CROSS-LINGUISTIC INFLUENCE ON MORPHOLOGY IN THE BILINGUAL MENTAL LEXICON

Wander Lowie

Abstract. This article addresses the question if and, if so, how the acquisition and use of morphology in the second language is affected by L1 morphology. This issue is discussed in relation to a recent interdisciplinary model of the bilingual mental lexicon (Lowie 1998), in which affixes may have independent representations, conditioned by transparency, productivity and frequency. L1 influence, operationalised as the amount of semantic overlap between an L1 affix and an L2 affix and developmental factors (the productivity of L2 affixes) were included in an experiment involving Dutch learners of English. The results show a strong effect of cross-linguistic influence at all levels of proficiency and an effect of productivity only at the highest level of proficiency.

1. Introduction

In the acquisition of the morphology of a second language, it can be expected that the learner is guided by the system that he or she has already acquired, i.e. the morphology of the learner’s first language. If a Dutch learner of English, for instance, learns the affix -able, he or she may benefit from the fact that this affix has much in common with the Dutch affix -baar. The overlap between these affixes is both syntactic (both form adjectives based on transitive verbs) and semantic (the meaning of both affixes is ‘that can be V-ed’). On the other hand, there may be affixes in L2 that show only minimal or no overlap with an L1 affix and which may confuse rather than help the learner. This paper addresses the question if and, if so, to what extent L2 learners are guided by the perceived overlap between affixes in L1 and L2 relative to other factors, like the productivity of an L2 affix. The framework of this discussion is a model of the role of morphology in the bilingual mental lexicon recently proposed (Lowie 1998). The model is interdisciplinary in nature: it is based on converging evidence from studies on the (bilingual) mental lexicon, morphological theory and L1 acquisition. This paper will briefly outline this model, concentrating on cross-linguistic influence, and will then discuss an experiment in which the role of the overlap between L1 and L2 affixes is the central variable.

2. Morphological types

A recurring issue related to morphology in the mental lexicon is the way morphologically complex words are dealt with. Are affixes and stems...
‘stored’ independently or do morphologically complex words have their own entries? Most contemporary linguists will agree that the two approaches are not mutually exclusive and that this question itself is an oversimplification of the issue. It is now generally accepted that both the composition and storage of morphologically complex words are possible and that the two possibilities are even applied simultaneously in a model of parallel processing. The element that is essential to morphological compositionality is the affix. In recent proposals on the role of morphology in the mental lexicon (Schreuder & Baayen 1995; Lowie 1998), affixes themselves are assumed to have independent representations, which are called ‘morphological types’. Similar to all other lexical entries, morphological types ‘contain’ syntactic and semantic information and refer to information about phonological and orthographical characteristics. This is graphically represented in Figure 1.

The introduction of morphological types and parallel access to the mental lexicon raises another question: how can it be determined or predicted when a word is stored and retrieved as unified elements or when a word is composed on the basis of a morphological type? The answer to this question must be found in a combination of three strongly interrelated factors: transparency, frequency and productivity. In the current framework, the combination of these factors determines the ‘activation level’ of a morphological type. The assumption underlying the activation metaphor is that representations in the mental lexicon with a higher level of activation will be selected faster and more often than representations that have a lower level of activation.

The level of activation is primarily determined by the frequency of a lexical representation. A frequently occurring word will have a higher level of activation than a word that is scarcely used. Applied to morphological types, two different sorts of frequency must be distinguished: item frequency and type frequency. The item frequency of a morphologically complex word is the frequency of the entire word. The type frequency is the frequency of the morphological type. By means of the mechanism of ‘activation feedback’ (see Schreuder & Baayen 1995), it can be predicted that a high item frequency will result in a higher degree of activation for the morphological type. Therefore, for a morphological type to gain an independent entry in the lexicon, the affix has to occur with many different stems. The degree to which a morphological type occurs with different stems (the ratio of type frequency to item frequency) can be regarded as a measure of the productivity of that type (for a related definition of productivity, see Baayen 1989). In other words, whether morphological types have an independent representation in the lexicon is dependent on their productivity. In this, transparency must be seen as a condition to morphological productivity: if a morphologically complex word is not transparent, there can never be a compositional interpretation.
3. Second language acquisition, morphology and cross-linguistic influence

Focusing on second language acquisition\(^1\), the model briefly sketched above requires a number of adjustments. The first adjustment concerns the information attached to the lexical representation in the mental lexicon. The starting point is a model of the mental lexicon in which each entry (words and morphological types) is linked to syntactic and semantic information. In case of the bilingual mental lexicon, an additional link has to be postulated to the language to which the entry belongs. This situation is sketched in Figure 1. All the entries belonging to the same language can be considered a ‘subset’ of the lexicon. An extra-lexical language selector increases the activation level of all the elements of the subset.

