# The Psycholinguistic Reality of Abstract Representations

Meghan Sumner
*SUNY Stony Brook*

## 1. Introduction

This paper addresses the notion of abstract phonological representations, and the capacity speakers have to construct a single abstract form from multiple surface forms of a single morpheme. The degree of abstractness of representations is a point of debate across theories, ranging from those that posit representations to account for extreme cases of abstractness such as opacity (i.e., Sympathy (McCarthy 1998), Interleaved OT (see Bermudez-Otero 1999)) to those that posit representations that more or less match the surface form, although some allow for abstract representations for productive, transparent alternations (i.e., Natural Phonology (Hooper 1976, Bybee 2001), Cognitive Grammar (Nathan 1998)). While the current architecture of phonology supports both abstract and concrete representations, we have little independent evidence supporting one or the other. In the past, diachronic arguments, aphasic studies, and loanword phonology have shed light on this issue, however we still have few tools to help us distinguish between psychologically plausible analyses and psychologically real ones.

In this paper, transparent and opaque alternations in weak verbs in Modern Hebrew are considered in order to further our understanding of the nature of phonological representations. Modern Hebrew provides an excellent opportunity not only to consider alternations, but to understand how phonology-independent factors such as language use and type frequency bear on phonology. In this paper, we will have an in-depth look at weak verb alternations in Modern Hebrew and some facts about the use of glottal stops, which are involved in these alternations. Finally, a psycholinguistic experiment is presented as evidence in favor of both abstract representations, and the incorporation of phonology-independent factors into phonological theory. To begin, we will consider analyses for

* I am grateful to Mark Aronoff, Christina Bethin, Ellen Broselow, Yiya Chen, Robert Hoberman, and Arthur Samuel, for their time, patience, and guidance.

 *WCCFL 21 Proceedings*, L. Mikkelsen and C. Potts (eds.), pp. 429-442. Somerville, MA: Cascadilla Press.

transparent and opaque alternations in Modern Hebrew that are available to us via current phonological theory, showing that there are a number of possible analyses that are on par with in each other in terms of merit. These analyses, however, are vastly different from each other in terms of predictions made regarding both the types of evidence speakers use to identify phonological relatedness and the threshold of this ability.

## 2. Stalemate in phonology

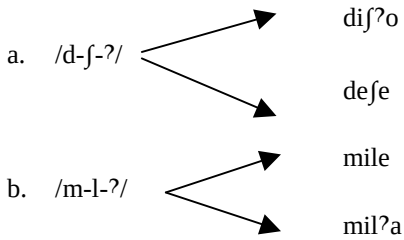
Depending on whether a theory assumes an abstract or a concrete representation, or a mixture of the two, a different prediction is made regarding the kinds of surface patterns and relationships speakers recognize. Here, possible analyses of transparent and opaque alternations in Modern Hebrew are provided. The two forms we will focus on for this section are the Hebrew forms *mile* 'he filled' and *deʃe* 'grass, lawn'. These are two forms from Modern Hebrew that are traditionally analyzed as having a glottal stop as a final root consonant. The first form, *mile*, is transparent, as the glottal stop cannot occur in coda positions in Modern Hebrew. Any inflected form of the verb that results in this syllabification will surface without the final root consonant. This form can be compared with *milʔa* 'she filled' in which the final root consonant surfaces when it occurs in the onset position. The second form, *deʃe*, is generally assumed to be opaque. In this form, the glottal stop also does not surface, adhering to the phonotactic constraint disallowing coda glottals. However, its presence as an abstract segment motivates the second surfacing vowel, as it is epenthetic. The second vowel *e* is epenthesized in a class of nouns referred to as segholate nouns, in which a vowel is epenthesized in order to break up an illicit consonant cluster, as in the word *delet* 'door'. One additional cue that this vowel is epenthetic is that this class of nouns has initial stress that does not follow the traditional stress pattern in Modern Hebrew of final stress.[1] Additionally, the final root consonant surfaces in related forms, such as *diʃʔo* 'his grass, lawn'. With this in mind, we move on to possible analyses that are available to us via current phonological theory.

