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Semantic and phonological interference in the mental lexicon of learners of English as a foreign language and native speakers of English

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Abstract
Foreign-language learners often have difficulties in keeping similar words apart. These difficulties, which are discussed in a connectionist, activation-spreading view of the mental lexicon, seem to occur especially with words of the following categories:
(a) words which are similar in form but not in meaning, e.g. considerable/considerate, inherent/inherited;
(b) words which are similar in meaning but not in form, e.g. adjust/adapt, lawful/legal;
(c) words which are similar in both form and meaning, e.g. historic/historical, fanciful/fancy.

The aim of this investigation was to explore the extent to which English word pairs, which are similar in form, in meaning, or in form and meaning, are confused by learners of English, and, if so, whether less proficient learners, in comparison to more proficient learners, are more prone to phonological interference and less prone to semantic interference.

For the investigation of these questions, 36 English word pairs were selected, 12 in each of the three categories mentioned. One member of the word pair had to be supplied (Experiment 1, using a recall task) or selected from three or two alternatives (Experiments 2 and 3, using a recognition task). The main dependent variable was the frequency with which the other member of the word pair was supplied (recall) or selected (recognition). The tests were administered to intermediate and advanced learners of English as a foreign language, as well as to a small number of native speakers of English.

The main result of this investigation is that meaning similarity seemed to cause more interference than form similarity for advanced but not for intermediate learners. However, it is argued that this result cannot be interpreted as evidence supporting the view that the mental lexicons of intermediate and advanced foreign language learners are differently organised. It is claimed that their mental lexicons differ not in a qualitative, but only in a quantitative way.
1. Introduction

In an interesting study, Laufer (1988) draws attention to word confusion errors of the following kind:

"Russia freed their Jews from vulnerable (venerable) restrictions on marriage."

"Relations between societies are found to be impermanent and artificial (superficial)."

Laufer calls words similar in form, such as the ones confused, "synforms". As a teacher at the English Department of Haifa University, Laufer observed that many of her students, intermediate as well as advanced learners of English as a foreign language (FL), confused such words in comprehension and production. Other examples of synforms are: interested/interesting, experiment/experience, historic/historical, presumption/assumption, passion/compassion, affect/effect, live/alive, extend/extent, conscious/conscience, ingenious/ingenuous.

According to Laufer, the most difficult category of synforms is the one consisting of suffix synforms, such as interested/interesting, experiment/experience, historic/historical.

Laufer’s study is the first attempt to define, illustrate, classify and validate synformy and synform errors. In the last chapter of a monograph on synforms, Laufer (1991) presents suggestions for further research. Firstly, Laufer suggests to investigate whether semantic similarity between words induces more errors than phonological similarity. Secondly, she suggests that FL learners at different proficiency levels as well as native speakers be tested to find out whether proficiency is a factor which influences the number of errors made in the more difficult categories. These considerations motivated us to undertake an exploratory investigation of word confusions. We precede the presentation of our research questions by describing in short current models of the mental lexicon. In doing so we focus on the question as to whether these models can account for the kind of word confusions observed by Laufer, and if so, to what extent.

2. Words as constructs in the mental lexicon

What sort of conception should we form of 'words', the individual elements, in the 'mental lexicon', i.e. the memory system in which knowledge of a vast number of words, accumulated in the course of time, has been stored? A proper definition of 'word' in the mental lexicon should account for the fact that language users store information, be it more or less complete, on a wide variety of word characteristics such as: orthography, phonological structure, pronunciation, morphological structure, syntactic characteristics, as well as various sorts of semantic information (literal, idiomatic, pragmatic, and other meanings). Most theorists agree that, as it is impossible to draw a clear borderline between lexical knowledge and encyclopedic knowledge, the mental lexicon cannot be regarded as an information module stored separately from other kinds of knowledge in long-term memory (Aitchison, 1987, Levelt, 1989). Furthermore, most
theorists agree that words in the mental lexicon should not be regarded as clear-cut entities. This opinion is based on the fact that word knowledge may only be partially available. An example of this is "tip-of-the-tongue phenomenon", a speaker searching for a particular word in his/her mental lexicon. Levelt (1989: 231), however, is cautious about forming conclusions as to whether lexical retrieval takes place in one step (simultaneous availability of semantic and phonological information) or in two steps (availability of semantic information preceding phonological information).

