The Acquisition of Interlanguage Morphology

A study into the role of morphology in the L2 learner's mental lexicon

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Contents

Chapter 1

Introduction

1.1 Morphology and second language learning

If Dutch learners of English encounter a word like *undoable*, they may recognise it because they have seen it before and have remembered it. They may also fail to recognise it and guess the meaning of the word on the basis of the context. A third possibility is that they do not recognise the word and attempt to guess the meaning by decomposing the word into parts they do recognise and arrive at its meaning on the basis of these parts. In doing so, they may use the knowledge of word analysis they have gained in their mother tongue. The strategy a learner will employ in this situation will depend on a range of interrelated factors. Is the word used frequently? Is the word decomposable? Are the parts of the word used frequently? Does the learner know these parts? Are the parts similar to parts in the learner's native language? Does the combined meaning of the parts make sense? All these questions are related to the acquisition and use of morphology in a second language, which is the subject of this study. Many of the questions raised here are related to questions that go beyond this specific subject. The first question that has to be answered is how do adult native speakers of a language store and retrieve (parts of) words? Secondly, how do people acquire knowledge and skills to produce and recognise words? Thirdly, how can this be explained by theories of language learning and theories of morphological structure? Furthermore, are the processes underlying the acquisition of morphological skills different for L1 learners and L2 learners? What, for instance, is the role of the second language learner's first language? All of these questions and many more will be addressed here, as they constitute essential parts of the central research question of this study: What are the mechanisms and processes underlying the acquisition and use of morphological complexity in the production and comprehension of polymorphemic words by learners of a second language? More specifically, the current study will focus on the acquisition of these mechanisms and processes for Dutch learners of English. In this dissertation, an integrated multi-disciplinary model will be proposed to account for the acquisition and use of second-language morphology.

The acquisition of second language morphology is a relatively new area of research, which means that there is little material to draw on. Previous studies of L2 morphology have mainly concentrated on the order of acquisition of morphemes as a function of the learner's L1 background (the "morpheme order studies"). These studies provide ample -though contradictory- information about the order of acquisition of several specific morphemes and may contribute to the overall picture of foreign language morphological acquisition. These studies, however, have hardly paid attention to the underlying strategies applied by the learner in acquiring, processing and producing morphologically complex words and the general organisation and development of the foreign language learner's lexicon. As studies in this particular area have been sparse, clues for the strategies and processes of L2 learners in the production and comprehension of morphologically complex words must be obtained from other sources. One of these sources is morphological theory. This area has seen the introduction of many concepts and ideas that could solve part of the puzzle. Another major source is the psycholinguistic study of the (adult native speaker’s) mental lexicon. Many such models of the mental lexicon address the problem exemplified in the opening lines of this chapter: does the mental lexicon consist of whole words, parts of words, or a combination of the two? And in case of the latter situation, how is it determined which mechanisms the speaker or listener employs to produce or comprehend morphologically complex words? Out of the many approaches to this problem, one particular model will be selected that serves as the sound basis for a model of the acquisition of L2 morphology. A third source is found in case studies describing the acquisition of L1 morphology. Studies of children’s lexical innovations reveal that children make use of morphological generalisations on a large scale. These data provide invaluable insights into the mechanisms and processes of the acquisition of morphology, which can partly be generalised to the acquisition of L2 morphology. This also holds for studies of the bilingual mental lexicon. Although these studies do not have anything to say about the acquisition of morphology explicitly, models of the bilingual mental lexicon provide useful insights into the differences between the monolingual and the bilingual lexicon. These insights can be utilised to define the role of morphology in the acquisition of the L2 mental lexicon. For example, an obvious question that is amply addressed in this field is whether the bilingual mental lexicon consists of discrete lexicons for each language or of one unified lexicon. If morphology is regarded as part of the lexicon, the question of the discreteness of L1 and L2 morphology will largely depend on the model of the bilingual lexicon adhered to. A final source of information is found in theories of second language acquisition. This field provides an insight into the importance of the second language learner’s native language and into the role of the learner’s input. Furthermore, this area addresses developmental issues and supplies data to complete the interdisciplinary model of the acquisition of L2 morphology.

1.1.1 Relevance of morphology for second language learning

Many words in a language are morphologically related, at different levels and with different strengths. The verb “to learn”, for example, is not only linked to inflectional forms like “learns”, “learned” and “learning”, but also to the noun “learner” and the adjective “learnable”. It would not be very economical if all these related forms had to be learned and stored separately. This would be unlikely considering the impressive number of words that can be composed using morphology. For purely agglutinative languages like Turkish, impressive absolute figures have been calculated to this effect. Hankamer (1989) computed that a typical educated speaker of Turkish, with a lexicon size of approximately 20.000 noun roots and 10.000 verb roots could dispose of more than 200 billion entries based on this lexicon. These figures demonstrate the power of morphological relations and show the relevance of morphology for learners of a language: with a limited knowledge of morphological regularities, the learner can achieve a tremendous expansion of her[1] vocabulary.

Secondly, morphology can be a helpful tool to facilitate the acquisition and use of words. Recent research into the acquisition and retention of foreign and second language vocabulary has shown that newly acquired words are better retained if they were initially inferred through linguistic cues rather than through context (see e.g. Haastrup, 1989)[2]. Drawing attention to the morphological structure of words in a second language may result in an increasing awareness of morphological complexity, which can be an important strategy of inferring and acquiring words. In “printed school English”, 84 per cent of the prefixed words and 86 percent of the derivationally suffixed words are semantically transparent, i.e. their meaning can be inferred on the basis of their constituent morphemes (Nagy & Anderson, 1984). Obviously, morphological cues for the inference of words in a second or foreign language can be essential to vocabulary acquisition. This is confirmed by other studies, for instance Freyd and Baron (1982), which indicate that learners who are good at analysing words are the more successful word learners.

1.1.2 Relevance of the study of interlanguage morphology

The study of interlanguage morphology can provide insights into the relative importance of morphology teaching in SLA. Knowledge of processes underlying the learner’s use of morphology may support teaching, as it will make clear on which areas of morphology language teaching should concentrate and will help determine the best way of teaching morphology.

Secondly, this line of study could support the work that is being done in the area of vocabulary acquisition. As many words are related by form and/or by meaning, studying the nature of these relations may shed new light on the processes and factors that are relevant to the acquisition of vocabulary.

Thirdly, the study of L2 morphology may contribute to general theories of second language acquisition. The role of the learner’s native language, for instance, is one of the factors that will play a major role in the study of both L2 morphology and other areas of SLA research, and findings in the field of morphology could be generalised to the other fields.

Finally, insights in the field of interlanguage morphology may contribute to models of morphological processing in L1 and L2 and models of the bilingual mental lexicon.

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[1] I will try to be consistent in referring to learners as female human beings. Readers who feel offended by this may rest assured that I will use “he” and “him” in my next dissertation.

[2] For a complete overview of the effects of context on the acquisition of vocabulary, see Mondria (1996).

1.2 Focus, aim and structure of the present study

The primary focus of this study is to investigate the processes and principles underlying the acquisition of English morphology by Dutch learners. To this end, an interdisciplinary model of the acquisition of L2 morphology is proposed and tested. This model draws on different sources that are discussed in Chapter 2 and 3. Chapter 2 focuses on the role of morphology in the comprehension and production of polymorphemic words by adult native speakers. It first discusses some pertinent current theories of morphology that contribute to the model. Next, it surveys the most influential models of the mental lexicon and expresses a preference for one particular model. Then, the most relevant issues related to morphology and the lexicon are discussed thematically, focused on determining the most powerful model of morphology in the mental lexicon. It will be argued that a model of morphology should comply with a more general model of language processing, and requirements will be set for the adjustment of morphological models in this direction. In the conclusion of Chapter 2, additional support is provided for the model selected, and further adjustments are suggested. Chapter 3 concentrates on the role of morphology in first and second language learning and on the structure of the bilingual mental lexicon. After a detailed discussion of diary data describing children's lexical innovations, the main conclusions about the principles and processes of L1 acquisition are listed. These observations give rise to elaboration and adjustment of the model proposed in Chapter 2. Additional information about the L2 learner's lexicon is provided by models of the bilingual lexicon, which are predominantly based on speech error data. This culminates into further elaboration of the model. Finally, the model is checked against observations from the area of (general) second language acquisition research, in which particularly the role of the learner's first language will be highlighted. Chapter 3 concludes with a sketch of the overall picture as it emerges from Chapters 2 and 3. Aspects of the model thus proposed are tested in Chapter 4. This chapter describes three empirical studies (some of which consist of several experiments), all concentrating on testing the one aspect of the model that appears to be most crucial: the role of the learner's first language. The first study explores the relations between Dutch and English morphology in a series of three experiments. In the second study, an implication of the model is tested in a psycholinguistic priming experiment involving reaction time measurement. The third study includes a typological comparison of Dutch and English derivational morphology based on corpus data. Predictions originating from this comparison are tested in a production experiment in which learners from three levels of L2 proficiency participate. In Chapter 5, the model proposed in Chapter 2 and 3 is evaluated in terms of the results of the empirical studies in Chapter 4. Finally, some implications of the studies are mentioned and some suggestions are put forward for further research.

