvable as the homophonic mates of words presented during naming, and one-fourth of the fragments were solvable as nonhomophones presented during naming. Thus, the task will measure both identity (i.e., nonhomophonic) and homophonic repetition effects. Furthermore, comparisons between the priming obtained following tasks that encouraged either assembled or addressed phonology should indicate whether homophonic priming is a function of having processed the words through a phonologically-mediated pathway and/or having heard the words pronounced.

## CHAPTER 3

## METHOD

### Subjects

112 undergraduates from the University of Massachusetts served as subjects. Subjects were enrolled in various psychology courses, and had the option of receiving either partial credit or payment for their participation. Fifty-six subjects were in each of the two between-subjects conditions. Finally, all subjects had normal or corrected to normal vision and were native English speakers.

### Design

The experiment is a mixed-factorial design with three 2-level within-subject factors: Prime-target relatedness (primed vs. unprimed), type of priming (homophonic vs. identity), and target frequency (high vs. low); and one 2-level between-subjects factor: Type of filler items (exception vs. regular).

### Stimuli

Twenty-eight homophone pairs were selected with the constraint that one word in each pair was high in frequency ($\underline{M}$ = 237.7, $\underline{SD}$ = 368.2; Francis & Kucera, 1988) and one word was low in frequency ($\underline{M}$ = 16.9, $\underline{SD}$ = 28.0). Twenty-eight nonhomophone "pairs"[4] were also selected so that one word in each pair was high in frequency and the other was low in frequency ($\underline{M}$ = 282.9, $\underline{SD}$ = 358.0, and $\underline{M}$ = 13.9, $\underline{SD}$ = 16.2, respectively). Homophone and nonhomophone pairs were matched so that high-frequency homophones and nonhomophones were the same length (M = 4.2 letters, SD = .8), as were the low- frequency homophones and nonhomophones (M = 4.2 letters, SD = .8).

The matched homophone-nonhomophone pairs were also yoked so that the word fragments constructed from the pairs satisfied several constraints. First, fragments derived from the matched homophone-nonhomophone pairs shared the same number, type (i.e., vowels vs. consonants), and serial position of letters within the fragments. For example, "-ail," the fragment from the low-frequency homophone "pail," was matched to "-eat," the fragment from the low-frequency nonhomophone "seat."

Second, fragments derived from the homophones shared minimal orthographic similarity with their mates. The maximum number of letter overlap was one letter in the same serial position. For example, "-ail" shares only one letter with "pale." (Note that some of the homophones, like the example just presented, do share letters in different serial positions.)

Third, each fragment was constructed to have at least two possible solutions. Also, each of the fragments derived from low-frequency words had at least one solution higher in frequency than the word from which the fragment was derived. The fragments thus provided a strong test for priming if unprimed word fragment completion is affected by word frequency.

Finally, the fragments were constructed so that they could not be solved as words from which other fragments were derived. For example, "pale" and "sale" were not both used because the fragment "-ale" can be completed as either word. This precaution was necessary to eliminate the possibility that fragment completion would be affected by the solutions given to earlier fragments.

All 56 word pairs were used in the priming task. However, each of the four sets of 28 words (i.e., high- and low-frequency members of each homophone pair and of each nonhomophone pair) were rotated through an 4 X 4 Latin square. Seven words were selected from each set with the constraint that both members of a pair were never selected. Thus, each subject pronounced only 28 experimental words: (a) seven high-frequency homophones; (b) seven low-frequency homophones; (c) seven high-frequency nonhomophones; and (d) seven low-frequency nonhomophones. With 112 subjects, each word was pronounced 28 times, yielding 784 observations per condition. The priming task stimuli are presented in APPENDIX A.

Each subject viewed 28 priming stimuli intermixed with either 28 phonologically regular and orthographically legal pseudowords (e.g., "burd"), or 28 exception words ("cello"). These filler stimuli are presented in APPENDIX B. The pseudowords were intermixed with the priming stimuli to encourage maximal use of assembled phonology in pronouncing the stimuli. The exception words were taken from Seidenberg (1985) and cannot be pronounced on the basis of "spelling-to-sound" correspondence rules (i.e., assembled phonology). Inclusion of these items thus should have discouraged the use of assembled phonology in pronouncing the priming stimuli.