If words are not a clear-cut entities in the mental lexicon, then, one might question, as Gümther (1989) has done, the appropriateness of the word 'lexicon' in the expression 'mental lexicon'. Gümther argues convincingly, that the metaphorical label 'lexicon' might lead to three misconceptions, (1) the impression that words are arranged in people's minds as they are in dictionaries, (2) the notion that people treat words as entities or unities, and (3) the idea that, when speakers have accessed ('looked up') a word, all its information should instantaneously be available to them. Gümther proposes instead to regard words in the mental lexicon in set theoretical terms, as constructs of more or less tightly interconnected nodes.

Since De Saussure (1916), the traditional view on words is that they constitute a unity of form and meaning, a view illustrated by comparing words with sheets of paper or coins, whose two sides are inseparable. However, as Gümther points out, this view is not entirely compatible with a set theoretical approach. Information about the form of a word may be separated from that of its meaning, momentarily or even permanently. Simultaneous availability of form and meaning may not always be at speakers' disposal. It is also possible that they may know a word form but not be familiar with its meaning; they may even have invented a concept but not have a word form for it.

It has become customary to envisage the mental lexicon as a network of more or less tightly interconnected nodes. Some subsets of these nodes correspond to the traditional concept of word. Words can be linked to other words on a variety of grammatical ("formal") dimensions, such as spelling, pronunciation, phonology, morphology or syntax, as well as on a variety of semantic dimensions. It should be noted, however, that the distinction made between these two groups of dimensions and the subsequent categorization of the mental lexicon into two kinds of storage, formal and semantic, should not be regarded as absolute (Levelt, 1989: 187-188), since the relationship between forms and meanings in a language need not always be of an arbitrary nature (e.g. gender, in French, has both a grammatical and semantic function).

The linkage between two words in an individual's mental lexicon may originate from their co-occurrence in samples of oral or written language use, encountered by the individual. Thus contiguity of occurrence in the language learner's input may result in word associations of a syntagmatic nature ('drink' - 'milk'), and some of these syntagmatic relations may, if frequently made, turn into paradigmatic word relations ('milk' - 'juice' - 'tea' - 'wine'). It has been suggested that Tulving's (1972) well-known
distinction between episodic memory (recollections of specific events) and semantic memory (the linkage between abstract semantic features, such as 'drinkable' and 'beverage', shared by words such as 'milk', 'juice', 'tea', and 'wine') should not be considered as referring to two separate memory stores, but to two developmental stages of association between elements in the same store. Episodic verbal links may, therefore, develop into semantic links. In other words, the representation of a word's semantic information is the sum (or highest common factor) of a large number of episodic representations (Wolters & van der Heyden, 1989:180). A complementary theory holds that the representation of an episode consists of a great number of semantic representations (Anderson, 1976). Both views, however, converge on the claim that episodic and semantic memory should not be seen as entirely separate stores.

A connectionist, non-modular view of the mental lexicon, as represented for instance by Aitchison (1987), which perceives words as featural constructs assembled from a variety of formal and semantic features, forming the links with a great number of other words, may be particularly relevant to our understanding of the mental representation of foreign language words. According to the connectionist view, much of the debate on the number and nature of a bilingual's lexical stores has become irrelevant (De Bot, 1992). The connectionist view postulates a single lexical store for the words in a bilingual's mothertongue (L1) and foreign language (FL). This implies that access to a FL word form may take place in a direct way, in that the concept is linked to the FL word form immediately, or in an indirect way, in that the concept is linked to the L1 word form first, which is then linked to the FL word form. For many learners of a foreign language, especially those in the beginning stages, lexical access often takes place indirectly, via L1. Increasing exposure to the FL, however, strengthens the connections between concept and FL word and gradually allows direct access to the FL word form. Thus, the connectionist view nicely reflects the feeling of most FL learners, that some FL words offer themselves immediately when needed, whereas other FL words, especially words encountered on an infrequent basis, can only be remembered via "translation of the L1 word".