Chapter 2

Morphology and the lexicon

2.1 Introduction

It is a universally accepted fact that the lexicon is the most essential element in language processing. Without knowledge of words, no language can be understood. If the words in the language are examined more closely, many words appear to have an internal structure. It is this internal structure, the morphology of words that is the main issue in this and the following chapters. Morphology can be seen as an important component of the lexicon, and morphological information about words is essentially lexical information. This chapter will elaborate on the role morphology plays in the comprehension and production of words.

All speakers of a language have the capacity to analyse words into their components. This capacity is evident from the observation that people can perfectly understand morphologically complex words that they have never seen before. Consider the word *unmumbleable*. If native speakers of English were to come across this word, they would definitely be able to attribute meaning to it, although this is not an "existing" word in English. To deduce the meaning of the word *unmumbleable*, the reader or listener must first decompose the word into its morphological constituents to arrive at its root, *mumble*. The meaning of the entire word can be interpreted on the basis of the meaning of the root together with the meaning of the prefix *un-* and de suffix *-able*. From these three elements the reader or listener will be able to interpret this word as an adjective with the meaning "that cannot be mumbled". The reader or listener will even be aware of the inherited subcategorisation properties of the verbal root, and expect this adjective to take an external argument as its complement (for instance a word with many open vowels, which may be difficult to *mumble*). Apparently, (native) readers or listeners are able to deduce syntactic, semantic/pragmatic properties of words purely because of morphological analysis. All this seems very clear. At the same time, many questions can still be raised about morphology and the lexicon. What, for instance, will happen if the native speaker comes across a morphologically complex word that is not possible or questionable, like **bookity* or $^{?}$*sleepable*? And if decomposition of affixes is assumed, where do we stop decomposing? For instance, why, in the example above, don't we continue stripping off affixes until we arrive at *mum* as the root of *unmumbleable*? After all, *mum* is an existing English word; it does occur in the speaker's lexicon. Do we also apply morphological knowledge in producing morphologically complex words, and, if so, what stops us from forming words like **arrivation* for *arrival*? What are the conditions that should be met before a newly formed word is stored in the lexicon?

Two strategies can be distinguished for the processing of morphologically complex words. We can either assume that all words are stored in a ”mental lexicon” regardless of their morphological complexity, or that only roots are stored. The latter strategy would involve the application of devices to analyse or generate words during speech or comprehension. Arguments have been presented in favour and against both approaches. An argument that is frequently used in favour of storing only the roots in the mental lexicon is that it would not seem to be economical to store all words of a language separately, since this would involve storing a great deal of redundant information. For example, storage of the root *cat*, together with a general rule of plural formation would be more economical than storing both *cat* and *cats*. If efficiency of lexical storage is indeed a decisive factor, an approach that tries to minimise the number of entries in the lexicon is to be preferred. There is some evidence that one should be economical with the mental storage available. For purely agglutinative languages (like Turkish), as was argued in the previous chapter, Hankamer (1989) has argued that full storage of all words would require more storage capacity of the brain than people have at their disposal. On the other hand, there are two familiar arguments against root storage and in favour of a full-listing approach. These arguments point to the extreme complexity of storage and processing that has to be assumed in the case of root storage. Firstly, the combination of root storage and a system of morphological rules is less attractive for affixed words which have a bound root (*pre**fer***) or those which are highly complex (*un-re-**mit**-ting-ly*), as this would logically require the storage of bound roots like *fer* and *mit*. Storage of bound roots is usually rejected for reasons of psychological reality. Secondly, morphological decomposition complicates mechanisms for perceiving and producing morphologically complex words. For the comprehension of complex words it would require a complex perceptual system to distinguish between real derivatives (*un-true*) and pseudo-derived words (*uncle*). For the production of a complex word (e.g. *drawing*) it is not only necessary to know the rules to refer to the correct syntactic category and sub-category (V_{trans}+ing=N), but also the correct corresponding semantic relation (Ning= the result of V). Moreover, a number of spelling rules, phonological rules and sometimes even prosodic rules must be applied. This is even more complicated by anomalies in morphology: in English one morpheme can have several orthographic representations (*un-*, *in-*, *ab-*, etc. for negation) and one orthographic representation may represent more than one morpheme (the suffix *-s* can be plural, third person singular and possessive). Apart from the question whether such a notion of efficiency is at all psychologically real, it cannot account for a large number of irregularities and idiosyncrasies in the lexicon.

In the past few decades numerous studies of the language user's production and reception of morphology have been conducted, from two points of view. First, by linguists, who, starting from Chomsky's *Remarks on Nominalizations* (1970) and following Halle (1973), Jackendoff (1975) and Aronoff (1976), have produced a variety of theories and models of morphological (ir)regularities in the lexicon. Second, by psychologists who have investigated the language user’s “mental lexicon”. In the wake of Taft & Forster (1975), the theories of these researchers are mostly based on experimental studies of lexical access to morphologically complex words. Current models of morphological processing show that the situation proves to be more complex than a simple choice between the two strategies exemplified above. Most linguists as well as psychologists will now agree that instead of a choice between listing and active rule-based word formation both strategies are likely to interact in a complete model of producing and processing morphologically complex words.

The aim of this chapter is twofold. Firstly, to evaluate some representative models of morphology. Secondly, to select a suitable model of morphological processing that can be adopted as the basis for a model of morphological processing by second language learners. I will review a variety of linguistic theories and psycholinguistic models determining the role of morphology in the lexicon. After this review of the prevailing theories and concepts, some of the most relevant and controversial issues will be elaborated on. Based on this discussion, a set of requirements will be established that the preferred model should comply with. These requirements will lead to the selection of one particular model, for which some alterations and extensions will be proposed.

2.2 Terminological conventions

To avoid confusion about the terminology used, I will briefly touch upon some terms for which no firm conventions have yet been established, and make explicit which choices have been made for the current work.

A first source of confusion is the use of the terms *base*, *stem* and *root*; all referring to the part of the word that remains after affixes have been removed. Following Matthews (1974), Lyons (1977) and Bauer (1983), the following distinction will be made when relevant: the term *root* will be used for any form that cannot be further analysed morphologically, either in terms of inflection or in terms of derivation. The *base* of a word is that part of a word to which affixes can be added. The term *base* refers to a more general concept than *root*: a base can be a root, but also any (derivationally complex) form to which (other) affixes can be added. Bauer (1983) makes the additional distinction between *root* and *stem*, where *root* is used to refer to derivation and *stem* to refer to inflection. However, as a principled distinction between inflection and derivation is difficult to make (see 2.5.5), I will not distinguish between *stem* and *root* and use the latter term to refer to any form from which inflectional or derivational affixes have been stripped.

2.2.1 Morphemes and words

A recurring issue in discussions about morphological theories is the definition of morphemes and word. Obviously, these definitions are essential to any theory of morphology, as they constitute the primitives of the theory. Halle (1973), for instance, uses a definition of morphemes that allows him to analyse words like *brother* as consisting of two morphemes, *bro-* and *-ther*, in which the latter is seen as the affix attaching to the root *bro-* and to similar roots like *fa-* and *mo-*. Not everyone will agree with this definition, not in the least because it seems very counter-intuitive and artificial, as it will be hard to attribute semantic content to these morphemes.

Traditionally, a morpheme has been defined as the smallest, indivisible unit of meaning. Moreover, it was generally assumed that there is a strict one-to-one relation between form and function: one morpheme should essentially have one function and meaning. But, although it may be more appealing than Halle's definition, this definition is not flawless either. It is, for instance, not always possible to attribute meaning to a morpheme. This is exemplified by English words like *cranberry*: in this word, two morphemes can be distinguished (*cran* and *berry*). The second morpheme clearly carries meaning (classifying it as a type of *berry* and contrasting it with, for instance, *strawberry* and *blackberry*), but the grammatical function and meaning of the first morpheme are not clear. The same holds true for the meaning of *-fer* in words like *prefer*, *infer*, *confer*, *transfer* and *refer*: although the meaning of the first element may be obvious, it will be hard to identify a consistent meaning for the second. The solution to this problem will have to be sought in the definition of morpheme. Instead of defining morphemes in terms of meaning or function, it could be defined as relating to distribution. Recently, Katamba (1993) suggested the following definition:

> The morpheme is the smallest difference in the shape of a word that correlates with the smallest difference in word or sentence meaning or in grammatical structure.
> Katamba (1993: 24)

This definition may solve the "cranberry problem", but the result is that Katamba's concept of morphemes is very similar to Halle's and will allow morphemes like *bro-* and *-ther*. What is obviously lacking in this definition is some way of referring to the productivity of affixes to form words. This point will be addressed in 2.4 and in 2.5.1.

Another problem that remains is the assumed one-to-one correspondence between meaning and form. This assumption is a result of using English as a source language for morphological theory. The morphology of English, and other agglutinative languages for that matter, is very limited and problems arise when these theories are generalised to non-agglutinative languages. The lack of a one-to-one correspondence between meaning and form is illustrated by cases where several morphemes are realised by a single portmanteau morph[3] or where a single morpheme is realised by several morphs. In all these cases, a complex relation exists between morphemes and forms. An example of a word that contains both one-to-many and many-to-one relationships is the following analysis of the Latin word *finerebbero* based on Matthews (1970: 108):

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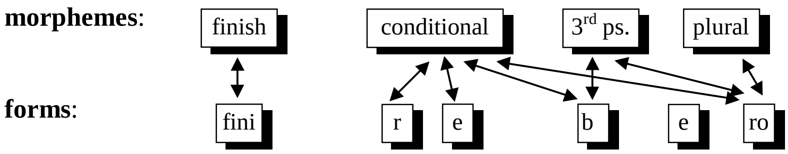
[3] A morph is defined as the physical realisation of a morpheme ("it is a recurrent distinctive sound (phoneme) or a sequence of sounds (phonemes). (Katamba:1993: 24). The lack of a one-to-one correspondence between meaning and form can thus also be defined as the lack of a one-to-one relation between morpheme and morph.