Finally, 144 additional words were selected to serve as practice and buffer stimuli. Half of the words consisted of pseudowords and regular words and half of the words consisted of exception words.

The stimuli for the word fragment completion task consisted of fragments derived from the same set of stimuli used in the priming task. Each subject was presented 56 fragments taken from one of two complementary groups. Each group included: (a) 14 homophonic mates of words used in the priming task (seven of each frequency); (b) 14 new homophones (seven of each frequency, but not from the same pair); (c) 14 nonhomophones used in the priming task (seven of each frequency); and (d) 14 new nonhomophones (seven of each frequency). The two groups were complementary in that repeated fragments for one subject were new fragments for the next subject. The fragments were rotated through the same Latin square used to select the priming stimuli. With 112 subjects, each word was used as a fragment 56 times (28 times primed and 28 times unprimed), yielding 784 observations per condition. Word fragments and the words from which they were derived are presented in APPENDICES C and D.

To reduce the use of strategies in completing fragments (e.g., using the same phoneme to complete consecutive fragments), the test fragments were alternated with filler fragments. The filler fragments were derived from 56 low-frequency words, and were constructed so that their initial phonemes could not be used to complete the ensuing test fragments. For example, the filler fragment "dru-" preceded the test fragment "-ade." Filler fragments were also selected so that their solutions did not overlap with possible test fragment (i.e., target) solutions. The same set of filler fragments was used across conditions.

Finally, 20 words were selected to serve as practice stimuli. These stimuli were derived from low-frequency words and were chosen so that their solutions did not overlap with possible target solutions.

## Apparatus

The priming stimuli were presented in lowercase letters on a Visual 60 display driven by a Leading Edge Model D computer interfaced with a voice key. The letters comprising each stimulus were separated by single spaces (e.g., "d a y s"). Response latencies were measured to the nearest millisecond.

Word fragments were presented on the same apparatus. Letters comprising the fragments were presented in lowercase and were separated by single spaces. Blanks were represented as dashes (e.g., "- a y s"). Response latencies were measured to the nearest millisecond and were recorded on tape so that responses could be double-checked.

## Procedure

The basic paradigm consisted of a priming task (pronunciation) followed by the word fragment completion task. The priming task stimuli were presented as a random sequence of 56 trials arranged into two blocks of 28 trials each. Each block had an approximately equal number of high- and low-frequency homophones and nonhomophones, and either 14 pseudowords or 14 exception words. In addition, 32 trials at the beginning of the experiment and four trials at the beginning of each block served as practice. The 40 practice trials consisted of either pseudowords and regular words, or exception words. Finally, a block of 32 trials (pseudowords and regular words, or exception words) served as a recency buffer.

Each of the 128 trials in the priming task consisted of the following sequence of events: (a) a warning tone (500 Hz) presented for 250 ms; (b) a 250 ms silent interval; and (c) the letter string presented until the voice key was activated. A blank screen was presented after each response for 2500 ms (until the next stimulus).

On each trial the subjects pronounced the letter string as quickly and as accurately as possible. The voice key recorded onset of responses and the author recorded response errors. Subjects were given feedback (average latency and percent correct) and allowed to rest after each block of trials.

Following the priming task, subjects were presented with the instructions for the word fragment completion task. As with the priming task, instructions were presented on the television screen and subjects were free to page back and forth through the instructions. The instructions stated that the task was not related to the priming task, but that some of the fragments might be solvable as words that were previously pronounced. Subjects were instructed to pronounce aloud the first word that came to mind that correctly completed each fragment. The instructions are presented in APPENDIX E.

Following the instructions, the fragments were presented as two blocks of trials, each consisting of 28 target trials and 28 filler trials. Each block was preceded by 10 practice trials. Thus, there were 132 trials, each consisting of the following sequence of events: (a) a warning tone (500 Hz) presented for 250 ms; (b) a 250 ms silent interval; and (c) a word fragment presented until the voice key was activated. A blank screen was presented after each response for 2500 ms (until the next fragment).

On each trial the subjects said aloud a word that correctly completed each fragment. The voice key recorded onset of the responses and the author recorded the solutions given. Responses were also recorded on tape. The dependent variables were the percentages of fragments completed for primed vs. unprimed targets and both the response latencies and error rates for completing those fragments.