3. A connectionist account of phonological and semantic interference

Connectionist models of the mental lexicon, and corresponding explanations of word recognition and word retrieval processes in terms of activation-spreading among related network nodes, can serve to clarify all kinds of intrusions which occur during the word finding process, and induce a wide variety of speech errors (Levelt, 1989, Ch.6), as well as the kinds of production errors FL learners make. Thus, the synform errors Laufer (1988) observed in FL learners, as well as the malapropisms, (misuse of a word, in mistake for one that resembles it, causing amusement) native speakers produce, can be seen as resulting from the intrusion of phonological (i.e. formal) features of other lexical items (Levelt, 1989:
Note that synform errors, malapropisms, and other word form errors are usually made unintentionally (though this is sometimes not the case with malapropisms). We assume that such errors are caused by ignorance of the exact relationships between the two forms and their respective meanings. Take, for instance, the child who has come across the words 'continent' and 'component' a few times, but has not yet established firm relationships between the two word forms and their respective meanings. In trying to remember the word for the kind of glue consisting of two substances, this child could come up with the word form 'two continent glue' rather than 'two component glue'. In terms of memory research, where a distinction is made between recognition tasks and recall tasks, the child would be described as being able to recognize both word forms, but only able to recall one ('continent'). In a similar vein, it could be argued that the FL learner who produced the mistake quoted at the beginning of this article, may have had imprecise knowledge of the words 'vulnerable' and 'venerable'. However, since the meaning-form links had not yet been firmly established in her/his mental lexicon, the word form 'vulnerable' may have offered itself as a candidate sooner than, or even instead of, the word form 'venerable', when (s)he wanted to express the message 'deserving respect'. This can be considered a case of formal (phonological) interference.

Another class of mistakes, not mentioned by Laufer, consists of confusion of words similar in meaning but not in form. For instance, a language user may have come across the words 'legal' and 'lawful' a few times. Not yet being able to tell exactly their meaning differences, (s)he may use 'legal' to mean 'lawful' (or vice-versa): a case of semantic interference.

Finally, the language user unsure as to the precise meaning of 'historic' and 'historical', though somewhat familiar with both words, may confuse the two. Since 'historic' and 'historical' are related in form as well as in meaning, this mistake may constitute a case of either phonological or semantic interference.

4. Research questions and research design

As was mentioned in the introduction, Laufer calls for further research in order to find out whether synform errors of the historic/historical type are caused by phonological or semantic interference. This suggestion motivated us to conduct an exploratory study on this question. Instead of collecting and analyzing natural language production data, as Laufer did, we chose to elicit word confusion errors systematically by means of tests. We aimed at eliciting word confusion errors which arise in the scenario described in the previous section. In this scenario, the test taker is vaguely acquainted with two words, which are related to each other phonologically and/or semantically, but has not yet established firm form-meaning relationships for each word separately in his/her mental lexicon. Therefore, when confronted with a situation in which one word is required, the other word is likely to present itself as a candidate sooner than, or instead of, the required word,
thereby creating an instance of interference.
We elicited confusion errors from three types of word pairs:
1. Words similar both in form and meaning (F+M+), e.g. historical/historic, use/usage.
2. Words similar in form only (F+M-), e.g. considerable/considerate, physician/physicist.
3. Words similar in meaning only (F-M+), e.g. affluence/abundance, lawful/legal.
For each category, we selected twelve word pairs. Word confusion errors were elicited with two types of tasks, a cued recall task (fill-in test) and a recognition task (multiple-choice test). Each test consisted of 36 items, each of which offering the possibility to make a word confusion error. Our first research question was:

**Question 1.** Are confusions between words similar in form and similar in meaning (historic/historical) caused primarily by form similarity or by meaning similarity?

In order to answer this question, we compared the incidence of word confusion errors in each of the three categories.

As was said in the introduction, Laufer (1988) suggested that FL learners at different proficiency levels as well as native speakers could be tested to see whether proficiency is a factor which influences the number of errors in difficult categories. She refers to studies on the arrangement of items relative to each other in the mental lexicon (Hatch, 1983; Meara, 1984). According to Laufer, these studies indicate that while there are strong semantic links between lexical items in the native speaker’s lexicon, in the mental lexicon of the FL learner these semantic links are much weaker, and the organization is primarily phonological (see also Laufer, 1990). However, we believe that the findings of the word association studies conducted by Meara (1984) and Söderman (1989) and the word recognition study conducted by Henning (1973), which tested FL learners of different levels of L2 proficiency, need not be explained in terms of different organizations of the mental lexicon. The fact that, in Meara’s study, less proficient FL learners appeared to make fewer semantic and more phonological associations than more proficient FL learners (Meara does not report any figures), could also be explained as resulting from the fact that they had smaller vocabularies: they may not have been familiar with the meaning of the stimulus words, or may not have had any semantically related FL words in their vocabularies, in which case, they simply could not have responded semantically even if they had wanted to. Like Meara, Söderman (1989) found that less proficient EFL learners responded with fewer semantic and more phonological associations than more proficient learners. However, Söderman does not conclude from this that there is a fundamental developmental shift in the organization of their vocabularies. We will return to Söderman’s view in the discussion.