The second adjustment is that the model has to be able to account for the acquisition of the lexicon. Studies of the acquisition of morphology in the first language have convincingly shown that transparency is a key factor in acquiring morphology (see Clark 1993). Transparency can be interpreted in two ways: as the maximum, inherent, transparency of a

\(^1\) No distinction is made here between second language acquisition and foreign language learning. Although this distinction may be very relevant in other situations, the current model is claimed to cover both situations.
morphologically complex word \textit{(seldom, random and condom simply cannot be interpreted transparently in the way kingdom can)} and as the transparency of a word for a particular person at a particular moment in time. The latter interpretation is what Lowie (1998) has labelled ‘psychotransparency’. Psychotransparency is particularly relevant for learners, as learning morphology can be regarded as a process of the gradual discovery of productivity. Transparency, being a condition to productivity, is essential in this process.

In second language acquisition an additional complicating factor is that the learner has already acquired a set of lexical entries. An important question with regard to this type of learning is therefore if and, if so, how the established morphological types affect the acquisition of morphological types in the second language. In other words: where does cross-linguistic influence come in? In the current model, cross-linguistic influence can be expected to affect the acquisition of L2 morphological types at two levels. First, it can be expected to occur on the left-hand side of the model, at the end of the phonological/orthographic representations. Orthographic and phonological similarity to L1 morphological types may affect the psychotransparency of morphologically complex words in L2. This effect may be facilitating in the case of cognates but can be confusing when formal similarity does not coincide with semantic similarity (Lowie 1991). Second, cross-linguistic influence can be expected to occur at the level of the degree of semantic overlap between items or types in different languages. Most bilinguals will share the experience that the meaning of words in different languages may come very close, but will hardly ever fully overlap. This observation holds for words as well as for morphological types. The degree to which morphological types in the first and the second language overlap is what I have defined as ‘morphological translation equivalence’. It is the latter type of cross-linguistic influence that was the object of an experiment investigating the role of translation equivalence and productivity for Dutch learners of English.

4. An experiment

In a study investigating the role of cross-linguistic influence in different stages of the acquisition of L2 morphology, translation equivalence was considered as the key influence of the learner’s mother tongue. Items and types that have a high relative degree of translation equivalence can be expected to be acquired sooner and more fully developed than items with a low degree of translation equivalence. Translation equivalence was used as a within-subjects variable: scores were obtained for all subjects, at both levels.

The second independent within-subjects variable was productivity. The learners’ hypotheses about the productivity of a morphological type in L2 can only be formulated on the basis of L2 input. Learners will notice the
type-item frequencies and can only draw conclusions about morphological productivity on the basis of this. L2 productivity is therefore seen in this study as a ‘developmental factor’, as opposed to translation equivalence, which is seen as a cross-linguistic factor.

The third within-subjects variable refers to two different tasks: a translation task and a gap-filling task. The reason to include the two different tasks was to determine a possible difference in the language context. In the translation task, the learners were exposed to maximum interference, whereas the gap-filling task was set up without any reference to the learners’ native language. This fact was therefore labelled ‘context’.

The between-subject independent variable in this study was the level of L2 proficiency. To investigate this, pupils from three different levels of acquisition participated in the experiment: secondary school, 3rd form; secondary school, pre-final year; and first-year students of English at the University of Groningen.

The dependent variable was the number of correct scores in the tests.

Dutch–English suffix pairs were composed that represent different levels of translation equivalence and productivity. These pairs were tested in the two contexts with 120 Dutch learners of English, representing the three different levels of L2 proficiency.

4.1. Materials

The affix pairs were based on a corpus analysis for which the CELEX lexical database was used. In the selection, interference of orthographical or phonological information was prevented by excluding pairs that show orthographical or phonological similarity (e.g. -er/-er). In this way, the suffix pairs (e.g. -heid/-ness) were only based on their overlap in semantic and syntactic properties.

Word pairs were selected to include two levels of both translation equivalence and productivity. The two levels of translation equivalence were determined by calculating the degree to which a Dutch affix could successfully be translated by the ‘equivalent’ English affix. In total, the translation equivalence of more than 50 affix pairs was calculated. Out of these, four pairs were selected representing a relatively high degree of translation equivalence and four with a low degree of translation equivalence. These pairs were combined with pairs representing high and low levels of productivity. Productivity was determined by calculating the proportion of hapaxes, i.e. morphologically complex words that have only one occurrence, relative to the frequency of the morphological type (see Baayen 1989 for a motivation of this method). Some of the selected affix pairs are listed in Table 1. For each affix pair, six items were selected. The item frequency of the morphologically complex words was controlled. For items with a low degree of productivity this posed some problems (see discussion).
Table 1: Some examples of the Dutch–English affix pairs selected for the experiment. In this table the absolute values are listed for translation equivalence and productivity. The cut-off point for translation equivalence was set at 50%.