# CHAPTER 4

# RESULTS

The fragment completion responses identified on line by the experimenter were compared to those recorded on tape to ensure accuracy of the data. The percentage of fragments completed as words from which the fragments were derived (i.e., targets) were then used in the following analyses. Because "errors" in pronouncing targets during the priming task were infrequent (less than three percent) and consisted primarily of failure to trigger the voice key (due to speaking softly) as opposed to mispronunciations, none of the fragment completion data were excluded from the following analyses on the basis of priming task performance. However, fragment completion trials where the voice key failed to operate correctly (due to speaking softly, coughing, stuttering, etc.) were excluded from the latency analyses. Finally, in the following analyses, tests reported as reliable have $p$ values less than .05.

The percentages of unprimed fragments completed as targets are presented in Table 1. These data were examined using a mixed-factor ANOVA with type of priming (homophonic vs. identity) and target frequency (high vs. low) as within-subject factors, and type of filler items (exception vs. regular) as the between-subjects factor.

Table 1. Rates (in percentages) for completing unprimed fragments as targets.

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | 28.3 | 26.0 | 28.1 | 23.0 |
| Regular | 30.9 | 19.6 | 24.2 | 24.2 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

The main effect of target frequency was reliable, $F(1, 110) = 12.54$, $MS_e = 193.57$, with more unprimed fragments completed for high- (27.9%) than for low-frequency (23.2%) targets. None of the other main effects or two-way interactions were reliable (all $F$s < 2). However, the three-way interaction between type of priming, target frequency, and type of filler items was reliable, $F(1, 110) = 5.44$, $MS_e = 253.34$.

It is unclear why the preceding interaction was reliable, although the result could simply reflect a Type 1 error. Regardless of the interaction's validity, however, its importance is minimal because the largest discrepancy in completion rates for corresponding conditions across the between-subjects groups (i.e., the difference in completion rates for low-frequency homophones in the exception vs. regular conditions) is only marginally different than zero (using the Bonferroni procedure, $t(110) = 2.43$, $SE = 2.43$, $p = .07$). Furthermore, the completion rates for unprimed fragments are far enough below ceiling to ensure that any priming effects derived from the differences between primed and unprimed completion rates have not been spuriously reduced via ceiling effects.

The repetition effects (i.e., the differences between fragment completion rates for primed and unprimed targets) are presented in Table 2. These data were also examined using a mixed-factor ANOVA with type of priming and target frequency as within-subject factors, and type of filler items as the between-subjects factor.

Table 2. Repetition effects (in percentages).

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | 8.7 | -1.5 | 23.0 | 24.0 |
| Regular | 3.1 | 2.0 | 18.1 | 21.4 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

The type of priming main effect was reliable, $F(1, 110) = 65.23$, $MS_e = 591.40$, with more identity (21.6%) than homophonic (3.1%) facilitation. None of the other main effects or two-way interactions were reliable (all $F$s $< 3$), except for a marginal interaction between type of priming and target frequency, $F(1, 110) = 3.64$, $MS_e = 465.36$, $p = .06$. This latter finding suggests that frequency affected facilitation more with homophonic (5.9% vs. .2%) than identity (20.5% vs. 22.7%) targets. This conclusion remains tentative, however, because the suggestion of facilitation in the homophonic exception condition is weakened by the absence of a reliable Type of priming x Target frequency x Type of filler items interaction ($F < 1$). Nevertheless, in order to further investigate the possibility of homophonic repetition effects, separate ANOVAs were performed on each between-subjects condition using type of priming and target frequency as within-subject factors.

Within the exception condition, the main effect of type of priming was reliable, $F(1, 55) = 42.42$, $MS_e = 522.68$, with larger identity (23.5%) than homophonic (3.6%) repetition effects. The target frequency main effect was also marginal, $F(1, 55) = 2.85$, $MS_e = 414.56$, $p = .10$, with more facilitation for high- (15.8%) than for low-frequency (11.2%) targets. Finally, the Type of priming x Target frequency interaction was marginal, $F(1, 55) = 3.35$, $MS_e = 526.41$, $p = .07$. This latter finding supports the hypothesis that, with homophonic repetition, facilitation occurred only for high-frequency targets.