In Henning’s study, learners of English as a second language (ESL) listened to several paragraphs of English text, after which they were given a word recognition test. Each test item consisted of the correct word, which
had appeared in the text heard, along with three distractor words, a phonologically related word, a semantically related word, and a non-related word. Less proficient ESL learners gave more phonologically related and fewer semantically related responses than more proficient learners. We believe that this may have resulted from the fact that the less proficient learners were less proficient in listening comprehension, and had understood and comprehended the text less thoroughly. If they had not comprehended the text, there would have been no reason to respond with a semantically related distractor word. Therefore, even though this study showed differences between less and more proficient learners in terms of their responses, it does not necessarily provide evidence that their mental lexicons were organized differently.

The issue of a possible shift in the organization of FL words in the mental lexicon of more and less proficient FL learners, called, we believed, for a verification in the domain of synformic confusions, and led us to formulate the following complementary research questions:

**Question 2A.** Are less proficient FL learners more prone to phonological interference than more proficient FL learners?

**Question 2B.** Are more proficient FL learners more prone to semantic interference than less proficient learners?

In order to study the second question, we compared the frequency of confusions of each word pair category, among three groups of subjects: (1) native speakers of English, (2) advanced EFL learners, and (3) intermediate EFL learners.

There are several reasons why we consider our study as an exploratory rather than a hypothesis-testing study. First, it is impossible to measure objectively the distance in form or meaning between two words. Furthermore, it cannot be taken for granted that the 24 (i.e. 12 x 2) target words, in each of the three categories posed equal difficulties for each test taker. Finally, it should be borne in mind that, although the responses elicited in written fill-in and multiple-choice tests tell us something about the product of information processing, they do not tell us anything about the online processing of information. That is, our scenario of how interference errors may arise may well be only one of many scenarios, and the responses elicited with our experimental tasks do not permit us to distinguish between them. For these reasons, we consider our study as an initial exploration to assess the relative weights of phonological and semantic interference in word pairs.

We set up three small experiments, differing slightly in design, materials and procedures. We report on these experiments in the following three sections. The results of all three experiments are discussed in the final section.
5. Experiment 1

**Target words and test sentences.** We chose 36 word pairs, 12 in each of three categories (see Appendix 1). For each word we constructed a verbal context, consisting of a carrier sentence. For 36 word pairs, this amounted to the construction of 72 carrier sentences. We then made two parallel versions, A and B, for the fill-in task, such that of each word pair, one member figured in version A and one member in version B. This resulted in two fill-in tests, each consisting of 36 items, i.e. three sets of 12 items (from the three word pair categories), arranged in random order.

**Task.** We decided to approach this investigation of interference from the perspective of the language speaker/writer, that is language production, rather than from the perspective of the language reader/listener. We purported to simulate the word-finding process of speakers/writers who want to express a certain concept or meaning and start searching in their memory in order to retrieve the appropriate word. To simulate this process, we chose the following cued-recall test, using a written fill-in format. The test provides the test taker with four cues for the target word: (1) a context, consisting of one or two sentences, (2) the first letter of the target word, (3) the word class indicated by a N, V, or A in parentheses, and (4) a paraphrase of the target word’s meaning.

The following two examples, taken from versions A and B of this fill-in task respectively, illustrate the format of this test:

A. Don’t underestimate these small revolutionary groups. What we are talking about was a h......... (A) change and these people played a major part in it.
   (important events with great influence over the years)

B. At first people believed the newly discovered papers, allegedly written by Chaucer, false but later they proved to be autographs and manuscripts of h......... (A) interest.
   (concerned with the events of the past)

With this elicitation procedure, there are four types of responses:
1. Correct response, correct target (e.g. 'historic', in item A).
2. Incorrect response, the "counterpart" ('historical').
3. Incorrect response, not the counterpart, (e.g. 'huge').
4. No response.

Obviously, we were primarily interested in the frequency of counterpart responses, indicative of the incidence of interference.