This example also illustrates the necessity of assuming additional “empty morphs”: no obvious function or meaning is attributed to the second *e*-formative. Whether or not meaning and form should be separated has been subject to intense debate and forms a source of disagreement among morphologists. This issue is elaborated on in section 2.5.2 below.

Another notion that seems obvious, but that is actually very difficult to define, is the nature of the *word*. As all theories of morphology and the lexicon are inherently dealing with words, the definition of a word is quite relevant for the current discussion. Generally, most people will agree about what is a word and what is not. Even speakers of languages that do not exist in writing are able to identify words in a sentence (Sapir, 1921: 34). This would suggest that words can be defined syntactically as the smallest unit that can exist on its own, or “minimal free form” (Spencer, 1991: 43). But this will not hold for all words. Speakers of English, for example, may argue whether *all right* should be considered as one word or as two. Most of the borderline cases can be found among compounds; especially phrasal compounds, like *sister-in-law*, *lady-in-waiting*, *pain-in-the-stomach gesture*[4] are examples of phrases that may also be seen as words. Syntactic criteria for words are even harder to determine when languages other than English are taken into account. In Turkish, for instance, affixes can be added to words to create meanings for which English would need a phrase or a sentence: *ev·ler·in·de* means “in their house” (Lyons, 1968:130) and *çaliş·tir·il·ma·maliy·miş* means “they say that he ought not to be made to work” (Spencer, 1991: 189). These examples show that syntactic criteria of wordhood, regarding the word as the minimal free form, are not reliable.

Semantic criteria for words are also hard to define, for two reasons. First, because words are usually not semantically transparent. If words are supposed to constitute a unit of semantic content, idiomatic expressions like *pass away* will have to be considered as one word, rather than as a phrase. If this is accepted, one is faced with longer and syntactically more complex expressions like *kick the bucket*, which do have a lexicalised meaning. This view, however, will run counter to all accepted linguistic analyses. Second, because of the existence of “bracketing paradoxes”, like *transformational grammarian*. If this is seen as a phrase consisting of two words [[transformational] [grammarian]], this leads to an (in most cases) incorrect semantic interpretation: “a grammarian that is transformational”. If, on the other hand, the semantically correct bracketing is presumed ([[transformational grammar]ian], the phrase *transformational grammar* will have to be regarded as a word, which, again, is not in line with the conventional concept of words.

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[4] These examples are mentioned in Bauer (1983:207).

As yet, morphological theory has not solved the problem of wordhood. Attempts have been made to disambiguate the concept "word" by introducing terminology that is supposed to be less confusing. The term "word" is mostly used to refer to "word forms", which are seen as realisations of more or less abstract underlying forms, called "lexemes" (normally printed in capitals). The lexeme GIRL, for instance, is realised by "girl" and "girls" as its word forms. With regard to the traditional distinction between inflection and derivation (see 2.5.5), inflectional paradigms are seen as word forms of the same lexeme, while derivation creates new lexemes. When referring to the items listed in the lexicon, usually the term "lexical items" is used (though Di Sciullo & Williams (1987) prefer the term "listemes"), but when the lexical item is meant including the (subcategorisation) information it includes, normally the term "lexical entry" is utilised. In psycholinguistically oriented theories, moreover, the term "lemma" is sometimes used to refer to the abstract representation of words (e.g. Levelt, 1989). Whether the continuous introduction of disambiguating terminology really contributes to more clarity is doubtful, but the variety of terms is evidence of the general tendency to avoid the term "word". This is not surprising in view of the discussion above, but the conceptual problems of, for instance, compounds and bracketing paradoxes have not been solved by the introduction of new terms.

Further terminological variability is found for *compounds*. In the literature, the term *compound* is variably used to refer to any word that is morphologically complex (Butterworth, 1983) or to "a lexeme containing two or more potential stems that has not subsequently been subjected to a derivational process" (Bauer, 1983: 29). I will use this term in the latter sense only, referring to combinations of at least two roots (usually free morphemes), as in *lead-free*, *ready-made*, *language laboratory*; but not *player*, *remorseful*, *unbelievable*). For the other words, I will use the more neutral term "morphologically complex word".

Finally, there is some confusion in the use of the terms "non-words" and "pseudo-words". If a distinction is made, pseudo-words are words that do not exist as such, but are not phonologically illegal either (like **debrile* in English), while non-words are words that are not "possible" (a word like **rlopm* in English). A further distinction is sometimes made between "possible" and "existing" words (e.g. by Meijs, 1981a), where "possible" words are referred to as words that may not readily exist but can be formed by applying productive morphology, leading to transparent new forms (e.g. *uncaressable* in English).

2.3 Theories of morphology and the lexicon

In this section some of the most influential linguistic theories of morphology will be discussed, as these theories have shaped all subsequent thinking about morphology and the lexicon, and also form the basis of many psycholinguistic theories that were later developed. Although the model presented later in this study can be categorised as a psycholinguistic model, it shows traces of linguistic theory that cannot be properly discussed without any elaboration of its origins. First, a brief historical overview of the ideas about morphology and the lexicon is given, starting with

Bloomfield (1933), and gradually working through history to more modern linguistic approaches dealing with this issue (for instance Lieber, 1981). Then some issues are discussed that are relevant to many basic assumptions about morphology and the lexicon, the forma and function word formation rules and the common ground of morphology, phonology and syntax. It should be noted that the purpose of this discussion is not to give a full and balanced account of all major linguistic theories (see Spencer, 1991), but to provide a framework for models presented later in this study.

2.3.1 A historical perspective

In the tradition of American structuralist linguistics, the lexicon was seen as only containing completely idiosyncratic information. Bloomfield (1933: 274) called it "an appendix of the grammar, a list of basic irregularities". He assumed that all words that can regularly be analysed on the basis of phonology or syntax are not listed in the lexicon. The basic unit of analysis in these theories is the morpheme. Morphemes were assumed to have an underlying form to which arrangement —in the Item-and-arrangement (IA) approach— or a process —in the item-and-process (IP) theory— applied to create derived forms. One problem of such approaches is their limited applicability. First, because the aim of these theories was to account for an analysis of the internal structure of words rather than to develop a general theoretical framework to account for productive language use. Secondly, because the analyses are limited to agglutinative languages by assuming a strict one-to-one relation between morpheme and meaning.

One of the earliest generative linguistic theories, the Standard Theory (Chomsky, 1965), did not accommodate morphology as such. In this theory most aspects of morphology (inflection, derivation, compounding) were accounted for by syntactic transformations; the role of the lexicon was limited to providing the items for (syntactic) lexical insertion transformations. Also, allomorphic variation was not regarded as the result of independent morphological operations, but as the result of the operation of phonological rules. Early lexicalist theories of morphology, starting with Chomsky's "Remarks on nominalization" (Chomsky, 1970), abandon the idea that all regular morphology is to be accounted for by phonology and syntax and emphasise the need for a separate theory of (derivational) morphology.

An influential article on morphology and the lexicon was Halle's "Prolegomena to a theory of word formation" (Halle, 1973). This paper initiated the discussion of many aspects of morphology. It raised questions that have been answered in many different ways, both within and outside linguistic theory. For some of these questions no satisfactory answer has yet been found, with regard to the nature of the entities listed in the lexicon, the internal structure of words (and the order in which morphemes appear in words), and the idiosyncratic features of individual words. Many aspects of the model that Halle proposed in this article are reflected in later models of morphology and the lexicon. Therefore, Halle's model will be briefly outlined here.

Halle's model (see Figure 1) is morpheme-based: its starting point is that the lexicon contains a list of morphemes that form the input of Word Formation Rules

(WFRs) to create words. As these WFRs can in principle generate any legitimate combination of roots and affixes[5], they also create words that do not actually occur in the language, like **arrivation*, **retribute*, ?*halation* and **fiss*. To account for these "lexical gaps", Halle postulates a filter that contains all exceptions to possible outcomes of the WFRs. The filtered output of the WFRs enters the Dictionary, which is a list of all actually occurring words that includes information necessary for the correct application of lexical insertion transformation of all words. After the application of lexical insertion transformations, the surface form of the word appears. To account for the fact that affixes can not only be added to morphemes, but also to morphologically complex words (for instance to derive *readability* from *readable*), Halle postulates a loop from the dictionary to the word formation rules. As all phonological rules apply after syntactic rules in the overall generative theory this model is part of, the loop has to run through the phonological component to enable phonologically defined constraints on surface forms.