Within the regular condition, the type of priming main effect was also reliable, $F(1, 55) = 25.16$, $MS_e = 660.11$, with more facilitation for identity (19.7%) than homophonic (2.5%) targets. In contrast to the exception condition, however, neither the target frequency main effect nor the

Type of priming x Target frequency interaction were reliable (both $F$s < 1).

Finally, a mixed-factor ANOVA performed on the homophonic priming data using target frequency as the within-subject factor and type of filler items as the between-subjects factor indicated that the main effect of target frequency was reliable, $F(1, 110) = 4.60$, $MS_e$ = 1180.96, with more facilitation for high- (5.9%) than for low-frequency (.2%) targets. In addition, although the type of filler items main effect was not reliable ($F$ < 1), the Target frequency x Type of filler items interaction was marginal, $F(1, 110) = 3.08$, $MS_e$ = 383.30, $p$ = .08, suggesting that target frequency affected homophonic priming more in the exception (8.7% vs. -1.5%) than regular (3.1% vs. 2.0%) condition.

The foregoing analyses thus suggest that repetition priming between homophones occurred solely in the exception condition, when fragments for high-frequency homophone targets had been primed with their corresponding low-frequency sound-alike mates. As a final test of this hypothesis, planned contrasts were used to determine whether the homophonic repetition effects in each condition differ reliably from zero (a baseline representing no priming).

In the exception condition, homophonic priming was reliable for high-frequency targets, $t(55) = 2.98$, $SE$ = 2.91, but not for low-frequency targets ($t$ < 1). In the regular condition, homophonic priming was not reliable for either high- or for low-frequency targets (both ts < 2). Collapsed across the between-subjects conditions, homophonic priming was reliable for high-frequency targets, $t(110) = 2.01$, $SE = 2.91$, but not for low-frequency targets ($t < 1$). However, homophonic priming for the high-frequency exception targets was not reliably different from priming for the high-frequency regular targets ($t < 2$). Finally, collapsed across all homophonic conditions, facilitation was not reliable ($t < 2$). Thus, the conclusion that homophonic priming occurred with high-frequency targets in the exception condition is again supported.

The response latencies for completing unprimed fragments as targets are presented in Table 3. As with the prior analyses, the latency data were examined via a mixed-factor ANOVA using type of priming and target frequency as within-subject factors, and type of filler items as the between-subjects factor.

Table 3. Response latencies (in ms) for completing unprimed fragments as targets.

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | 1104 | 1195 | 1199 | 1077 |
| Regular | 1074 | 1253 | 856 | 1336 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

The main effect of target frequency was reliable, $F(1, 110) = 8.94$, $MS_e = 415{,}175$, with shorter latencies for completing fragments for high- (1033 ms) rather than low-frequency (1215 ms) targets. The interaction between target frequency and type of filler items was also reliable, $F(1, 110) = 5.88$, $MS_e = 415{,}175$; frequency affected latencies more in the regular (965 ms vs. 1294 ms) than exception (1101 ms vs. 1136 ms) condition. None of the other main effects or two-way interactions were reliable (all $F$s $< 2$). However, the three-way interaction between type of priming, target frequency, and type of filler items was marginal, $F(1, 110) = 2.67$, $MS_e = 451{,}142$, $p = .10$.

The repetition effects (as measured by the differences between unprimed and primed latencies for completing fragments as targets) are presented in Table 4. These data were also analyzed using a mixed-factor ANOVA with type of priming and target frequency as within-subject factors, and type of filler items as the between-subjects factor.

Table 4. Repetition effects (in ms).

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | -6 | 23 | 171 | 78 |
| Regular | 63 | 13 | -90 | 323 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

None of the main effects or interactions were reliable (all *F*s < 2), except for the Type of priming x Target frequency x Type of filler items interaction, $F(1, 110) = 3.78$, $MS_e = 633{,}401$. To more fully understand this interaction, separate ANOVAs were performed on each between-subjects condition using type of priming and target frequency as within-subjects factors.

Within the exception condition, neither main effect nor their interaction was reliable (all $F < 2$). Similarly, neither main effect within the regular condition was reliable (both *F*s < 3). In contrast to the exception condition, however, the Type of priming x Target frequency interaction was reliable, $F(1, 55) = 3.92$, $MS_e = 762{,}871$; frequency affected identity (-90 ms vs. 323 ms) more than homophonic (63 ms vs. 13 ms) priming.