**Design.** We administered the A and B versions of the fill-in task to two groups of advanced EFL learners, 33 and 34 students respectively studying English as their major subject in English departments of six universities in
the Netherlands. We also administered both versions of the fill-in task to a group of 13 native speakers, students from a British university, studying at the Vrije Universiteit in Amsterdam, in the framework of a student exchange program. These 13 individuals completed the A version first, and then the B version.

Results. Table 1 gives the mean counterpart scores, averaged over the A and B versions of the task, for the advanced EFL learners and the native speakers. Since the N-sizes per group differ, the results are given in percentages. Thus, for instance, 10.6\% means that subjects had filled in the counterpart word in 1.27 out of the 12 items in the F+M+ condition.

<table>
<thead>
<tr>
<th></th>
<th>Advanced L2 learners (N = 33 + 34)</th>
<th>Native Speakers (N = 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Form+ Meaning+]</td>
<td>10.6</td>
<td>9.6</td>
</tr>
<tr>
<td>[Form+ Meaning-]</td>
<td>3.1</td>
<td>2.6</td>
</tr>
<tr>
<td>[Form- Meaning+]</td>
<td>13.8</td>
<td>13.1</td>
</tr>
</tbody>
</table>

Table 1
Fill-in Test
Counterpart Scores in %

On the counterpart responses of the advanced EFL learners and of the native speakers, separate multivariate analyses of variance (MANOVA) were conducted, with Version (A and B) and Condition (F+M+, F+M-, and F-M+) as the independent variables. Version was a between-subject factor in the former and a within-subject factor in the latter analysis. Condition was a within-subject factor in both analyses. Both analyses yielded a significant Condition effect. These analyses were followed up by correlated t-tests. For both the advanced EFL learners and the native speakers, the incidence of interference in the F+M- condition (3\% and 2.6\%) was significantly lower than in the F+M+ condition, and interference in the F+M+ condition was significantly lower than in the F-M+ condition.
6. Experiment 2

**Target words and test sentences.** The same target words and test sentences were used as in Experiment 1.

**Task.** For this experiment, we chose a recognition task, using a multiple-choice format. With this task, we wanted to simulate the situation in which various competing words are simultaneously activated. The items provided three alternative words for competition: the correct target word, its incorrect counterpart, and another incorrect distractor. This second distractor, sometimes a somewhat uncommon word (e.g. 'historiated' in the example below), was related to the correct target and the incorrect counterpart words phonologically but not semantically in the F+M+ and F+M- conditions, and semantically but not phonologically in the F-M+ condition. The following two examples, taken from versions A and B of this multiple-choice task, illustrate the format of this test:

A. Don't underestimate these small revolutionary groups. What we are talking about was a .......... change and these people played a major part in it.
A. historiated
B. historic
C. historical

B. At first people believed the newly discovered papers, allegedly written by Chaucer, false but later they proved to be autographs and manuscripts of .......... interest.
A. historiated
B. historic
C. historical

As in Experiment 1, we were primarily interested in the frequency of counterpart responses, evidence of interference, e.g. the incidence of 'historical' in the A example and 'historic' in the B example.

**Design.** We administered the A and B versions of this Multiple-choice task to 23 and 25 of the advanced EFL students, who had previously performed the B and A versions respectively of the Fill-in task in Experiment 1.

**Results.** Table 2 gives the percentages of counterpart scores, averaged over the A and B version of the multiple-choice task.
A MANOVA (Version x Condition) yielded a significant Condition effect. The results of subsequent correlated t-tests was that counterparts were chosen significantly less often in the F+M- condition than in the F-M+ condition, and significantly less often in the F-M+ condition than in the F+M+ condition. Thus, the results of Experiment 1 and 2, using recall and recognition tasks respectively, are identical in that phonological interference (F+M-) occurred least often, but they differ in the relative amounts of interference in the F+M+ and F-M+ conditions.