1. Traditional analyses of Hebrew opacity base abstract analyses, in part, on the regular pattern of final stress, however, in recent years there have been many claims that the regular stress pattern in Hebrew is not final, and the nominal system in general has more flexibility in the location of stress (i.e., Ussishkin 2000, Bat-El 1989).

**2.1. Abstract analysis**

An abstract analysis would include glottal stops in the underlying representations of both transparent and opaque surface forms, as shown below.

(1)

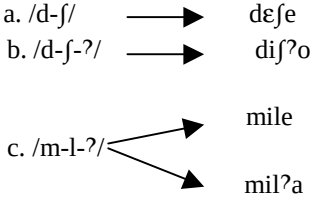



Support for this analysis includes the presence of glottal stops in related forms, the phonotactics of the language, and a strong preference in Hebrew for a triconsonantal root. According to Hayes (1999)**,** the phonotactics of a language are learned by speakers at an early stage. Therefore, we would not predict that the absence of coda glottal stops to deter a speaker from positing a glottal stop in the underlying representation.

**2.2. More concrete analysis**

Another possible analysis, moving toward an input that more closely resembles the output, is one in which the opaque nouns and their related surface forms do not derive from a single underlying representation. Instead, as Bolozky (1999) argues, the surface generalizations are memorized. As for the transparent alternations, these still stem from the same underlying representation.

(2)




The small number of opaque nouns and related forms along with their uncommon usage favor this analysis. In addition, the idea that surface generalizations are easier to learn than deciphering abstract forms from opaque surface forms provide further support for an analysis that assumes

lexicalization of opaque forms. This analysis allows for a difference between the two types of alternations, arguing that the verb paradigm is productive and powerful enough to cause speakers to capture the phonological relationship among words, while this is not so with the nominal paradigm, in which there are over 100 patterns and new words need not adhere to the patterns (Bat-El 1989).

### 2.3. Concrete inputs

Considering productivity, variation, and limited access to surface glottal stops, a third analysis would argue that there is simply not enough evidence in Hebrew to support underlying glottal stops in variants in which they do not surface, even in transparent alternations. They could be considered orthographic remnants, and the underlying representations for all forms with glottal stops look like the surface forms. The representation of this analysis is laid out in (3).

(3) a. /d-ʃ/ → deʃe
b. / d-ʃ-ʔ/ → diʃʔo
c. /m-l/ → mile
d. /m-l-ʔ/ → milʔa

Here, we have seen three completely plausible analyses of the distribution of glottal stops in Hebrew. Currently, we have no tools for choosing among analyses. In the following, I show that weak verbs in Modern Hebrew provide us with an outlet in which we can test the different predictions made by abstract and concrete analyses. In addition, I discuss the possible role phonology-independent factors might play in the development of representations in Modern Hebrew. Finally, an experiment that addresses these issues is presented, aiding in our understanding of what representations look like, and what criteria motivate or inhibit the formation of abstract representations.

## 3. Weak verbs

Weak verbs are those verbs in Modern Hebrew which surface without a root consonant, such as the form *mile* discussed in section 2. These verbs are interesting for abstract models of phonology, and serve as an outlet for experimental methods of explaining the nature of representations. The form *mile*, as previously discussed, has a final root consonant that does not surface in some forms of the verbal paradigm. In fact, the final root consonant only surfaces about 20% of the time, as shown in example (4).

(4) *mile* ‘he filled’, root *m-l-ʔ*

| | | | |
|---|---|---|---|
| 1s | mile_ -ti | 1p | mile_ -nu |
| 2ms | mile_ -ta | 2mp | mile_ -tem |
| 2fs | mile_ -t | 2fp | mile_ -ten |
| 3ms | mile_ | 3p | mil?_ -u |
| 3fs | mil?_ -a | | |

The missing final consonant is due to the fact that in Modern Hebrew, glottal stops form illicit codas. They can surface freely in the onset position, as in the form ‘she filled’, however, when they should appear in the coda position to satisfy the morphological pattern, they do not surface, as in the form ‘he filled’ in which the final root consonant should appear at the end of the word.