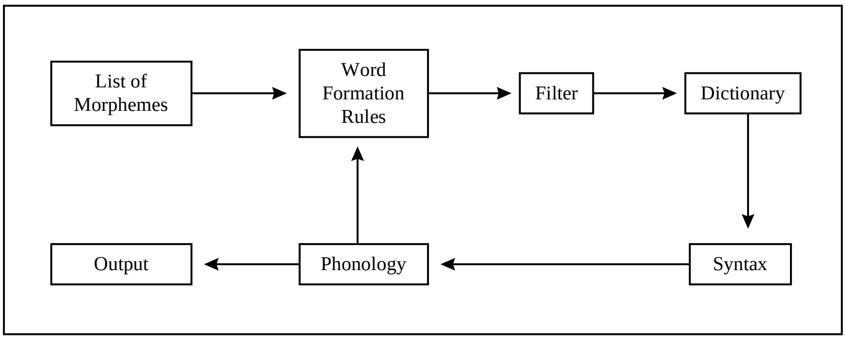

Figure 1. Halle's (1973) model

Halle's model has widely been criticised. Especially the idea of a powerful filter has generally been rejected, as this leads to the postulation of what Carstairs-McCarthy (1992:25) called an "anti-dictionary", which is not only rather counter-intuitive, but also seems an unnecessary duplication. After all, the dictionary and the filter are largely complementary. But the merit of Halle's model is that it is one of the first attempts to make explicit what the most pertinent problems are resulting from postulating an independent position of morphology in the lexicon. Many issues raised in Halle's article have been addressed by later theories of morphology and the lexicon, both within linguistic theory and in psycholinguistic and computational approaches, and for many of the problems mentioned no adequate or universally accepted solution has yet been found. The very basis of this model, the list of morphemes has been questioned by many linguists, particularly those taking a list of words as a starting point (e.g. Aronoff, 1976). This fundamental question is still current in morphological theory. A similar discussion has taken place among different groups of

[5] The legitimacy of Halle's words is determined by morphosyntactic features with which root morphemes are marked.

psychologists, taking either the morpheme or the word as the starting point of their models of access to the mental lexicon. Another issue of interest is the exact nature and function of the word formation rules, which is discussed in section 2.3.2 below. Also, the problem of lexical gaps, or the (over-)productivity of morphological rules, for which many different solutions have been suggested is further discussed in that section.

Two more "classical" models have been very influential, the model of Aronoff (1976) and that of Jackendoff (1975). These two models have in common that they take the word, and not the morpheme as the basic unit of their theory. The difference between these models is that Jackendoff's model can be categorised as a "full-listing" model, and that Aronoff's cannot.

Jackendoff posits a model in which all possible words in the language, both morphologically simple and complex, are listed in the lexicon. To account for the redundant information that the lexicon would contain (e.g. both *cat* and *cats* will be in the lexicon) he postulates "redundancy rules" that constitute links between the constituents of morphologically complex lexical entries. By separating morphological and semantic redundancy rules, form-based relations can be distinguished from semantic overlap. The advantage of Jackendoff's model is that the meaning of separate morphemes can be represented without having to be listed in the lexicon, and without having to be derived by means of word formation rules. The occurrence of links between words with identical patterns (*untrue* - *true*, *unhappy* - *happy*) will reduce the cost of referring to other words with the same pattern (*unsound*). Traces of Jackendoff's early model can still be found in current theories of the lexicon. The idea of lexical connections, for example, is reflected in the work of Bybee (1985, 1995) and the notion of the cost of referring to a redundancy rule provides a challenging explanation for different degrees of productivity (see 2.5.1).

Aronoff's (1976) model, which unlike Halle's is restricted to derivational morphology, takes the word as its starting point. Affixes are attached to words by productive word formation rules, and all morphologically complex words that cannot be regularly formed on the basis of productive word formation rules are assumed to be listed in the lexicon. However, the lexicon does not contain any words that can productively be formed by applying WFRs. Aronoff's model is centred around the application of productive word formation rules, which are similar but not identical to Halle's. The different notions of WFRs and their criticism are discussed in 2.3.2. Also, Aronoff's ideas are reflected both in later morphological theory and in psycholinguistic models of language processing. Spencer even claims that: "The model of word formation proposed by Aronoff (1976) marks a watershed in the development of morphological theory within generative grammar. A good deal of work done subsequently is an extension of, or reaction to, Aronoff's theory" (Spencer, 1991: 82).

Thus far, some models have been described that deal with the overall picture of the lexicon. Another relevant point that was raised by Halle (1973) is how the internal constituent structure of morphologically complex words should be determined. If a morphologically complex word is represented by a tree, how can the branching of that tree be accounted for? This problem can be illustrated by the example of *revitalisation*:

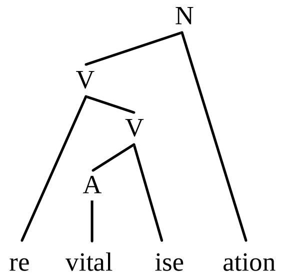

Figure 2. Example of bracketing problems for the word "revitalisation".

The bracketing in Figure 2 is one of several possible ways of bracketing. The "correct" way of labelling trees depends on the theory one adheres to. One solution is to shift this problem to the level of word formation rules. The word formation rules can be formulated in such a fashion that, for instance, the prefix *re-* cannot attach to adjectives to avoid $[_{N}[_{V}[_{?}\mathrm{re}[_{A}\mathrm{vital}]]\mathrm{ise}]\mathrm{ation}]$. The internal constituent structure of words can thus be accounted for by a series of word formation rules, each operating on the output of the previous. But many other interesting ideas have been developed with regard to this issue.

One of these is the idea of "level ordering". This idea originates from theories of traditional generative grammar (the SPE model), where the order of application of transformational rules is essential. For the same reason that Halle's model needs a loop through phonology (phonological rules apply after the application of syntactic transformations), Siegel (1979) divides affixes into different classes (Class I and Class II). She hypothesises that Class I affixes apply before stress rules and Class II affixes apply after stress rules (the "Level Ordering Hypothesis"). Class II affixes are stress-neutral (among others #ness, #less, #hood, #ise, #ful), but Class I affixes are not (among others +ity, +y, +al, +ate, +ion, +ous). Therefore, Class II affixes will always be external to Class I affixes. Moreover, Class I affixes may attach to bound roots (*callus*), but Class II affix only attach to words (*wordhood*). The idea of level ordering turned out not to be satisfactory. Class II affixes do, for instance, apply before Class I affixes in words like *organisation*; also in the example in Figure 2 the Class I affix *-ation* is outside Class II affix *-ise*. Yet, the idea of differential behaviour for different types of affix has been proposed in many other studies.

Another intriguing idea to account for the internal constituent structure of words is suggested by Lieber (1981). Lieber posits a morpheme-based lexicon that contains (bound and free) roots and affixes. At the very basis of Lieber's model are subcategorisation frames of all affixes listed in the lexicon. These subcategorisation frames state which syntactic (sub-)categories an affix may attach to. The subcategorisation frame of *-ation* will look something like:

(1) ation: [{[V], [N]} _______] [N, +abstract]

An affix can only be inserted if its subcategorisation restriction is met. For the actual insertion of the morphemes, Lieber postulates three steps. First, she proposes unlabelled binary branching trees that can be applied to account for the internal structure of any word, resulting in two possibilities for words consisting of three morphemes: left and right branching trees. The subcategorisation frame of the affix determines which of the two possible trees is used. After the insertion of the morphemes, the next stage is that the features of the morphemes will percolate up to the nodes in higher positions in the tree. By means of these "Feature Percolation Conventions", the labelling of the tree is accounted for[6] (see Figure 3). Lieber's model is not flawless. Especially its limited use to account for allomorphy other than English has been criticised. But the central role of subcategorisation frames is very appealing and can be applied to account for selection restrictions of affixes and for the interface of morphology with syntax in many other models of morphology and the lexicon, both inside and outside linguistic theory.

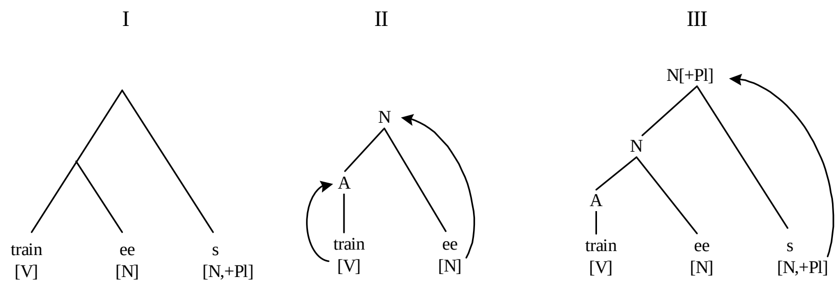

Figure 3. Three stages of morpheme insertion (Lieber, 1981)

2.3.2 Word formation rules

In spite of the unclear status of the term "word", most of the influential early generative morphological theories postulate word formation rules that create new words by the application of morphology. Many of the proposals involving morphological rules, for instance by Marchand (1969); Halle (1973); Siegel (1979); Jackendoff (1975); Aronoff (1976); Allen (1978); Selkirk (1981) and Meijs (1975, 1979, 1981b) include some sort of word formation rules. Of all the different proposals that have been suggested, two of the most influential types of rule will be discussed in this section, those of Halle (1973) and those of Aronoff (1976). The main purpose of this discussion is to show that word formation rules (WFRs), though intellectually appealing, are not likely to provide a powerful explanation for the actual role of morphology in language.