7. Experiment 3

**Target words and test sentences.** The same target words and test sentences were used as in Experiments 1 and 2.

**Task.** For this experiment, we used the multiple-choice task of Experiment 2. However, the task differed from that in Experiment 2 in two ways. Firstly, we limited the number of alternatives to two: the correct target word and its incorrect counterpart. Secondly, subjects not only had to choose from the two alternative word forms, but they also had to indicate how certain they were about their choice. We reasoned that even if subjects were to choose the correct response, they might have arrived at their choice only after having suffered from interference, experiencing the counterpart word as extremely attractive. Obviously, such interference experiences cannot be inferred on the basis of the response itself. We therefore required subjects to indicate how certain they were about their choices. This gave us the opportunity to assess the amount of interference experienced by subjects, independently of their actual word choices. The following two examples, taken from versions A and B of this multiple-choice task, illustrate the format of this test:
A. Don't underestimate these small revolutionary groups. What we are talking about was a ......... change and these people played a major part in it.
A. historic
B. historical
How certain are you about your choice?
A. very certain
B. reasonably certain
C. not so certain

B. At first people believed the newly discovered papers, allegedly written by Chaucer, false but later they proved to be autographs and manuscripts of .......... interest.
A. historic
B. historical
How certain are you about your choice?
A. very certain
B. reasonably certain
C. not so certain

**Design.** Our second research question requires the testing of subjects of different proficiency levels. The fill-in task (Experiment 1) had been administered to advanced EFL learners and native speakers only. A pilot test demonstrated that the fill-in task was far too difficult for less proficient EFL learners than university students. The multiple-choice test, however, being a recognition rather than a recall test, was not too difficult for less proficient EFL learners. This test could successfully be administered to grade 11 students, Dutch students in their fifth year of secondary school, having had five years of EFL instruction. We will label these subjects 'intermediate' EFL learners. Half of these students first did the A version and then the B version, half of them did the B version first and then the A version. The multiple-choice task in this experiment was also administered to 39 advanced EFL learners (university students, as in Experiments 1 and 2) and to 10 native speakers. The 10 native speakers in this experiment belonged to the group of 13 native speakers who had participated in Experiment 1, four weeks earlier.

**Results.** Table 3 shows the counterpart responses across conditions and subject groups. On the counterpart responses of the intermediate EFL students a MANOVA was conducted, with two within-subject factors: Order (A before B, and B before A) and Condition. This analysis yielded a significant Condition effect. Subsequent correlated t-tests showed that, while counterpart responses in the F+M+ and F+M- conditions did not differ significantly, responses in the F+M+ and F-M+ and in the F+M- and F-M+ conditions did. MANOVA tests on the counterpart responses of the advanced EFL learners and the native speakers both yielded a significant Condition
Condition effect. Subsequent correlated t-tests yielded significant differences between all three pairs of conditions for both groups, except for the difference between F+M+ and F-M+ of the native speakers (19% and 11%), which was only borderline significant (p = .054).

Naturally, the intermediate students made more errors than the advanced EFL learners. More interestingly, there is a striking difference in the pattern of error percentages across conditions between the intermediate learners on the one hand and the advanced EFL learners and native speakers on the other. For the latter groups, it was again the F+M- condition, as in Experiments 1 and 2, which yielded the lowest level of interference. For the former group, however, this is not the case: all three conditions affected interference in roughly the same degree, resulting in counterpart scores from 31% to 38%.

Table 3
Two-choice Multiple Choice Test
Counterpart choices in %

<table>
<thead>
<tr>
<th></th>
<th>[Form+ Meaning+]</th>
<th>[Form+ Meaning-]</th>
<th>[Form- Meaning+]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EFL learners</td>
<td>38</td>
<td>35</td>
<td>31</td>
</tr>
<tr>
<td>(N = 61)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
<td></td>
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<tr>
<td>EFL learners</td>
<td>24</td>
<td>9</td>
<td>16</td>
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<tr>
<td>(N = 39)</td>
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</tr>
<tr>
<td>Native Speakers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 10)</td>
<td>19</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 4 shows the results of the other dependent measure in this experiment, the certainty ratings. Not surprisingly, there is a difference between subject groups with respect to response certainty: the intermediate EFL learners felt least certain, the native speakers felt most certain about their responses, the advanced EFL learners occupying a position in between. An examination of only the C ratings learns that advanced EFL learners and native speakers felt more often "not so certain" about their responses in the F+M+ condition than in the two other conditions, whereas intermediate EFL learners felt "not so certain" in all three conditions equally often. However, this difference between advanced EFL learners and native speakers on the one hand, and intermediate EFL learners on the other was not statistically significant. Nine 3 x 3 Chi-square tests were performed, three Condition x Category tests, for each subject group separately, and
three Group x Condition tests, for each category separately, but none of these tests yielded a significant Chi-square value. Thus, the three subject groups did not differ significantly on the question of to what extent they felt very certain /reasonably certain / not so certain about their responses, between conditions. Thus, the most important result from this measure is that the certainty ratings reflected the proficiency differences between the subject groups: intermediate EFL learners simply new fewer words than subjects in the other groups, and therefore responded less often with "very certain" or "reasonably certain" in all three conditions alike. This was not the case with the advanced EFL learners and the native speakers. They felt most certain in the F+M-condition (Table 4), the condition in which they made fewest errors (Table 3).