We can contrast this weak verb with a different type, whose final consonant is not as transparent. The weak verb *nika* in Hebrew is considered opaque by a very abstract analysis. Historically, the root of this verb is n-k-y. In contrast to the transparent weak verbs, like *mile*, the final root consonant for weak verbs like *nika* does not surface in the verbal paradigm. The final [j] does surface, though, in a related noun, *nikuj* ‘cleaning’. The question is whether or not this serves as enough evidence to enable a speaker to identify the predictable alternation. Compare the paradigm in (5) with that for transparent weak verbs given in (4).

(5) *nika* ‘he cleaned’, root *n-k-y*

| | | | |
|---|---|---|---|
| 1s | niki_ -ti | 1p | niki_ -nu |
| 2ms | niki_ -ta | 2mp | niki_ -tem |
| 2fs | niki_ -t | 2fp | niki_ -ten |
| 3ms | nika_ | 3p | nik_ -u |
| 3fs | nikt -a | | |

There are two main distinctions between these two types of weak verbs. First, while the final root consonant rarely surfaces, it surfaces more often in the transparent case. Additionally, while the verbs in each category are common and frequent, the frequency of the type of verb varies, as there are only about 12-15 transparent weak verbs like *mile* in Hebrew, there are many (though not as many as a regular verb) opaque weak verbs like *nika*. We have to question the role each of these factors plays in the construction of abstract representations.

While the transparent weak verbs seem to be unproblematic for an abstract analysis, the picture becomes cloudy as soon as we consider a few facts about the nature of glottal stops in Modern Hebrew.

## 4. Glottal stops

The concrete analysis presented in section 2 raises questions in addition to the nature of phonological representations. A concrete analysis considers phonology-independent factors to be involved in the makeup of phonological representations. In this view, there are any number of factors that can contribute to or inhibit the postulation of abstract representations, however, we do not know the full extent to which these factors play a role. Modern Hebrew serves as an outlet for such explorations, as the status of glottal stops, while predictable based purely on the phonotactics of the language, is variable, and therefore possibly not as predictable as once thought, as the following discussion shows.

The pattern and use of glottal stops in Modern Hebrew are important to us for a number of reasons. As shown above, forms with glottal stops have been used as support for analyses of opacity, and thus for support for frameworks that are able to account for opacity. While a claim cannot be made here about opacity in general, certain facts about glottal stops in Modern Hebrew lead us to question the reliability of analyses based on them, and they also lead us to question how speakers treat forms with glottal stops in general, even forms that are not opaque. Before getting into more details about the treatment of glottal stops, let us first consider some facts that should not be neglected before developing an analysis of the phonology of Modern Hebrew, or a part of it anyway. A list of important details is given in #.

(6) Glottal stops in Modern Hebrew are:
- a. possible only in onset position (Rosén 1977)
- b. optional in onset position (Berman 1980, Schwarzwald 2001)
  - i. milʔa ~ mila ‘she filled’
  - ii. kafʔa ~ kafa ‘she froze’ (cf. kafa ‘he froze’)
  - iii. baʔar ~ ba.ar ‘gloss’
- c. usually deleted (Berman 1980)
- d. present in less than 5% of new words (Schwarzwald 1984)
- e. the prescriptive form (Berman 1981)
- f. always written.

