

THE INFLUENCE OF NON-PHONETIC FACTORS ON THE FORM OF L2 LEXICAL ENTRIES: RESPONSE TO CUTLER AND WEBER

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ABSTRACT

Cutler and Weber argue that L2 lexical representations must incorporate both abstract and episodic information. In this paper, the nature of non-phonetic information that is useful to L2 learners is further explored, with a focus on orthographic and minimal pair data. It is argued this type of information is useful to L2 listeners because it provides them with an overt incentive to distinguish non-native phonemic or phonotactic categories. However, it is noted that not all phonemic categories may be equally learnable in L2 acquisition, which is a challenge for episodic models of lexical storage.

Keywords: second language, exemplar, episodic, lexical representation

1. INTRODUCTION

In their paper, Cutler and Weber argue that the lexical entries of second language (L2) learners are influenced both by episodic and abstract knowledge. To start off, it should be noted that in the context of their experimental results, the term “abstract” has a different connotation than is often used in the debate over “exemplar” versus “categorical/abstract” theories of lexical representation. Most often, “abstract” refers to representations that are independent of the acoustic properties of specific instances that the perceiver has been exposed to [e.g. 8]. Abstract models do not necessarily preclude the role of any episodic knowledge, but they crucially posit a lexical level which is independent of such information. In contrast, episodic or exemplar models generally hold that no such abstract level is necessary for lexical storage; rather, lexical entries are composed of the episodic traces of all of the utterances that a listener has experienced [e.g. 4, 6].

In discussing L2 learners, the type of abstract information that Cutler and Weber propose as affecting lexical entries is of a more “extragrammatical” sort. They specifically discuss orthography, demonstrating that when L2 learners

have knowledge of the orthographic representations of an L2 lexical item, it affects their processing of that item. Cutler and Weber [1] show, for example, that when Dutch participants, who are proficient in English, are presented with the words *panda* and *pencil* in an eye-tracking task, they are more likely to look toward the pencil when presented with *panda* than toward the panda when presented with *pencil*. That is, the participants do not treat these phonemes as interchangeable even though /æ/ is not a phoneme of Dutch and /ɛ/ is, and Dutch listeners have trouble distinguishing them. Similar results were shown by Escudero, Hayes-Harb & Mitterer [3], who demonstrated that Dutch listeners who learned new “English” words in an audio+text condition showed competition effects similar to the Dutch listeners in [1], whereas listeners receiving only audio information about the new words showed symmetrical competition effects.

Cutler and Weber argue that the asymmetry in the eyetracking tasks is due to the fact that Dutch speakers, who know that these words are spelled with different vowels, have included in their lexical entries more than just acoustic/phonetic information, and this helps them to distinguish between words with /ɛ/ or with /æ/. Indeed, the role of orthography in affecting lexical representation has also recently been documented in related areas, such as loanword adaptation. For example, Vendelin and Peperkamp [11] demonstrate that when French listeners who are proficient in English are presented with English non-words, the adaptation of the vowels in those words depends on whether they are presented in an audio-only condition, or with both audio and text information. Audio-only presentation of words that contained vowels such as [ɛ, ʌ, u] included more productions with [ø, o, o] respectively, whereas the responses in the audio-visual condition were more likely to be [ɛ, ø, u], which conform to the grapheme-to-phoneme correspondence rules often employed by French speakers of English.

2. INCENTIVIZING DISTINCTIONS

While recognition that orthography plays an important role in L2 and non-native speech perception is growing, it is unclear exactly how this type of information is used by listeners such that it assists them in distinguishing between non-native sounds, or between a native and non-native sound. For example, in the case of the Dutch listeners in Cutler and Weber [1], it is not that orthography clearly demarcates English / ϵ / and / \ae /. Though these two vowels do not appear to be entirely interchangeable for Dutch listeners, their behavior is predictable: they are biased to categorize both vowels as / ϵ /.

In terms of an Exemplar Theoretic account of vowel representation, such as that described in Pierrehumbert [10], if given only perceptual input, the collected exemplars representing / ϵ / would include the formant values for both [ϵ] and [\ae]. Yet, with the addition of orthography—and presumably having been taught that the ‘a’ of *panda* is different than the ‘e’ of *pencil*—Dutch learners of English have some incentive to begin disassociating the formant values that accompany the English / \ae / from their Dutch category of / ϵ /.

However, while the orthography is a start, it may not be sufficient to induce the L2 learners to form a whole new category that is as robust as the one established for their native language. That is, there is some evidence suggesting that unless L2 learners are taught minimal pairs that differ only in the contrast that is difficult for them to discriminate, there may be little need for them to establish a new category that would distinguish between lexical items.