Table 4
Two-choice Multiple Choice Test
Certainty Ratings in %

<table>
<thead>
<tr>
<th></th>
<th>[Form+ Meaning+]</th>
<th>[Form+ Meaning-]</th>
<th>[Form- Meaning+]</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Intermediate</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>FL learners</td>
<td>33</td>
<td>46</td>
<td>21</td>
</tr>
<tr>
<td>(N = 61)</td>
<td></td>
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<td></td>
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<tr>
<td>Advanced</td>
<td></td>
<td></td>
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<tr>
<td>FL learners</td>
<td>54</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>(N = 39)</td>
<td></td>
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<td></td>
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<tr>
<td>Native</td>
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<tr>
<td>Speakers</td>
<td>59</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td>(N = 10)</td>
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<tr>
<td>A =  &quot;very certain&quot;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B =  &quot;reasonably certain&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C =  &quot;not so certain&quot;</td>
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14
8. Discussion

In this section we will first discuss the results pertaining to research question 1, and then the results pertaining to question 2.

**Question 1.** For the Advanced EFL learners and the native speakers, the results of Experiment 1, using a cued-recall task, and of Experiments 2 and 3, using a recognition task, can be summarized as follows (see Table 1, 2 and 3). In the second condition (Form+ Meaning-), purely phonological interference seldom occurred. The frequency of counterpart responses in the two other conditions is much higher. The frequency of counterpart responses in the first condition (Form+ Meaning+) is a little higher (in the recognition tasks in Experiments 2 and 3) or a little lower (in the recall task in Experiment 1) than in the third condition (Form- Meaning+). Since the nature of this study is exploratory, no strong conclusions can be based on these results. Yet these data suggest that the causes for counterpart choices in the first condition (F+M+) are due more often to the semantic than to the phonological similarity of the two words making up the word pair. Thus, it is likely that confusions between 'historic' and 'historical' are due to the fact that they have similar meanings rather than to the fact that they have similar forms.

This interpretation is well in accordance with retrieval processes in normal speech production situations. In normal speech production situations, speakers search for words that fit in the discourse context, i.e. they search for words that meet semantic rather than phonological requirements. If this interpretation is correct, it could be concluded that the counterpart responses in the first condition (e.g. historical for historic) are due to their semantic resemblance to the target word rather than to their phonological resemblance.

**Question 2.** The pattern of word confusion errors across conditions differed remarkably between the intermediate FL learners on the one hand, and the advanced EFL learners and native speakers on the other (Experiment 3, Table 3). Whereas the latter two groups made very few phonological confusions, the former group had equal error rates in all three conditions. Note that, in contrast of what one might have expected on the basis of Laufer’s suggestion mentioned in the introduction, intermediate FL learners did not make more errors in the F+M- than in the F-M+ condition, but that the mean number of errors was about the same in all three conditions. Our explanation of this finding runs as follows.

The differences between advanced and intermediate EFL learners, in the context of this task, are twofold. First of all, advanced learners know more words. That is, they know more word forms and their corresponding meanings. Secondly, however, their word knowledge is richer. That is, for many word forms, they know more about what these forms mean and in which contexts they can or cannot be used. Since, for many words, such as
the ones used in these experiments, it takes more time to acquire complete semantic knowledge than complete formal knowledge, the advanced learners and native speakers suffer more from semantic than from phonological interference. This explains the lower percentages of counterpart scores and higher percentages of certainty ratings for these two groups in the second condition, in comparison to the first and third condition.

Less proficient learners, in comparison to more proficient learners, know fewer words in the test and are thus more susceptible to choosing the counterpart in all three conditions. Among less proficient learners there will therefore be less room for differences between conditions. This is a consequence of the artificial nature of the recognition task.