Glottal stops cannot occur in coda positions, due to the phonotactics of Modern Hebrew (4a). This is learnable and predictable information, in theory. We do not fully understand, though, whether this is the case, and to what extent factors such as 4b-g play in the notion of predictability. For example, the forms in 4b are in free variation. The forms with glottal stops (theoretically underlying glottal stops) are frequently produced (Berman 1981), or more commonly produced (Schwarzwald 2001) without glottal

stops, even if that creates hiatus (4bi). Each form given in 4b is different. In (4bi), the loss of the glottal stop simplifies the syllable structure.[2] The deletion does not result in ambiguity, as it does in (4bii). The deletion of the glottal stop in 4bii results in the pronunciation [kara], which traditionally means "he froze", but with the deleted segment, it also means "she froze". So, we have a case where the glottal stops are deleted even when resulting in ambiguity. Finally, in (4biii), glottal stops are deleted intervocalically, creating hiatus. Hebrew, however, is creating a hiatus context by deleting an intervocalic glottal stop. This example is particularly interesting, because a data set comprised of words of this form may be unclear as to whether a glottal stop is being epenthesized to resolve hiatus, or whether it is deleted, causing a less preferred structure.

With these factors in mind, we move now to a psycholinguistic experiment designed to test the nature of phonological representations of weak verbs in Modern Hebrew. The experiment is designed to incorporate the issues raised thus far, in order to better understand the influence they may have on the phonology of Hebrew, and on phonology in general.

## 5. Experiment

Priming experiments were conducted in Modern Hebrew in order to find independent support for the nature of phonological representations. Priming has been used to show relatedness among phonologically and morphologically related words (Marslen-Wilson 1980, Slowiaczek & Hamburger 1992, Radeau et al. 1995, Deutsch et al. 2000). More specifically, in Modern Hebrew verbal pattern priming has been shown to occur (Frost et al. 1999). Frost et al. 1999 showed that when primes and targets share the same verbal pattern, the target verb is recognized faster than when the same word is preceded by a verb of a different pattern. AS an example, a verb like *diber* 'he spoke' primes *tipes* 'he climbed', but not *katav* 'he read'. Likewise, a verb in the paʔal pattern like *CaCaC* primes a verb of the same pattern, *katav*, but not a verb of a different pattern like *tipes*. These results enable us to design experiments to examine the nature of representations.

The morphological priming experiments show that regular verbs are able to prime one another as long as they share the same morphological pattern. This has been interpreted as morphological decomposition, in which the subjects are able to break down words into separate morphemes.

2. It seems reasonable that the deletion of glottal stops has more to do with perception than creating simple structures, along the lines of [h]-deletion in Turkish discussed by Mielke (2001), as the glottal stops are difficult to perceive compared with other consonants, and their deletion also results in more marked structures.

For weak verbs, this raises an interesting question. Depending on the analysis, abstract or concrete, a different prediction is made for the representation of weak verbs. An abstract analysis would posit three root consonants in the phonological representation for each type of weak verb, transparent and opaque. If this is the case, we would expect the presence of the root consonants to allow decomposition of the surface form, as priming taps into the phonological level of processing (see Goldinger 1996). Therefore, in experimental terms, we would expect to find facilitation of regular target verbs when preceded by both types of weak verb primes. If, however, a concrete representation is supported, we would expect no effect in either situation, as there is no final root consonant present in the phonological representation under this type of analysis. One additional prediction, based on the middele-of-the-road analysis in section 2, predicts a split in behavior correlating to the degree of abstractness a speaker is able to recognize. If opaque patterns are not detected by speakers, and are therefore not associated with abstract representations, but have been reanalyzed as lexical items themselves, we would expect no effect for the opaque weak verb condition. We would expect an effect for the transparent weak verb condition, though, as this is still predictable based on sufficient surface information.

In addition to purely representational issues, we can also make a separate prediction based on a phonology-independent factor. The transparent weak verbs have a low type frequency. This means that, while the words themselves are frequent and commonly used, words with this surface form are rare, totaling only about 12-15 words in the language. The opaque weak verbs are also frequent and commonly used, but the type or form of word is more common than the transparent weak verbs, however, they have a significantly lower type frequency than regular verbs. Therefore, we are able to examine whether or not the frequency of the type of word has an effect on word recognition. This is important in making an initial step towards understanding the interaction of phonology-independent factors and phonology. If type frequency plays a role in word recognition, we would then expect a three-way distinction in reaction times among transparent weak verbs, opaque weak verbs, and regular verbs.