<table>
<thead>
<tr>
<th>Affix pair</th>
<th>Transl. Eq.</th>
<th>P·10⁻³</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>heid/ness</td>
<td>52</td>
<td>10</td>
<td>High/High</td>
</tr>
<tr>
<td>baar/able</td>
<td>93</td>
<td>1</td>
<td>High/Low</td>
</tr>
<tr>
<td>teit/ness</td>
<td>3</td>
<td>10</td>
<td>Low/High</td>
</tr>
<tr>
<td>heid/ity</td>
<td>11</td>
<td>1</td>
<td>Low/Low</td>
</tr>
</tbody>
</table>

The test items were divided across two data sets (A and B), which were again divided across the two language contexts (L1 and L2). In the L1 context, the subjects had to translate sentences in which the relevant stem was provided:

(1) Leesbaar (lezen = to read).

In the L2 context, the subjects were asked to fill in a morphologically complex word:

(2) The sky is very grey. The grey _______ of the sky reminds me of England.

Half of the subjects did the L1 test with the items from set A and the L2 test with the items from set B. For the other half of the subjects this was the other way around. In this way, none of the items were represented between conditions for any of the subjects.

4.2. Subjects

120 Dutch learners of English participated in the experiment. The subjects represented three different levels of acquisition. The lowest level that was found to be able to carry out this abstract task was the third form of secondary school. The second level was represented by learners from the fifth form (pre-final year) of secondary school. The highest level of L2 proficiency was represented by first year students of English.

4.3. Expectations

Based on the model sketched above, the following predictions were made with regard to the main variables:
1. If the learner’s L1 morphological types affect the acquisition of L2 morphological types, a higher degree of translation equivalence will lead to a larger percentage of correct scores.
2. If the acquisition of L2 morphological types is primarily affected by the exposure to L2, a higher degree of productivity will lead to a higher percentage of correct scores.
3. Obviously, the percentage of correct scores will increase with increasing levels of L2 proficiency.
4. Interactions:
   a. The effect of translation equivalence will be strongest in the L1 context, as L1 is most strongly activated here.
   b. Similarly, the effect of productivity will be the strongest in conditions where cross-linguistic influence is weak, i.e. in the L2 context.
   c. Since productivity must be based on exposure to the language, the effect of productivity will be the strongest at higher levels of L2 proficiency.
   d. The largest proportion of correct scores can be expected where both translation equivalence and productivity are high.

4.4. Analyses

The results were analysed with a MANOVA, in which context, translation equivalence and productivity were the factors and the level of L2 proficiency the grouping variable (three levels). The level of significance was set at 5%.

4.5. Results

For translation equivalence, larger proportions of correct scores were found at the higher level: 63% at the higher level vs. 41% at the lower level. This effect turned out to be significant (F[1, 113] = 9.98; p = 0.002). There was a significant interaction between translation equivalence and group (F[2, 113] = 5.75; p = 0.004). The effect of translation equivalence was strongest at higher levels of L2 proficiency. No significant interaction was found between context and translation equivalence.

The effect of productivity appeared to be significant (F[1, 113] = 99.2; p = 0.001). However, the larger proportion of correct scores was found at the low level of productivity. A significant interaction was found between group and productivity (F[2, 114] = 22.6; p < 0.001). The largest (negative) effect of productivity was found at the lower level of L2 proficiency. A significant three-way interaction between context, group and productivity (F[2, 113] = 3.09; p = 0.049) shows that the negative effect of productivity was the strongest in the L1 context at lower levels of
proficiency. For the highest level of proficiency the effect of productivity turned out to be positive in the L2 condition.

The overall scores in the L1 context were higher than the scores in the L2 context. This difference turned out to be significant (F[1, 113] = 9.98; p = 0.02). A significant interaction was found between context and group (F[2, 113] = 6.49; p = 0.002), in which the context effect appeared to be strongest at lower levels of L2 proficiency.

There was a clear and significant difference between the mean scores of the groups (F[2, 113] = 20.32; p < 0.01). The scores strongly increased with increasing levels of language proficiency.

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Translation equivalence and productivity interacted significantly (F[1, 113] = 11.65; p = 0.001). The effect of productivity was strongest at the low level of translation equivalence.