9. Conclusions
As was stated earlier, we consider this investigation an exploratory study. The results, therefore, do not constitute hard evidence concerning the question of whether lexical confusions of the historic/historical type is caused by phonological or semantic interference. However, we believe that the results do suggest that confusions between words similar in form and meaning (historic/historical) is primarily a matter of semantic uncertainty as to the precise semantic boundaries between the two words. This may be partly due to incomplete encyclopedic knowledge ("knowledge of the world"). For example, even some native speakers in this study apparently did not know the difference between 'legal' and 'lawful' (in the F-M+ condition). On the basis of our results it cannot be ruled out that phonological interference in the F+M+ condition did play a role in some instances, but our hypothesis, based on this exploratory study, is that phonological interference only plays a limited role in language production. There are two reasons for this. First, in normal language-production situations, speakers' primary goal is to search their memory for words which fit the discourse context, meeting semantic rather than phonological requirements. Second, learning all the semantic features of a lexical item, may require much more time than to learn the word's formal properties. Learners will therefore continue to suffer from uncertainty as to a word's precise meaning long after their uncertainty concerning its form has ceased to exist.

Our answer to the second question of whether less proficient learners, in comparison to more proficient learners, are more prone to phonological and less prone to semantic interference, is affirmative. However, the conclusion from this cannot be that the items in the mental lexicons of less and more proficient language users are differently organised, as suggested by Laufer, following Henning (1973) and Meara (1984). Instead, we agree with Söderman's conclusion from these findings: "The lexicon of a language learner never changes as a whole at a specific level of proficiency. It is always a slow process affecting the individual words being or to be incorporated in the lexicon" (Söderman, 1989, p. 119/120).
The difference between language users of different proficiency levels is primarily not a qualitative but a quantitative difference. The higher frequency of phonological interference among less proficient learners, in comparison to more proficient learners, may appear at first sight indicative of a qualitative difference in the organization of the mental lexicon, but in reality it is the consequence of their smaller vocabulary. They do not encode information about new words in a fundamentally different way than more proficient learners do. For most words in a language, there is less to acquire in terms of formal word characteristics than in terms of semantic word characteristics. In addition, for many new words to be acquired, especially words with abstract meanings, such as the ones figuring in Laufer's study and the present study, it will take more time to acquire their semantic than their formal features. This is equally true for both less and more proficient learners. Hence, for such newly-learned abstract words, the likelihood of semantic interference will persist longer than the likelihood of phonological interference. That explains why advanced learners and native speakers in these experiments were more susceptible to semantic interference than to phonological interference. The fact that the intermediate learners showed proportionally more phonological interference than the advanced learners and the native speakers may be merely the consequence of their having a smaller vocabulary. Our conclusion is therefore that in this study no evidence was found for a qualitative difference in the organization of the mental lexicon of learners at different proficiency levels. The decoding and encoding processes among learners of different proficiency levels are identical.

Notes
1. An important part of this investigation was carried out by the second author, in the framework of her Master's thesis, supervised by the first author.
2. Incidentally, it should be noted that loose conceptions of connectionism, in which any node may activate any other node without restriction, run the risk of becoming unfalsifiable. A model which 'accounts' for all existing phenomena may degenerate into a metaphorical description of these phenomena. It may then become too powerful in the sense that it will also account for non-existent phenomena, thereby losing much of its explanatory force.
3. Copies of all testing materials used in this study can be obtained from the first author, whose address is: Applied Linguistics Department, Vrije Universiteit Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam NL.
4. A detailed report of the statistical analyses may be obtained from the first author, whose address is given in note 3.
References


Appendix

The 36 word pairs

**Condition 1: [Form+ Meaning+]**
- disposition, disposal
- economical, economic
- fanciful, fancy
- historic, historical
- imaginative, imaginary
- literary, literate
- lodge, lodging
- policy, politics
- practical, practicable
- proposition, proposal
- social, sociable
- use, usage

**Condition 2: [Form+ Meaning-]**
- adulthood, adultery
- comprehensible, comprehensive
- considerable, considerate
- capable, capacious
- exacting, exact
- front, frontier
- hardship, hardness
- industrious, industrial
- inherent, inherited
- objective, objectionable
- physician, phycisist
- sensuous, sensible

**Condition 3: [Form- Meaning+]**
- adjust, adapted
- affluence, abundance
- include, involve
- last, latter
- lawful, legal
- matrimony, marriage
- medium, moderate
- part, piece
- partiality, prejudice
- rational, responsible
- suggest, suppose
- teaching, tuition