Finally, a mixed-factor ANOVA performed on the homophonic priming response latencies using target frequency as the within-subject factor and type of filler items as the between-subjects factor indicated that neither main effect nor their interaction was reliable (all *F*s < 2).

To further investigate the effects of repetition on fragment completion latencies, planned contrasts were used to determine whether any of the group latencies differ from zero (a baseline representing no priming).

Within the exception condition, none of the group latency means differed reliably from zero (all *t*s < 2).

Within the regular condition, only the latency for the low-frequency identity group differed reliably from zero, $t(55) = 3.01$, $SE = 107.31$ (all other $t$s $< 1$). Collapsed across target frequency and type of filler items, neither the homophonic nor identity priming latencies differed reliably from zero (both $t$s $< 2$). Thus, aside from demonstrating that it generally takes less time to complete fragments for primed low-frequency identity targets in the regular condition, the preceding latency analyses provide little additional information concerning the nature of the observed repetition effects.

Finally, fragments that were not completed within 5 s or completed incorrectly (i.e., misspellings or nonwords) were considered to be errors. The percentages of errors made in completing unprimed fragments are presented in Table 5. These data were analyzed with a mixed-factor ANOVA using type of priming and target frequency as within-subject factors, and type of filler items regular as the between-subjects factor.

Table 5. Error rates (in percentages) for completing unprimed fragments as targets.

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | 14.3 | 12.0 | 10.5 | 6.9 |
| Regular | 13.0 | 12.8 | 10.0 | 6.1 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

The type of priming main effect was reliable, $F(1, 110) = 15.16$, $MS_e = 4.12$, with fewer errors made in completing fragments for identity (8.4%) than for homophonic (13.0%) targets. The target frequency main effect was also reliable, $F(1, 110) = 4.68$, $MS_e = 22.33$, with fewer errors completing fragments for low- (10.5%) than for high-frequency (10.9%) targets. No other main effect or interaction was reliable (all $F$s < 2).

The repetition effects (as measured by the differences between unprimed and primed error rates) are presented in Table 6. As with previous analyses, these effects were analyzed using a mixed-factor ANOVA with type of priming and target frequency as within-subject factors, and type of filler items as the between-subjects factor.

Table 6. Repetition effects (in percentages of errors).

| Condition | HF Homo | LF Homo | HF ID | LF ID |
|---|---|---|---|---|
| Exception | 6.4 | -1.8 | 5.9 | 1.0 |
| Regular | 3.3 | -1.0 | 2.3 | 0.0 |

Note: HF = high frequency; LF = low frequency; Homo = homophone; ID = identity.

The main effect of target frequency was reliable, $F(1, 110) = 8.90$, $MS_e = 303.60$; inhibition (as measured by more errors) was greater for high- (4.47%) than for low-frequency (-.4%) targets. No other main effect or interaction was reliable (all $F$s < 2). Finally, planned contrasts indicated that none of eight condition error rates differed reliably from zero (all $t$s < 1).

# CHAPTER 5

# DISCUSSION

As is typically the case with the word fragment completion paradigm (e.g., Roediger & Blaxton, 1987; Durgunoglu & Roediger, 1987; Weldon & Roediger, 1987), the latency and error rate data collected in the present experiment are quite variable and thus relatively uninformative. As a result, the following discussion is limited largely to the findings that emerged from the analyses of the completion rate data.

One such finding is that identity priming occurred regardless of the type of filler items with which the nonhomophones were pronounced, or the frequency of the target. Although this result is not unexpected given the robust nature of repetition effects (e.g., Scarborough et al., 1977), the finding is nonetheless unusual because frequency effects have been observed using a number of indirect tasks (e.g., lexical decision: Chumbley et al., 1992). The presence of identity priming does indicate, however, that the experimental methodology was conducive to priming.

More important are the suggestions of homophonic priming. Although such homophonic repetition effects have also been previously reported (Chumbley et al., 1992), the priming reported in the present paper is noteworthy because of the circumstances surrounding its disclosure.