Halle's (1973) postulates two types of WFRs. As the lexicon in Halle's model consists of morphemes, the first type of WFRs combines these morphemes to make

6 The Feature Percolation Conventions that have applied in this example are FPC I: "The features of a stem are passed to the first dominating non-branching node" and FPC II: "The features of an affix are passed to the first node which branches. FPC II has applied twice.

words. This type of WFR is described as: $[\text{STEM + ther}]_N$, to create words like *bro+ther*, *mo+ther*, *fa+ther* (Halle, 1973:10). The second type of WFRs accounts for morphologically complex words that take words as their basis, for instance $[\text{ADJ+ness}]_N$, to create words like *blackness*, *blindness*, *shortness*. Halle's model further implies that some WFRs supply syntactic information to the resulting words, as is the case in the latter example quoted: the input of this word formation rule is an adjective; the output a noun. Some WFRs will also comprise semantic information. In the case of the WFR used to create words with the affix *-hood*, for example, it is stated that this rule applies to nouns designating human beings (*boyhood*, *brotherhood*[7]), and that the result of the rule is a noun marked with the feature [+abstract]. The result of a WFR can be subject to further word formation (as is obvious from the loop in Figure 1), to account for words that contain more than two morphemes. The word *totality*, for instance, is the result of the subsequent application of $[\text{STEM+al}]_A$ (accounting for *total*) and $[\text{ADJ(+i)+ty}]_N$.

As one of the first models in the lexicalist tradition, it is only natural that Halle's model raises more questions than it answers. One of the weaknesses of this model is the order in which WFRs are assumed to apply. The derivation of *totality*, for example, requires that for the correct sequence of WFRs the system should "know" what the internal constituent structure of words looks like. However, as the discussion in 2.3.1 shows, this is problematic. A further problem for Halle's WFRs is that they are extremely powerful. For example, to account for the word *serendipity*, Halle needs the rule $[\text{STEM+i+ity}]_N$. But if this rule applies to the morpheme *tot*, the result, **totity*, is not a valid word. This word, like all other over-generated "words" will have to be marked "[-lexical insertion]" in the Filter. Seen from the perspective of generative grammar in those days, the disadvantages of Halle's WFRs are that they are substantially different from the contemporary syntactic and phonological rules. They are also much too powerful, leading to an extreme extent of over-generation, arbitrarily solved by postulating an all-powerful filter. From the point of view of psychological reality, this type of WFR must in any case be rejected for reasons of economy: a rule-based system that mostly generates non-existing words that have to be stored in an "anti-dictionary" is psychologically unlikely.

Aronoff (1976) worked within the same theory of generative grammar as Halle, and he too assumes word formation rules to be an essential part of the grammar related to lexicon. Aronoff's WFRs, however, are different from (many of) Halle's in that Aronoff takes the word and not the (bound) morpheme as the basis of WFRs. Aronoff's word formation rules are further restricted in that they are only used to account for regular productive derivations that take single words as their input: "a new word is formed by applying a regular rule to a single already existing word" (p. 21). All morphologically complex words that are irregular and unproductive are assumed to be listed in the lexicon, while inflection and compounding are taken care of by syntactic transformations. Like Halle's rules, Aronoff's WFRs define the syntactic

[7] The fact that *brotherhood* is not transparent, as it does not refer to a male sibling, is of no importance to the application of the WFR; all idiosyncratic meaning is accounted for by the Filter.

and semantic properties of their output. An example of the kind of WFR that Aronoff's advances is:

$[[X]_V\#er]]_N$ 'one who Xs habitually, professionally, …' (Aronoff, 1976: 50).

Due to Aronoff's restrictive assumptions, many of the problems that were noticed for Halle's WFRs present no problem for Aronoff's. The cranberry problem, for instance, is avoided by assuming a word-based morphology, in which there is no place for (bound) morphemes. The disadvantage of this position is that one loses the possibility to refer to some semantic generalisations for forms containing similar bound morphemes like *reduce*, *deduce*, *induce*, *conduce* and *adduce*. Limiting the application of WFRs to existing words and limiting WFRs to living, productive formations minimises the chance of rules to over-generate and create words that are not possible. However, even productive morphological types can generate non-existing words. As *curiosity* can be formed on the basis of *curious*, it will be difficult to stop **gloriosity* from being formed on the basis of *glorious*. To account for this apparent inconsistency, Aronoff introduces the notion of "blocking", based on the non-occurrence of synonymy in the lexicon: **gloriosity* will not be formed, as its semantic slot in the lexicon has already been taken by the already existing noun *glory*. Words formed by fully productive WFRs cannot be blocked, because these words will never be entered in the lexicon. This explains the possible co-existence of *gloriousness* and *glory*. Aronoff has a point in claiming that pure lexical synonymy does not exist: even for seemingly synonymous words pairs like *buy* and *purchase*, and *bucket* and *pail*, some semantic/pragmatic (e.g. register) difference can always be found. This position is further supported by acquisition data (see Chapter 3). However, an obvious problem for this approach is how to determine the exact productivity of a WFR, especially since productivity does not seem to be an all-or-nothing affair. This issue will be addressed in section 2.5.1 below.

Assuming a word-based system, Aronoff avoids many problems that morpheme-based approaches are being faced with. However, this is at the expense of some possible semantic regularity of bound morphemes. Limiting the application of WFRs to single words only leaves us with the problem of the status of compounds. Especially root compounds tend to be rather unpredictable in their meaning (compare, for instance the meaning of *poison* in the words (or phrases) *rat poison* and *snake poison*) suggesting that these words should be part of the lexicon. Disregarding compounds in word formation is a serious flaw, especially when bracketing paradoxes, like *transformational grammarian* are taken into account. The same can be said about other types of affixation in which the word cannot be considered the basis, like the affixation added to phrases: *a far outer* (a nonconformist) and *I feel particularly sit-around-and-do-nothing-ish today*[8]. In addition, the exclusion of inflection from the lexicon may not be justified, as the basis for a distinction between derivation and inflection is unsound (see 2.5.5) and because some (inflectional) allomorphy is lexi-

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[8] These examples are taken from Bauer (1983). For a detailed critique on Aronoff's word-based WFRs, see Bauer (1980).

cally conditioned and must be accounted for by the lexicon. Finally, the limitation with regard to the productivity of WFRs is appealing, as a model that generates words that are not possible in a language is too far from linguistic reality. Yet, this raises questions about the degree of productivity that Aronoff's model is unable to answer. So, apparently, all of Aronoff's assumptions can be challenged, either on theory-internal grounds or on grounds of psychological reality.

In fact all WFRs (both Halle's and Aronoff's) are very much like redundancy rules in that they apply only once and cannot be undone once they have applied. They are what Spencer (1991: 84) calls "once only" rules. Their function is therefore predominantly to be used in the analysis of words rather than in word production. In this respect both Halle's and Aronoff's models are quite different from psycholinguistic models of language processing. Their function is to describe a static situation in language, not to provide a diachronic explanation of word processing. But although neither Aronoff's nor Halle's model is geared towards the explanation of actual language processing, the psychological reality of any model must be accounted for. Moreover, it has been argued (e.g. by Walsh, 1983) that the classical type of word formation rules cannot be accounted for in terms of language acquisition: these rules are claimed to be "unlearnable". The issue of the "learnability" of morphological rules is elaborated on in Chapter 3 (3.2.3.1). Despite the rich source of inspiration that the classical model of morphology and the lexicon has been in the past twenty odd years, the conclusion must be that a theory of language that is not in agreement with the actual linguistic behaviour of language users must be considered of little value.

2.4 Modelling morphological processing

Besides theoretical linguistic approaches to morphology, several psycholinguistic models of morphology and the lexicon have evolved. In search of a model that can be adopted (and adapted) to account for the acquisition and use of L2 morphology, a wide range of proposals made over the past twenty years will be examined in this section. Similar to the overview of the linguistic theories in the previous section, the main aim of this survey is to provide a framework for the model proposed later in this book, and does not pretend to be an all-embracing overview of the field. This discussion is organised according to the main streams of theories modelling storage and retrieval of morphologically complex words: models postulating that morphologically complex words are always divided into their constituent morphemes before lexical access takes place, models postulating that morphologically complex words are stored as whole words in the lexicon and are never or hardly ever analysed into morphemes, and models taking a compromise position between these two extremes. The two main approaches run parallel to linguistic theories of the lexicon that posit a morpheme-base lexicon and a full-listing lexicon respectively. Not surprisingly, psycholinguistic models and linguistic theories share the issues that are essential to any theory involving morphology and the lexicon: the role of productivity, the distinction between meaning and form, the nature of lexical representations and the distinction between inflection and derivation. These issues may occasionally arise in this section (as they did in the previous section), but will be elaborated on in a separate section later in this chapter (2.5).

Contrary to linguistic theories, psycholinguistic models have primarily been based on experimental evidence. Most of the experiments investigating word access in the mental lexicon involve reaction time measurement in lexical decision tasks, and priming tasks. The basic assumption underlying lexical decision tasks (LDTs) is that the processing time for the recognition of words can be measured and that the difference in reaction time to respond to different forms (e.g. morphologically complex vs. morphologically simple) provides information about the structure of, and the access to the lexicon. The same principle is used in priming tasks, in which the effect of a prime (e.g. the root of a morphologically complex word) on a target (the whole word) is measured and expressed in terms of facilitation or inhibition (in milliseconds). Although the focus of attention will be on visual word recognition, I will also include some models of and experiments involving auditory comprehension whenever these appear to be relevant for the discussion. Furthermore, as it will be argued later in this study that the core of the lexicon is neutral between comprehension and production, production studies are equally relevant for this discussion and are therefore referred to.