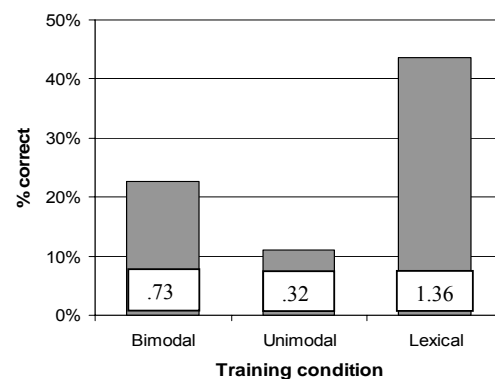
2.1. Minimal pairs affect the information stored in lexical entries

This hypothesis is initially supported by data from two studies: Hayes-Harb [5] and Davidson, Shaw and Adams [2]. Using a methodology similar to that of Maye [7], Hayes-Harb tested English learners in both statistical and lexical conditions to see whether they could learn the distinction between [g]-[k] (unaspirated [k]). For the stimuli, Hayes-Harb created a continuum of 8 tokens between [k] and [g]. The important statistical conditions for the purposes of this discussion were the unimodal condition, where listeners were presented with the midpoint of the continuum four times more often than they were presented with the endpoints, and

the bimodal condition, where two tokens near the endpoints (tokens 2 and 7) were presented four times more often than examples from the center of the continuum. In the lexical condition, tokens 2 and 7 from the continuum were paired with different pictures. Thus, listeners were given lexical evidence to demonstrate that [k] and [g] are different phonemes. Other control conditions were also carried out to ensure appropriate interpretation of the data; see Hayes-Harb [5] for details.

Following the training, listeners were presented with pairs of words and were asked to indicate whether the two items in the pair were the same word repeated twice or instances of two different words. The target-different pairs were composed of tokens 1 and 8 from the continuum. Although accuracy on target-different pairs was low overall, both the percentage correct and the d-prime scores indicate that while the bimodal group had an advantage over the unimodal group, the participants tested in the lexical condition demonstrated the greatest discrimination accuracy and the greatest sensitivity according to the d-prime measure. The results are shown in Figure 1.

Figure 1: Accuracy on target-different pairs in Hayes-Harb. The bars represent the percentage of target-different pairs that were accurately discriminated. The number in the white box is the d-prime score.



These results suggest that while the bimodal distribution provides some boost over unimodal evidence, the lexical evidence using minimal pairs is even more helpful. Like orthography, the presence of minimal pairs may give the listeners more incentive to distinguish between acoustic differences that they might otherwise collapse.

A similar situation was also reported by Davidson, Shaw and Adams [2], who examined phonotactics as opposed to phonemic categories. In the first of two picture-word learning studies,

American participants were taught 16 new words (over two blocks) that contained a phonological contrast between #CC ~ #CəC, but without the benefit of minimal pairs (e.g. *zɪmapi* and *zəmɪgu*). The stimuli were recorded by an English speaker; to create the #CC tokens, the schwa was spliced out. In the training session, participants were presented with auditory instances of target words that were paired with different cartoon characters and were told to memorize the pairings. The real learning came in the second part of the training session, where participants listened to the target words and were asked to click on the correct cartoon character presented in a display. Only once they correctly paired all target words to the right pictures without errors could they move on to the test phase.

The test was a multiple choice task in which a picture was presented either with the correct word (e.g. *zəmɪgu*) that had been learned or the phonotactically related “distracter” word (e.g. *zɪmɪgu*), and with a completely new word that the participants had never heard. They had to indicate which option was correct, or they could choose “neither” if they did not think either word they had heard was correct. In the test phase, the stimuli were spoken by a different speaker in order to examine whether participants could generalize what they had learned to a new voice.

In the second experiment, participants were taught minimal pairs. Thus, while *zəmɪgu* was paired with a cartoon of a dragon, *zɪmɪgu* was paired with a type of fish. The training session was the same in this experiment. For the test phase of this experiment, the cartoon picture was paired with both the #CC and #CəC utterances and participants had to choose the right word. Again, a different speaker was used in the test phase.