First, an indirect test (word fragment completion) was specifically used in order to minimize the contributions that strategies based on episodic traces of the stimuli might produce in completing the fragments for repeated targets (Schacter, Bowers, & Booker, 1989). The presence of homophonic priming in this task thus suggests that the locus of homophonic priming is not episodic memory.

Second, the between-subjects manipulation of the priming task materials (i.e., intermixing targets with either pseudoword or exception filler items) was designed to encourage the use of either assembled or of addressed phonology, respectively (Davelaar, Coltheart, Besner, & Jonasson, 1978). Absence of homophonic priming in the former condition therefore suggests that such effects did not stem from hearing the words pronounced because the priming stimuli were articulated in both conditions. In addition, the presence of homophonic priming in only one condition suggests that these effects are not solely the product of using repeated articulatory programs (as would be predicted by postlexical accounts) or of remembering how the homophonic mates of targets had earlier been pronounced (as would be predicted by episodic memory accounts).

Third, the presence of homophonic priming with high-frequency targets suggests the manner whereby the effects were produced. In the exception condition of the priming task, the irregular nature of the filler items and the relative difficulty of the task--as indicated by reliably longer latencies (581 ms) and more errors (7.6%) in the exception condition as compared to latencies (551 ms) and errors (4.8%) in the regular condition; $t(110) = 2.30$, $SE = 13.02$; and $t(110) = 4.40$, $SE = .65$, respectively--resulted in many of the words' phonological representations (regardless of whether they were gained through assembled or addressed means) being checked against the contents of lexical memory, with a match indicating the correctness of the ensuing pronunciation. By using this "phonology check" the subject would decrease the likelihood of making a mispronunciation. Because the logogens of high-frequency words are more easily activated than those of low-frequency words (Morton, 1969), however, the checking procedure would often result in the activation of high- rather than low-frequency homophone logogens. This inadvertent activation of the high-frequency homophone logogens, then, is what later facilitated the completion of fragments having high-frequency homophone targets.

In the regular condition of the priming task, each item's phonological representation did not need to be checked against the contents of lexical memory; the inclusion of pseudoword filler stimuli made it possible to quickly and accurately pronounce the items without first verifying the correctness of their pronunciations. Consequently, pronouncing the low-frequency homophones did not cause lexical activation of their high-frequency mates or the facilitation normally associated with such activation.

One problem with the above interpretation, however, is that it seemingly contradicts earlier reports that the identification of low-frequency homophones inhibits the lexical activation of their high-frequency sound-alike mates (Davelaar et al., 1978). According to Davelaar et al., when homophones are identified under conditions that encourage the use of assembled phonology, a spelling check procedure is adopted in which each word's spelling is compared to spelling "templates" stored in the lexicon. Because the check proceeds according to word frequency (e.g., "sail," a low-frequency homophone, is first checked against the template for "sale," a high-frequency homophone, and then the template for "sail"), correct identification of a low-frequency homophone requires that the lexical activation of its high-frequency mate first be repressed. Consequently, homophonic priming would not be expected when high-frequency targets are preceded by their low-frequency homophonic mates.

However, it is important to emphasize that, whereas the checking procedure proposed by Davelaar et al. (1978) involves orthography, the checking procedure proposed in the present paper instead involves phonology. With the spelling check, "sale" would not suffice as the correct spelling for "sail," and activation of the "sale" logogen would be repressed. With the phonology check, however, /sayl/ (the phonological representation of "sale") does suffice as the correct pronunciation for "sail," and the "sale" logogen would therefore remain activated. Thus, the Davelaar et al. (1978) findings are not necessarily incongruent with the present results.

This paper was intended to explain the findings reported by Chumbley et al. (1992). Consequently, a discussion of the present results would not be complete without consideration of how the preceding "phonology check" explanation fares as an interpretation of the Chumbley et al. results.

One indicator that the present explanation of homophonic priming is correct is that the homophonic repetition effects observed by Chumbley et al. (1992) stemmed largely from facilitation[5] in pronouncing the high- (35 ms) rather than the low-frequency (-5 ms) mates of recently pronounced homophones. These results are consistent with the present results in that priming occurred going from low- to high-frequency homophones (but not vice versa). Thus, the Chumbley et al. results can be accounted for by the explanation of homophonic repetition put forward in this paper.