The discussion in this section will show that models accounting for the processing of morphologically complex words should ideally combine the two extreme positions: neither a full-listing approach (2.4.2) nor an approach exclusively assuming decomposition (2.4.1) is tenable or adequate. The many compromise positions that have been proposed (discussed in 2.4.3) vary widely with regard to both the access procedure that is considered the default and the factors that determine when and how each procedure is applied. Based on the examination of the models in this section, I will express a preference for a compromise position that has great explanatory power. This preference will be further supported in section 2.5.

2.4.1 Affix stripping

Similar to morphological theories assuming a morpheme-based lexicon in combination with word formation rules, psycholinguistic models of the mental lexicon have been proposed that posit lexical storage of morphemes combined with access procedures in which all affixes of a morphologically complex word are always “stripped off” prior to lexical access. One of the first and most influential papers taking this stand was written by Taft and Forster (1975). They view lexical access for the visual recognition of prefixed words as a serial process consisting of a number of steps to be taken in a fixed sequence (see Figure 4). They make this claim on the basis of empirical research involving reaction time measurement: it takes longer for readers to decide that a non-word containing a real prefix is not a word than to decide on matched unprefixed controls. One of their assumptions is that affixed words are stored in their base form in the lexicon: *un**lucky***; ***cat**s*. The target of lexical search, they claim, is the root and not the word as a whole. Bound roots are also stored separately and words containing these roots (like *pre**fer**ability*) must be decomposed before lexical can occur. This view was supported by further studies by the same authors, though with some substantial alterations. Taft & Forster (1976) conducted five experiments examining the storage and retrieval of polysyllabic words. In this paper, the authors argue that polysyllabic words are accessed via their *first* syllable, regardless of whether the words are polymorphemic or monomorphemic. Polysyllabic single morphemes (*platform*), they claim, "are recognized by the same procedure as are polysyllabic words containing two morphemes" (p. 611/612), as non-morphemic syllables and morphemic syllables are functionally equivalent. To determine the first syllable of the word, left to right processing is postulated until a matching lexical entry is found. One of the effects found in lexical decision tasks was that words beginning with letters that could signal a prefix (*regatta*, *disciple*) take longer to recognise than words that do not begin similar to a prefix: *graffiti*, *Tabasco*). Taft & Forster take this as evidence that an attempt is made to strip off prefixes whenever possible.

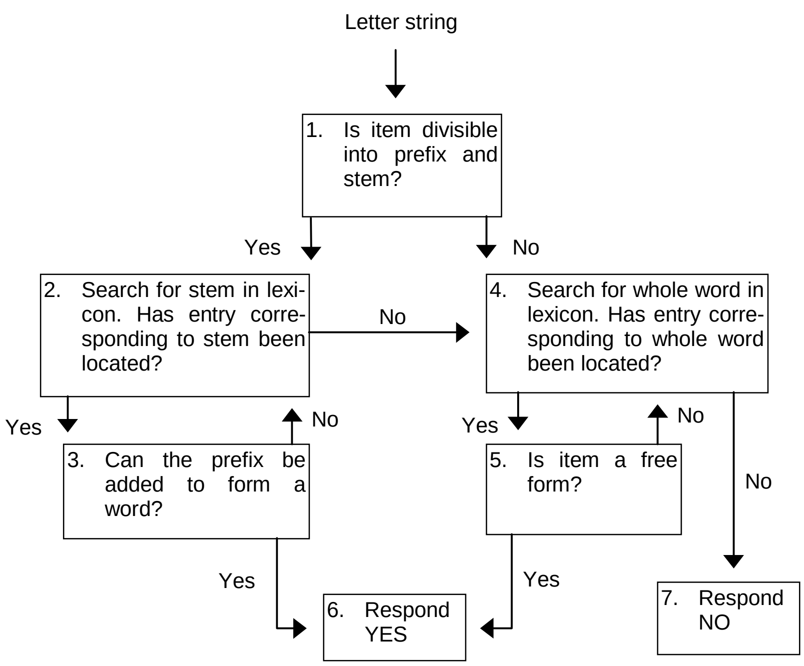

Figure 4. Model of word recognition as proposed by Taft & Forster (1975).

Taft & Forster's articles have initiated a lively discussion between advocates and opponents of the affix stripping position, addressing both the methodology they used (especially the criteria set for the distinction between affixed and pseudo-affixed words, see 2.5.6), their basic assumptions and the motivation for their model. Henderson (1985) elaborates on the problems of this model of lexical access. One of his objections is that stage 1 in Taft & Forster's (1975) flow chart (see Figure 4) is problematic, because "English words are likely to be subject to several decompositional solutions" (p.43) out of which only one can be chosen. Henderson's critique can be generalised to all other theories postulating serial processing: this problem will hold for any serial model of morphological processing and can only be overcome by assuming a parallel model of lexical access. Taft & Forster's rationale for assuming morphological decomposition is economy of storage: it is more economical to store one root for a number of different words. If efficiency of lexical storage is indeed a decisive factor in the choice of the strategy to be employed, it is likely that a minimal number of lexemes are stored to reduce redundant information in the lexicon. However, for similar reasons of efficiency it can be argued that it is unlikely to assume exclusive reliance on word formation rules in producing and processing morphologically complex words. Firstly, morphological decomposition is less attractive for affixed words which have a bound root (*pre**fer***) or those which are highly complex (*unre**mit**tingly*). Secondly, as MacKay (1978) points out, it complicates mechanisms for learning, perceiving and producing morphologically complex words. It requires, for instance, a complex perceptual system for distinguishing real derivatives (***un**true*) and pseudo-derived words (*uncle*), and this would complicate connections that have to be made to the semantic system. Taft & Forster's second argument in favour of decomposition is that this allows for the clustered storage of morphologically related roots, which would increase processing efficiency: by stripping off the prefix, words can be stored alphabetically. In this way, the entry for, for instance, (*re)juvenate* could be located without having to search through all the words beginning with *re-*. But this assumption bears some problems as well: although clustering may economise storage in transparent cases, (*work, works*, *worked*, etc.) it would pose a semantic problem for opaque word formations: *(in)vent* and *(pre)vent*; *(im)plore* and *(ex)plore*. A related problem is the assumed access via the root of the word: a pure model of decomposition cannot accommodate the large number of irregularities and idiosyncrasies in the lexicon. For strongly lexicalised and opaque complex words like *sweetbread, runner* (in the interpretation of table covering)[9] and *drawer* (in the interpretation of part of a *dresser*) access via the root will lead to incorrect semantic interpretation. Finally, as Taft & Forster assume storage of morphemes, utilising a very broad definition of morpheme, their model faces the same problems as Halle's (1973) model of the lexicon: no mechanism is incorporated to check the legality of concatenations of root and affixes, and thus fails to solve the problem of lexical gaps.

Taft (1979) attempts to solve some of these problems by assuming a different way of storing stems in the "access bin", the stage at which words are decomposed before entering the lexicon. Taft introduces the BOSS unit: basic orthographic syllable structure for the visual recognition and storage of stems. The BOSS unit is the string that starts with the first consonant after the (stripped) real prefix and contains as many consonants past the first vowel as possible, but without violating orthographic rules and without crossing morpheme boundaries. This means that *fin*, *final*, *finance, fine, finish, finite, define* and *confine* all share the same BOSS unit and as Taft (1987) puts it are "listed together in some way" (p. 266). Although this may

[9] Example from Meijs (1985b).

speed up access procedures for some words, there are some obvious disadvantages to it as well. As Sandra (1994) points out, moving away from the morpheme as a basic unit implies that words sharing an access code need not be morphologically or semantically related. This means that at the level of the access bin speed may be gained that is lost again once the structure enters the mental lexicon.

In reaction to Taft & Forster's articles, Stanners et al. (1979) argue that affix stripping will not always take place. Contrary to Taft & Forster, they propose a model that assumes separate memory representations for roots that are bound morphemes and roots that are free morphemes. For affixed words both the root and the whole word is represented in the mental lexicon; words with free morphemes (*untrue*) as their root access both the unitary representation (*untrue*) and that for the root (*true*). As lexical processing is assumed to combine information about the whole word and the root, they argue, parallel processing is required. To investigate the representation of words in the lexicon they tested three types of prefixed words in a series of priming experiments: one with free morphemes as roots (*untrue*), and two with bound morphemes as roots: with a unique roots (*rejuvenate*) and with a roots that are shared with other words (*progress*). Their results show that prefixed words may access memory representations of word constituents, but (in addition) always access unitary representation of the whole word. Partial representations of the word with free morpheme roots (*untrue*) access both the representation for the whole word and that for the root (*true*). Words with bound morpheme roots (like *progress*) access memory representations for both the whole word and for words with which they share a prefix (like *regress* and *ingress*). This position is heavily opposed to by Taft (1981), who claims that the experimental data of Stanners et al. could also be accounted for by the Taft & Forster (1975) model. Taft's conclusion is that "the notion that whole words as well as stems are stored in the lexicon is an unnecessary elaboration of the model on the basis of these experiments" (p.290).