### 5.1. Method

#### 5.1.1. Subjects

Twenty native Hebrew speakers living in the United States participated in the experiment. Hebrew was either the main language spoken at home, or the language spoken at work for every subject. The mean age of the

subjects is 49.5. This age group was used in order to compare the results with a later experiment involving college-aged Hebrew speakers.

### 5.1.2. Stimuli

Four stimuli conditions were present in this experiment. The transparent condition consisted of transparent weak verb primes followed by a regular verb from the same pattern (mile – DIBER). The opaque condition consisted of an opaque weak verb prime followed by a regular verb from the same pattern (nika – DIBER). The nonalternating condition consisted of regular verbs followed by a regular verb of the same pattern (tipes – GIDEL). Finally, the baseline condition consisted of prime and target verbs that mismatched in pattern (katav – GIDEL). Twelve primes and targets were chosen for each condition, totaling 48 critical pairs. Thirty-six real word fillers, including nouns and verbs from multiple patterns, and 72 nonword fillers were used to bring the critical stimuli down to 30% of the total trials. While there is no Hebrew word frequency database available, native speakers judged the frequency of both prime and target words to ensure that word frequency will not play a role in the results.

### 5.1.3. Procedure

Subjects listened to the stimuli through headphones and were told that they would hear pairs of Hebrew words. They were instructed to press one button (with their dominant hand) if the second word in the pair was a real Hebrew word, and a different button (with their non-dominant hand) if the second word in the pair was not a real Hebrew word, or a nonsense word. Due to the limited number of stimuli, and the limited number of subjects, each subject heard both sets of stimuli. Half of the subjects heard set A first, followed by set B, while the other half heard set B first, followed by set A. Each trial consisted of the presentation of the prime, a 500ms period of silence (interstimulus interval), and the target. The time it took for the subjects to make a decision for the target word was recorded, along with their response. Trials with incorrect responses were discarded.

## 5.2. Preliminary Results and Discussion

The reactions times for each condition were averaged across speakers. A priming effect of 24ms was found for the related condition, supporting previous findings. With this in mind, the focus of the rest of the discussion will be on the transparent and opaque weak verb conditions. Table 1

illustrates the reactions times for each of these conditions compared to the control, or unrelated, condition.

| Condition | Reaction times (ms) | % Error |
|---|---|---|
| **Opaque weak verb** | 852 | 6.8 |
| **Control (unrelated)** | 856 | 6.7 |
| **Difference** | -4 | |
| **Transparent weak verb** | 885 | 7.3 |
| **Control (unrelated)** | 856 | 6.7 |
| **Difference** | 29 | |

Table 1. ANOVA: $p<.01$ for transparent weak verb condition. Opaque weak verb condition not significant.

As shown in Table 1, the difference between the control and the condition with opaque weak verb primes is -4ms. This is not a significant difference, and therefore provides us with no evidence supporting a final root consonant. There is a significant difference between the reaction times in the control condition and the condition with transparent weak verb primes. The difference, however, is a positive difference, not a negative one, which, while significant, is not a priming effect. In fact, the recognition of regular verbs preceded by transparent weak verbs is inhibited. Additionally, there is only a two-way distinction, not a three-way distinction, ruling out the influence of word type frequency in phonology, at least for the case of weak verbs in Modern Hebrew.