One problem with this interpretation of the Chumbley et al. (1992) results, however, is that the phonology checking process is thought to be employed only when the stimuli presented are difficult to pronounce. Consequently, this explanation requires the assumption that the Chumbley et al. stimuli were sufficiently difficult to pronounce that, in order to avoid making errors, subjects had to first check many of the words' phonological representations against the contents of lexical memory. This assumption is questionable because, in contrast to the present experiment, the Chumbley et al. stimuli included few, if any, difficult-to-pronounce exception words.

It is important to note, however, that other factors might make words difficult to pronounce and thereby lead to the phonology check process. By being low in word usage frequency, for example, many of the low-frequency homophones may have been unfamiliar or novel and thus required that their phonology be checked to avoid mispronunciations. Thus, the Chumbley et al. (1992) results might still be interpreted within the "phonology check" framework. Such an interpretation would, in turn, further support the claim of this paper, that homophonic repetition effects have a lexical locus.

# APPENDIX A

## PRIMING TASK STIMULI

| High Frequency | | Low Frequency | |
|---|---|---|---|
| Homophones | Nonhomophones | Homophones | Nonhomophones |
| die | see | dye | toy |
| toe | man | tow | sin |
| tied | head | tide | fame |
| made | wife | maid | leak |
| soul | door | sole | rung |
| days | mean | daze | rage |
| four | book | fore | lake |
| hair | week | hare | pine |
| pain | room | pane | tune |
| blue | plea | blew | claw |
| loan | bear | lone | rope |
| pale | time | pail | seat |
| great | plain | grate | glide |
| shoot | blood | chute | glove |
| sweet | clear | suite | grape |
| board | death | bored | felon |
| shown | print | shone | chore |
| loot | pool | lute | pile |
| tax | law | tacks | latch |
| some | race | sum | fig |
| right | hands | rite | hive |
| break | sleep | brake | blade |
| stare | space | stair | grief |
| flower | travel | flour | trout |
| knows | cross | nose | fate |
| son | job | sun | jog |
| fur | jet | fir | rod |
| wait | deal | weight | launch |

# APPENDIX B

## FILLER STIMULI

| Regular Pseudowords | Low Frequency Exception Words |
|---|---|
| ait | acre |
| beem | among |
| burd | beret |
| cleen | breast |
| doktor | bury |
| durby | cafe |
| elboe | cello |
| fakt | debris |
| flaim | debt |
| flote | facade |
| frend | full |
| froot | gnaw |
| grean | heard |
| grupe | hoof |
| gurl | indict |
| korn | knob |
| kurl | lure |
| markit | mild |
| munkey | move |
| munth | myth |
| muzic | once |
| nektar | police |
| panzy | sieve |
| peech | suit |
| purson | tomb |
| skalp | tongue |
| teath | vague |
| tode | yacht |

APPENDIX C

HIGH-FREQUENCY WORD FRAGMENT STIMULI

| Homophone | Fragment | Nonhomophone | Fragment |
|---|---|---|---|
| die | - i e | see | - e e |
| toe | - o e | man | - a n |
| tied | - i e d | head | - e a d |
| made | - a d e | wife | - i f e |
| soul | - o u l | door | - o o r |
| days | - a y s | mean | - e a n |
| four | - o u r | book | - o o k |
| hair | - a i r | week | - e e k |
| pain | - a i n | room | - o o m |
| blue | - - u e | plea | - - e a |
| loan | - o a n | bear | - e a r |
| pale | - a l e | time | - i m e |
| great | - - e a t | plain | - a i n |
| shoot | - - o o t | blood | - - o o d |
| sweet | - - e e t | clear | - - e a r |
| board | - - a r d | death | - - a t h |
| shown | - - o w n | print | - - i n t |
| loot | - o o t | pool | - o o l |
| tax | - a x | law | - a w |
| some | - o m e | race | - a c e |
| right | - i g h t | hands | - a n d s |
| break | - - e a k | sleep | - - e e p |
| stare | - - a r e | space | - - a c e |
| flower | - - o w e r | travel | - - a v e l |
| knows | - - o w s | cross | - - o s s |
| son | - o n | job | - o b |
| fur | - u r | jet | - e t |
| wait | - a i t | deal | - e a l |