4.6. Discussion

The results found for translation equivalence met the expectations outlined above. This result clearly shows that semantic overlap of L2 morphological types with a familiar L1 morphological type positively affects the acquisition of the L2 type. The interaction showing that this effect was strongest at the higher levels of proficiency seems to suggest that translation equivalence is gradually developed. Probably, some ‘exposure’ is needed to discover the semantic similarity of morphological types.

The strong effect of productivity ran counter to the expectations. Upon further looking into the data, it was found that this effect can largely be attributed to frequency. In composing the tests, it had been very difficult to find low-frequency items for types that are not very productive, like -ship. As a result, the overall frequency for the low-productive items was slightly higher. The high scores on these items might therefore be due to item-familiarity and the well-attested frequency effect of the item. The higher order interactions suggest that this frequency effect is neutralised in conditions where productivity was expected to be strongest: at the higher levels of proficiency and in the L2 context.

The lack of interaction between context and translation equivalence was not in agreement with the expectations. Apparently, the cross-linguistic influence (i.e. translation equivalence) was so strong that it even occurred in a context where the role of L1 was minimised. Another observation in relation to context was that the context effect did not occur at higher levels of proficiency. This may be due to the nature of the task; learners at lower levels of proficiency may find support in the Dutch translations of the words provided.

The expected effect of the different levels of English proficiency was very clear and confirmed the predictions.
5. Conclusion

In the experiment, one aspect of a model of morphology in the bilingual mental lexicon was tested. With regard to the role of the first language on the acquisition and use of L2 morphology, it was argued that the first language plays a role at two levels of the model proposed: at phonological/orthographic level and at the level of semantic overlap between morphological types in the two languages. The focus of the current paper was on the latter type of cross-linguistic influence. The amount of semantic overlap between the two languages was represented as translation equivalence. Translation equivalence was operationalised as the percentage of actual translatability of L1 types into L2 types and translation vice versa, as appeared from a corpus study. The experiment shows that translation equivalence plays a major role in written production at all levels of acquisition and even in contexts where L1 is not explicitly active. Apparently, the learners rather strongly relied on their morphological experience in L1. Consequently, low scores were found for L2 affixes that do not have a consistent L1 counterpart.

The experiment shows that learners, especially at lower levels of proficiency, have not (yet) acquired the productivity of L2 morphological types. Only at the highest level of proficiency included did productivity positively contribute to the scores in the test, and then only in the context where L1 was not explicitly activated. This may be partly due to the interfering frequency effect, but it does show that L2 learners are not generally aware of the productivity of L2 morphological types. This is quite conceivable, as a sense of productivity can only be acquired after extended exposure to the L2. However, unfamiliarity of morphological types can possibly be overcome by explicit instruction in this area. Since the majority of the morphologically complex words that learners at these levels may come across is semantically transparent, familiarity with morphological productivity may provide a boost in vocabulary acquisition. Instructors should, of course, limit their instruction to morphological types that are highly transparent. Otherwise, confusion is more likely to occur than facilitation.

The experiment described here also raises some more theoretical issues. It may contribute to the further modelling of L2 morphology: the interfering frequency effect found is in line with activation models of language processing and should be fully taken into account. In the bilingual mental lexicon, the strong effect of cross-linguistic influence must also be accounted for. This experiment has shown the importance of cross-linguistic influence at the level of the semantic overlap between L1 and L2 morphological types. An earlier study (Lowie 1991) has shown a similarly strong effect at the level of transparency. The results of this experiment may contribute to the discussion, starting from Dulay & Burt (1974), about the balance between developmental factors and
cross-linguistic influence in SLA. If we go by these experiments alone, the learner is very much guided by his or her first language in the written production of L2 (derivational) morphology. Whether translation equivalence would also play a major role in other modalities is an empirical question. But since written production is the least automatic type of processing, and the links between the semantic information of L1 and L2 morphological types can be regarded unconscious (and implicit), the effect may even be stronger in oral production.

The experiment described here is by no means sufficient to support (or falsify) the entire model of morphology in the bilingual mental lexicon advocated; only one aspect of the model has been investigated and many other questions are yet to be answered. However, in a world where the majority of people speak more than one language, studies of language processing should not be limited to the monolingual lexicon, but should be able to account for the acquisition and use of the bilingual lexicon. The framework outlined here may prove a useful starting point for these studies.

References


Received October 7, 1999

Accepted January 20, 2000

Dr. Wander Lowie

Department of English

Postbus 716

9700 AS Groningen

The Netherlands

email: w.m.lowie@let.rug.nl

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