In sum, transparent weak verb primes result in latent response times to regular Hebrew verbs of the same pattern. While the inhibition was not predicted, a split between the two conditions was predicted. Therefore, to understand these results, we should look to the analysis that predicts an abstract representation for the transparent weak verbs and a concrete representation for the opaque weak verbs

### 5.2.1. Opaque weak verbs

The less interesting of the two results is that of opaque weak verbs. While less interesting, it is still important for phonology, as the lack of effect may be interpreted as a lack of a final root consonant. The only difference between the two primes, after factoring out word type frequency, is the presence of the final consonant. In the opaque forms, the root consonant surfaces only in related nouns, as previously discussed. This isolated form, and relation, is too weak to promote the construction of an

abstract representation. Rather, the opaque weak verbs have been reanalyzed by speakers of Modern Hebrew. The question now, is what have they been reanalyzed as? Here, we have two options. The opaque weak verbs can be reanalyzed as having two root consonants, or they can be reanalyzed as full words, single morphemes without a root and a pattern. Here, I consider the forms to be reanalyzed as whole words, similar to the reanalysis that has occurred within the nominal system in Modern Hebrew.

The nominal system in Modern Hebrew has over 100 patterns, none of which are obligatory (see Aronoff 1993). New words are borrowed into the nominal system without adhering to any of the existing patterns, however, a verb borrowed into Hebrew, must be adapted to one of the seven verbal patterns. Claims have been made that the traditional notions of root and pattern do not apply to nouns (Bat-El 1994). These claims have been supported by morphological priming experiments in Modern Hebrew showing that nouns of the same pattern do not prime (contrary to verbs). Opaque weak verbs in Modern Hebrew appear to be similar to nouns in their inability to prime, and their stark contrast to regular verbs in Modern Hebrew. There is too little evidence for a speaker to identify the historical root consonants, and therefore any representation other than one that mimics the surface form is unmotivated.

### 5.2.2. Transparent weak verbs

Reaction times to regular verbs preceded by transparent weak verbs are inhibited. To align this result with previous literature, this means that morphological decomposition does not occur in this condition. This does not mean that there is no abstract representation. Here, I argue that this result is compatible with an analysis that supports an abstract representation, and that access to the mismatched phonological representation inhibits decompostion.

Recent studies on phonological variation support the storage of phonological representations in long-term memory (Luce et al.). Additionally, Grey et al. 2001, and Tipper 2001 show that higher order processing can inhibit other processes. This research, then, supports an analysis in which morphological decomposition (an online process) is blocked by access to long-term memory. This suggests that a phonological representation is accessed for transparent weak verbs. The difference between the transparent and opaque weak verbs is that the opaque weak verbs do not have an abstract representation, whereas the transparent forms do. It is access to this abstract form that momentarily blocks the online processing of related forms, and results in latent response times. This support for abstract representations is expected since the alternation considered is a transparent one. However, it is also important to note that speakers only have access to the final consonant less than 20 percent of the

time, and this is the number we arrive at if the speakers produce onset glottal stops 100 percent of the time. When we factor in the optional deletion of glottal stops, this number decreases. Therefore, even when the percent of words surfacing with the final root consonant in the verbal paradigm less than 20 percent, speakers can relate surface variants as a single abstract form.

#### 5.2.2.1. Interpret with caution

While the above discussion draws supports the notion of abstract representations, we must use caution when interpreting these results. While I do argue that transparent weak verbs have an abstract representation, I do not believe that this representation is purely a phonological one, or purely based on the access speakers have to hearing the final root consonant. We have to remember that the glottal stop is always written in Hebrew, and we must also note the influence schooling has on phonology. For example, Berman (1981) notes that children acquiring Hebrew confuse the transparent weak verbs with the opaque weak verbs. In fact, they use the vowel forms for the opaque weak verbs with the transparent weak verb consonants. This results in forms like *mil**i**-ti* and *mil**a*** for 'I filled' and 'he filled', respectively. Berman notes that this confusion does not go away until the children begin school. This contrasts with other generalizations children make which disappear before they attend school. We therefore can use the above results to support the notion of an abstract representation, but at this point, we are unable to attribute the abstractness to phonology alone.

## 6. Conclusion

A detailed look at weak verbs in Modern Hebrew, along with morphological priming experiments have enabled us to address the issue of abstractness and understand what kinds of evidence speakers need in order to identify surface variants of a single morpheme. The experiments show that transparent and opaque weak verbs have different effects on the recognition of regular verbs. This supports an analysis which incorporates both abstract and concrete representations based on both phonological patterns and phonology-independent factors. Additionally, word type frequency does not appear to play a role in recognition processes, as word frequency does.