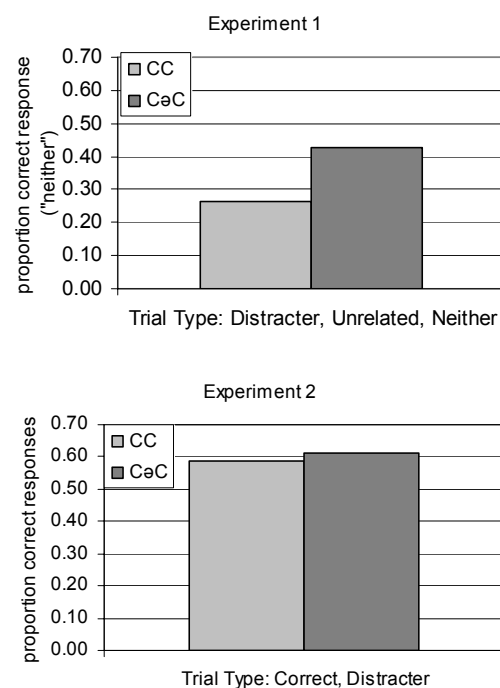
The results of the experiments are compared in Figure 2. The top graph shows the performance on the condition in Experiment 1 in which participants heard the distracter word; correct performance means that the listeners chose “neither” for these trials. The bottom graph shows performance in Experiment 2 on trials in which both #CC and #CəC options were presented. Correct performance in this condition indicates that participants matched the picture with the correct word.

These results indicate that in Experiment 1, which presented only phonotactic contrast but no minimal pairs, listeners had difficulty rejecting the distracter in trials where they had to choose between the distracter word, an unrelated word, and

a “neither” option (note that in these trials, the participants never chose the unrelated word). In addition, there is an asymmetry between words learned as #CC and words learned as #CəC; participants are more accurate on words learned as #CəC. This suggests that the phonotactically legal string may have led to the creation of a more stable lexical representation that allowed participants to more accurately recognize and reject the #CC distracters.

In Experiment 2, if the participants could not tell the difference between the two types of words, then they would have chosen either the #CC or #CəC options at a chance level. However, the proportion of correctly identified words (and therefore, correctly rejected distracters) is greater than chance, and greater than the rejection rate in Experiment 1 (note that chance is 33% for Exp. 1 and 50% for Exp. 2). These results suggest that minimal pairs encouraged the learners to pay attention to the acoustic differences between the two words, and also that they were able to generalize this discrimination to a new speaker. Furthermore, learning minimal pairs eliminated the advantage for #CəC words.

Figure 2: Correct responses on picture matching trials in Davidson et al. See the text for further explanation of the graphs. The columns represent the responses for words learned as #CC and words learned as #CəC.



2.2. Consonant vs. vowel discrimination in L2

While Hayes-Harb [5] and Davidson et al. [2] demonstrated that overt lexical distinctions provided learners with an advantage over either statistical information or simple phonological contrast for consonantal elements, Pallier, Colomé, and Sebastián-Gallés [9] essentially demonstrated that minimal pairs containing different vowels did not assist the formation of distinct vowel categories in the lexical entries of early Spanish-dominant Spanish-Catalan bilinguals. That is, in a repetition priming task, Catalan-dominant bilinguals did not show a priming effect for minimal pairs like [neta]~[neta] or [son]~[sɔn], but for Spanish dominant bilinguals there was as much priming as for repetition pairs like [son]~[son].

There are a few possible reasons for the discrepancy between these studies. First, it may be more difficult to establish distinct categories for vowels than for consonants or phonotactic sequences (and in Catalan, for example, orthographic cues cannot be used to distinguish phonemes since the same letters can be used for [e] or [ɛ]). Second, the tasks used by Hayes-Harb and Davidson et al. forced participants to attend to the distinctions being tested whereas the bilinguals may never have been specifically drilled on the difference between the vowels.

If some sounds are more resistant to category formation than others, this may be a problem for the application of Exemplar Theory to L2 acquisition. Whereas abstract models can exploit a disassociation between the processing of the acoustic input and the establishment of phonemic and lexical representation, in an Exemplar Theoretic model these are more closely aligned. If it is the case that repeated exposure to multimodal distributions of possibilities in the phonetic space should help in the formation of categories [7, 10], then there is no a priori reason that vowels should differ from consonants (though it possible that if vowels are more variable than consonants, it may be more difficult to establish a bimodal distribution). Whether exemplar models can explain such possible discrepancies in L2 acquisition remains to be seen.

3. CONCLUSIONS

While Cutler and Weber acknowledge that statistical factors certainly play a role in determining L2 lexical representations, their paper also raises the issue of what else must be factored

in. First, if extragrammatical information such as orthography, or other non-phonetic factors such as minimal pairs affect what information is encoded in a lexical entry, what model best incorporates all of these aspects? Second, if some new sounds are more capable of being categorized than others, regardless of similar statistical input characteristics, how can an episodic model account for that? Finally, do L2 learners rely more strongly on these extra-phonetic factors than child learners do? An adequate model of L2 lexical representations ultimately must address all of these issues.

4. ACKNOWLEDGMENT

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