As two essentially different models can explain the same experimental data, the conclusion must be that these early models are too general to make specific claims that can be tested in reaction time experiments. Taft's (1981) attempt to silence the opposition by producing new experimental results supporting the Taft & Forster model was not very successful due to many methodological uncertainties in these experiments (see 2.5.6). Due to the lack of sound empirical support and the ambiguous motivation of the affix stripping model, models leaving open the possibility of both decomposition and (simultaneous) unitary access appear to be more realistic: there is quite some evidence that decomposition does occur, but there is no evidence that decomposition always takes place. Nor, as Henderson (1985) points out, is it evident that decomposition necessarily takes place before lexical access. Henderson supports the latter remark by pointing to the observation that the initial letters of a word, whether they constitute a prefix or not, do activate semantic information, independent of the root of the word. In the word *introvert*, for instance, both *in* and *intro* may contribute some semantic activation, even though **vert* is not a free morpheme. This kind of semantic activation does definitely not involve prelexical morphological decomposition.

Also on the basis of *production* studies, claims have been made for decomposition of morphologically complex words as the default processing strategy. MacKay

(1978) compares the same two basic hypotheses as had been studied in word recognition tasks so far: derivation (the Derivational Hypothesis, DH) and direct access (the Independent Unit Hypothesis, IH). In his study, subjects were asked to nominalise orally presented verbs as quickly as possible. If, for instance, *defend* was provided, subjects were expected to rapidly produce *defence*. Four complexity levels were determined and tested: pairs like *decide / decision* were expected to require more complex processing than pairs like *conclude / conclusion*, because of the additional vowel alteration rule, and it would consequently take the subjects longer to respond to the former. The results indeed showed longer response latencies (and a higher error probability) for higher levels of phonological complexity, which leads MacKay to conclude that the subjects must have applied morpho(phono)logical rules: this could only be accounted for by DH. Based on these findings, MacKay pronounces a clear preference for derivation over direct retrieval; he concludes that the derivational hypothesis is more likely for "everyday production", but stresses that his study does not rule out the possibility that "words may be stored in some memory system" (p.70). Criticism of MacKay's study has concentrated on the limited set of English derivations and on the fact that although MacKay's findings did confirm the DH, no evidence is given against IH. Henderson (1985) points to the absence of a control condition, and remarks that without that, the effect noticed is not necessarily attributable to the phonological complexity of the process of nominalisation. Instead, Henderson assumes that the effect is "one of interference between independent units"(p.26): partial activation of the phonological output for one of the forms may interfere with the production of the other. Although MacKay's study does not in itself give evidence for this view, the lack of a control condition indeed gives rise to speculations like Henderson's. A final criticism could be that in MacKay's test the frequency of the items is only marginally taken into account, though this appears to be an important factor. However, in spite of all criticism, MacKay's study has provided some useful evidence for the DH, without excluding the possibility of direct access. This was an important next step towards the recognition that the two hypotheses are not mutually exclusive.

In the latest generation of psycholinguistic models, Taft & Forster's 1975 position of obligatory decomposition prior to lexical access is hardly adhered to. In most contemporary theories of the mental lexicon (Caramazza, Laudanna & Romani, 1988, Schreuder & Baayen, 1995), the compositionality of morphologically complex lexical items is certainly taken into account, but it is not obligatory, nor does it necessarily take the form of morphological decomposition. And it does not usually take place before lexical access. But the discussion on this issue is still very much alive. Taft's (1981) defence of the Taft & Forster (1975) model, has even very recently prompted a reply by Schreuder & Baayen (1995) in which new insights from computational linguistics are utilised to demonstrate flaws in the prefix stripping assumption. The main issue in their argumentation is that in a serial model involving decomposition prior to lexical access, pseudo-prefixed words leads to "backtracking": if the stem of a pseudo-prefixed word (de-*corum*) enters the lexicon, no match will be found and the system requires a second cycle, in which the lexicon is searched for an entry of the whole word. If backtracking is incidental, it will not strongly affect the overall processing efficiency of the system. However, by means of a computer corpus investigation Schreuder & Baayen demonstrate that in more than 80 per cent of all prefixed words in English backtracking is required[10]. They further calculated that the average number of search steps required for the prefix stripping model is almost eight times higher than the search steps that are necessary in a base-line model. The obvious conclusion must be that the addition of a prefix-stripping module to a serial search model does not contribute to greater processing efficiency, but rather impairs processing efficiency.

As the models of lexical processing have mushroomed since the early Eighties, a full account of all models currently available is not feasible within the scope of this study. But to illustrate the evolution of thinking about affix stripping over the past 20 years, the current position of Taft (1991, 1994) is interesting. In his most recent "interactive activation framework", based on, among others, McClelland (1987), Taft postulates that prefixed words are represented in a decomposed form, without the necessity of prelexical prefix stripping: in this model no separate storage of prefixes is assumed, but prefixes are treated separately from their roots, because morphemes constitute independent activation units. So, although Taft retains the position of a separate role for prefixes in a serial model of lexical access, he has given up the idea of obligatory prefix stripping prior to lexical access.

2.4.2 Full listing

The opposite position is that the lexicon does not contain any morphological information that is stored separately, be it affix or root, and that lexical access always takes place through an independent lexical representation for each word in the language. In linguistic theory, this "full-listing" position is taken by Jackendoff (1975). In psycholinguistic models of the lexicon an upsurge of the full listing model was initiated as a reaction to Taft & Forster's (1975) prefix stripping position. All models advocating this position, however, will have to account for people's observed ability to understand and create (pseudo-)words on the basis of roots and affixes: all speakers of English will be able to derive the form "wugger" for "someone who wugs" (Berko, 1958). To account for productivity, approaches supporting full listing usually incorporate the possibility of decomposition.

Advocates of the full-listing hypothesis usually point to the idiosyncrasy of affixation: the meaning of affixed words is often not predictable from the meaning of their constituents, and it may be hard to find regularity in the combinations of affixes and roots. In English, for example, the verb *induce* has the derived forms *induction* and *inducement*, whereas *produce* has *production* and *produce* (N), excluding **producement* (Butterworth, 1983: 264). In addition, Butterworth (1983) shows that there is little semantic regularity for suffixed forms (*induce-* + *-ment* / *-ive* / *-tion* / *-ible*). After an elaborate discussion pointing to evidence from speech production, speech perception and reading, Butterworth concludes that it is not likely for the mental lexicon to contain morphological rules, and that, due to the idiosyn-

[10] The definition of pseudo-prefixation used by Schreuder & Baayen is strict, giving the prefix stripping system the benefit of the doubt (if any).

crasy of semantic relations, a full-listing model is the only model possible. However, despite many convincing examples, doing away with morphological regularity altogether seems to be a rash decision that overlooks many morpho-semantic relations that are regular and productive[11]. Moreover, any conclusion regarding the structure and processing of lexical items should be based on sound empirical data instead of exemplary evidence.

Access procedures in full-listing models are generally assumed to take place through spelling patterns and syllables, rather than through affixes. Seidenberg (1987) and Rumelhart & McClelland (1986), for instance, try to account for the recognition or production of words by orthographic patterning without the use of morphological cues. In terms of reaction times, this would mean that there are no differences in access times between morphologically complex words and similar monomorphemic words of comparable length. This was indeed what Manelis & Tharp (1977) found when they conducted a reading experiment to compare the reaction times for unsuffixed words (like *fancy*) to suffixed words (like *dusty*). In their experiment, they included regular and productive derivations, like *-y*, *-est* and *-er*, to create a context that is most likely to elicit differences between the conditions in the test. However, no significant differences in response times were found for affixed words as compared to nonaffixed words. These results, they claim, show that word recognition does not involve decomposition, neither before, nor after lexical access. But this is a hasty conclusion that presents a gross oversimplification of the problem and that is not motivated by their results. The fact that they found no differences in reaction times for these items is not to say that lexical access never relies on morphological decomposition. In view of the productivity problem, this position cannot be maintained.

A compromise position would be to say that it is only in very specific contexts that morphological complexity plays a role. Evidence for this was found by Rubin, Becker & Freeman (1979). The results of a lexical decision task they conducted indicate that morphological structure affects word recognition (longer latencies) only in contexts where all words, including the filler-nonwords, were prefixed (*deview*, *enpose*). In a neutral context, where the words and nonwords other than the targets were unprefixed (*danger*, *custom*, *demple*, *curden*), the overall reaction times were faster, even for the pseudo-prefixed words (*uncle*). On these grounds, Rubin et al. conclude that a decomposition strategy may be available, but is only used in very specific contexts.