In conclusion, while this study brings us closer to understanding what cues speakers use to identify relatedness, we are still far from knowing all of the factors that influence phonology, and to what extent surface patterns are recognized by speakers. Future experiments exploring different types of

variation, and the intricacies of different languages will enable to us to better model the phonological component of grammar.

## References


Aronoff, Mark. 1993. Morphology by itself: Stems and inflectional classes. Linguistic Inquiry Monograph 22. Cambridge: MIT Press.

Bat-El, Outi. 1989. Phonology and word structure in Modern Hebrew. Doctoral dissertation.

Berman, Ruth A. 1981. Regularity vs. anomaly: The acquisition of Hebrew inflectional morphology. Journal of Child Language 8:265-82.

Bermudez-Otero, Ricardo. 1999. Constraint interaction in language change: Quantity in English and Germanic. Doctoral dissertation, University of Manchester.

Bolozky, Shmuel. 1999. Measuring productivity in word formation: The case of Israeli Hebrew. Leiden: Brill.

Bybee, Joan. Phonology and language use. Cambridge: Cambridge University Press.

Deutsch, Avital; Ram Frost; Alexander Pollatsek; and Keith Rayner. 2000. Early morphological effects in word recognition in Hebrew: Evidence from parafoveal preview benefit. Language and Cognitive Processes 15:487-506.

Goldinger, Stephen. 1989. Signal detection comparisons of phonemic and phonetic priming: The flexible bias problem. Perception & Psychophysics 60.953-65.

Grey, Amy L.; Vanessa Woog; Penny L. Yee; and Kristine Santoro. 2001. Deeper processing at target selection increases the magnitude of negative priming. 28:1429-36.

Hayes, Bruce. 1999. Phonological acquisition in Optimality Theory: The early stages. Rutgers Optimality Archive 327-0699.

Hooper, Joan B. 1976. An introduction to Natural Generative Phonology. New York: Academic Press.

Luce, Paul; Connor McLennan; and Jan Charles-Luce. 2001. Abstractness and specificity in spoken word recognition: Indexical and allophonic variability in long-term repetition priming. Rethinking implicit memory, ed. by Bowers & Marsolek. Oxford: Oxford University Press.

Marslen-Wilson, W. D. 1987. Functional parallelism in spoken word recognition. Cognition 25:71-102.

McCarthy, John. 1998. Sympathy and phonological opacity. Rutgers Optimality Archive 252-0398.

Mielke, Jeff. 2001. Turkish /h/ deletion: Evidence for the interplay of perception and phonology. Paper presented at the 32nd Annual Meeting of the North East Linguistic Society.

Nathan, Geoffrey S. 1998. What functionalists can learn from formalists in phonology. Functionalism and formalism in linguistics, ed. by Darnell et al. Amsterdam: John Benjamins.

Radeau, Monique; José Morais; and Juan Segui. 1995. Phonological priming between spoken words. Journal of Experimental Psychology: Human Perception and Performance 21:1297-1311.

Rosén, Haiim. 1977. Contemporary Hebrew. The Hague: Mouton.

Schwarzwald, Ora R. 2001. Modern Hebrew. Munich: LINOCOM EUROPA.
Schwarzwald, Ora R. 1984. Analogy and the regularization in morphphonemic chages: The case of the weak verbs in Post-Biblical and Colloquial Modern Hebrew. Afroasiatic Linguistics 9:87-100.
Tipper, Stephen P. 2001. Does negative priming reflect inhibitory mechanisms? A review and integration of conflicting views. Quarterly Journal of Experimental Psychology: Human Experimental Psychology 54:321-43.
Ussishkin, Adam Panter. 2000. The emergence of fixed prosody. Doctoral dissertation, University of California at Santa Cruz.