# APPENDIX D

## LOW-FREQUENCY WORD FRAGMENT STIMULI

| Homophone | Fragment | Nonhomophone | Fragment |
|---|---|---|---|
| dye | - y e | toy | - o y |
| tow | - o w | sin | - i n |
| tide | - i d e | fame | - a m e |
| maid | - a i d | leak | - e a k |
| sole | - o l e | rung | - u n g |
| daze | - a z e | rage | - a g e |
| fore | - o r e | lake | - a k e |
| hare | - a r e | pine | - i n e |
| pane | - a n e | tune | - u n e |
| blew | - - e w | claw | - - a w |
| lone | - o n e | rope | - o p e |
| pail | - a i l | seat | - e a t |
| grate | - - a t e | glide | - - i d e |
| chute | - - u t e | glove | - - o v e |
| suite | - - i t e | grape | - - a p e |
| bored | - - r e d | felon | - e l o n |
| shone | - - o n e | chore | - - o r e |
| lute | - u t e | pile | - i l e |
| tacks | - a c k s | latch | - a t c h |
| sum | - u m | fig | - i g |
| rite | - i t e | hive | - i v e |
| brake | - - a k e | blade | - - a d e |
| stair | - - a i r | grief | - - i e f |
| flour | - - o u r | trout | - - o u t |
| nose | - o s e | fate | - a t e |
| sun | - u n | jog | - o g |
| fir | - i r | rod | - o d |
| weight | - e i g h t | launch | - a u n c h |

## APPENDIX E

## FRAGMENT COMPLETION TASK INSTRUCTIONS

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Screen 1.

Now it is time for a new task. As with the previous task, on each trial you will hear a soft warning tone which will be followed by a stimulus presented in the center of the monitor screen. Instead of letter strings, however, the stimuli will consist of fragments of words. For example, the word fragment "- - s t e" might be presented. Your task is very simple: just say aloud the first word that you can think of which successfully completes each fragment. For example, appropriate responses for the fragment "- - s t e" include "taste," "paste," and "caste" since each of these words has two letters that can replace the dashes in the fragment and thereby make a word.

Screen 2.

When responding to the word fragments it is important that you say aloud the FIRST solution that you think of. If you cannot think of a solution within five seconds, the fragment will disappear and the message "TIME OUT" will appear on the screen. Please do not say "I don't know" if you cannot complete a fragment because this will trigger the voice key. Also, although your response times will be measured (as in the first task), we are more concerned with response ACCURACY. The computer in the next room will be recording responses and counting "errors" (i.e., times when you give an incorrect completion, do not speak loudly enough, mispronounce a word, etc.).

Screen 3.

There will be two blocks of trials with around 60 trials in each block. Feel free to rest after the first block. If questions about the procedure arise, feel free to simply ask your question. The intercom is on so the experimenter will hear your question and answer it for you. When you are ready to start simply push the white button.

## ENDNOTES

1. Response probability is the proportion of correct "word" and "nonword" responses, and is thought to affect the response production stage of processing. Thus, manipulating the response probability should affect only postlexical processing.

2. "Frequency attenuation" is the phenomenon that low-frequency words benefit more from repetition than do high-frequency words, and is thus simply an interaction between the effects of repetition and word frequency. Failure to find frequency attenuation when episodic sources of repetition priming were minimized (Forster & Davis, 1984) therefore suggests that the Repetition x Word frequency interactions reported by others (e.g., Scarborough et al., 1977; Norris, 1984; Chumbley et al., 1992) might also be interpreted as support for an episodic locus of repetition priming, rather than the lexical explanation that is predicted by additive factors (Sternberg, 1969).

3. Homophonic "repetition" is not true repetition. Although Chumbley et al. (1992) did present a third of the homophones twice (e.g., "sail" followed later by "sail"), the homophonic repetition effects mentioned occurred when homophones were followed by their sound-alike mates ("pail" was presented, followed about 50 trials later by the presentation of "pale").

4. The high- and low-frequency members of each nonhomophone pair are matched in terms of mean word length, types of letters, etc. to the corresponding homophones of each respective frequency.

5. "Facilitation" is measured here in terms of the differences between pronunciation latencies across presentation cycles. Thus, the first number represents the difference between the mean latency for low-frequency homophones in Cycle 1 and the mean latency for their high-frequency mates in Cycle 2.

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