The relevance of morphological information in word processing is further supported by several studies showing that morphological features do affect word recognition and that these effects cannot only be accounted for in terms of orthography and phonology (Fowler et al., 1985; Feldman & Moskovljević, 1987; Hanson & Wilkenfeld, 1985; Napps & Fowler, 1987), nor by semantics alone (Bentin & Feldman, 1990; Feldman, 1992). Stolz & Feldman (1995) conducted five (priming) experiments to investigate this further. In a long-lag priming task, prime-target pairs

[11] These regularities point to at least some consistency in the relation between form and meaning. This issue is further discussed in section 2.5.2.

were compared that were either identical (*mark-mark*), morphologically related (*mark-marked*) or orthographically related (*market/marked*). The results show significant facilitation for the identical prime-target pairs and the morphologically related pairs, whereas the facilitation obtained for orthographically related prime-target pairs was not significant. In the second experiment, orthographically related prime-target pairs with and without a shared base morpheme were compared (*marked* - *mark* and *market* - *mark*). The results of this experiment show that orthographically related but morphologically unrelated primes tend to inhibit rather than facilitate recognition of the target, indicating that morphological information in words is relevant, as the orthography was kept constant. The third experiment shows that the component structure of pseudowords does affect recognition, supporting the authors' claim that besides semantic information, also morphological information is important in the recognition of morphologically complex words. The fifth experiment conducted was a "segment shifting task", in which subjects were instructed to separate a segment from a source word, to shift the segment to a target word, and then to name the newly coined word as rapidly as possible. For instance, the form *harden* was provided with the target form *bright*; the subjects were required to shift the affix *-en* to the target and name the newly formed word *brighten*. This line of experimentation is very interesting as it seeks to combine production and perception strategies. In this experiment the results for morphologically complex source forms, like *harden*, were compared to morphologically simple source forms, like *garden*, involving both inflectional and derivational suffixes. The outcome of this experiment shows that shifting latencies are significantly faster for morphologically complex forms, even when these have a lower overall frequency than the morphologically simple words. Stolz & Feldman conclude that based on previous studies in combination with their own experiments, "similarity based on orthography and phonology or on associative semantics alone cannot account for morphological effects" (p. 126). This is a very reassuring conclusion for anyone who is eager to hold on to the meaningfulness of morphological information for word recognition, but it is also a conclusion that should be tentative. After all, as the authors themselves acknowledge, drawing a single conclusion about different dimensions of language based on a series of experiments involving different variables and different sets of words, cannot possibly take into account the interconnection of all variables. Moreover, some variables, like the distinction between inflection and derivation, may turn out to be more important than appears from this article. But in spite of this, their paper shows that morphological cues in word processing are not to be underestimated.

As morphological (de-)composition during lexical access is not a major issue for full-listing models, these models emphasise the role and organisation of the lexical entries in the lexicon. Butterworth (1983) proposes modality specific Lexical Representations consisting of words of which the internal structure marks the morpheme boundaries. All morphologically related forms (*walk*, *walks*, *walked*) are grouped together in one "unit type" (or "name", in Bradley's (1980) terms). To solve the productivity problem, Butterworth assumes "fall-back procedures" that can be used to produce new words or to analyse unfamiliar words. The idea of fall-back procedures is also used by Aitchison (1994), who postulates a full-listing model consisting of a "main lexicon" including all existing words, a "back-up store" in which the morphological boundaries of words are stored and a “lexical toolkit” to generate and analyse new or unfamiliar words. The main body of evidence Aitchison uses for her assumptions consists of speech error data. The fact that prefixed words often interchange with non-prefixed words (*porcubines* instead of *concubines*; *concubines* instead of *columbines*) is interpreted as evidence that prefixed words should not be regarded as a special category. In addition, malapropisms of words containing suffixes (as in *provisional* for *provincial*), are said to show that the suffix is "tightly attached" (p.115). But this evidence is not very convincing: all these words will be opaque for most speakers of English, and these examples cannot make any claims about the degree to which transparent, fully productive affixes are attached to their roots. Besides, Aitchison does not clearly distinguish between semantically motivated morpheme selection and the eventual selection of syllables. Speech errors can usually be attributed to the latter stage, and do not necessarily make claims about the storage of items in the mental lexicon. Although the idea of word boundaries included in lexical entries, linked by some mechanism of word formation may be appealing, its foundations in Aitchison's model are questionable. Moreover, this model does not satisfactorily resolve the question how it should be determined when unitary access takes place and when (de-) composition is used.

In sum, the evidence in favour of the full-listing hypothesis clearly suggests that a pure decomposition position cannot hold. This has been demonstrated by many examples of lexical irregularities that cannot be accounted for by decomposition alone. This view is supported by empirical evidence indicating that there is no difference in access time between some morphologically complex words and orthographically similar, morphologically simplex polysyllabic words. The counter-evidence against a pure affix-stripping position should, however, not be overgeneralised by stating that morphology plays no role whatsoever in word processing. Recent studies have convincingly shown the relevance of morphology in lexical access. Moreover, the logical problem of productivity requires full-listing models to accommodate the possibility of morphological decomposition. The conclusion must therefore be that neither a pure affix stripping position, nor a pure full-listing hypothesis is tenable and that a compromise position will have to be adopted. This conclusion, however, raises more questions than it answers. For instance, are the different methods of access applied simultaneously or successively? If simultaneously, what determines the eventual success of one procedure over the other. If successively, how is it determined which access procedure applies in which situation or with which words? Different proposals with regard to these questions are discussed in the next section.

2.4.3 Compromise positions

Two streams of compromise positions can be distinguished. First, there are models that use one of the “extreme” positions as a starting point and (are obliged to) incorporate parts of the opposite school to account for effects otherwise left unexplained. Secondly, there are models that use a mixed approach as a starting point and argue that some words or word groups are accessed directly whereas others are analysed, or that both types of access take place simultaneously in a model of parallel processing. Most of the models of the first type have been discussed in the previous sections. This section will therefore concentrate on the second type.

An early model combining the direct access and decomposition was posited by Meijs (1975, 1979, 1981b, 1985), graphically represented in Figure 5. His proposal is one of the few that seek to fit a psycholinguistic model of the mental lexicon into (transformational generative) linguistic theory. Like Aronoff's and Halle's, Meijs's model contains word formation rules, and aims at lexical insertion into syntax rules at deep structure. However, the model could best be compared to Jackendoff's (1975) theory of the lexicon, as it assumes full listing rather than morpheme or word listing. The WFRs that Meijs refers to are more similar to Jackendoff's redundancy rules than to Aronoff's or Halle's word formation rules in that they form projections of the patterns of morphologically complex words the speaker knows. An essential distinction in this model is that between *possible* and *existing* words. Existing words are listed in the full-entry lexicon, but possible words (that are always regular) are not: the speaker "knows" these words "projectively" by referring to a WFR. Meijs refers to this distinction by speaking of the Item Familiar Lexicon (IFL) and the "Type Familiar Lexicon" (TFL).

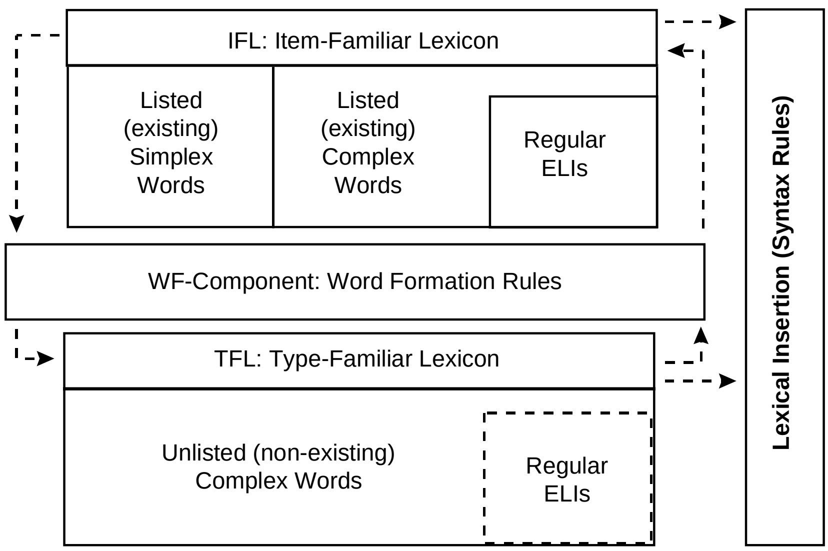

Figure 5. The structure of the mental lexicon according to Meijs (1981b) The item-familiar lexicon (IFL) comprises all existing lexical items, complex and simplex; the type-familiar lexicon refers to all words that can be derived from word formation rules. The regular existing lexical items (ELIs) are represented in both the IFL and the TFL: these items may be listed, but can also be derived on the basis of WFRs.

The IFL is a finite list of all existing words; the TFL is the indefinitely large set of words that can be formed or interpreted at a particular moment by the application of word formation rules. In this model, productive word formation rules can be applied to coin regular lexical items but need not be, since frequently used complex morphological items are assumed also to be stored in the Item-Familiar lexicon. In this way, all of the existing regular morphological complex words are accessible in two ways: via words formation rules in the ITL and directly as existing items in the TFL. The default strategy, however, will be direct access, Meijs argues, because this is faster.

In an experiment involving reaction time measurement, Meijs (1985) compared access times for complex and simplex lexical items and found that the results of his test confirmed the main predictions about the model. Access times for idiosyncratic complex items were equal to access times for simplex items (direct access is always used for full entries); existing regular complex lexical items (CLIs) were accessed as quickly as the idiosyncratic items if accessed directly (=default), but more slowly if not; non-existing, possible CLIs will have to be decomposed, and indeed turned out to have slower access times.

The power of Meijs's model is that it can account for newly formed complex words while maintaining a full-entry lexicon. But in spite of this asset, the model leaves many questions unanswered as it contains a number of "black boxes". How can the speaker have access to WFRs if these are not stored? What exact information do the WFRs comprise? What information is stored in the lexical entries? Moreover, the model is clearly inspired on the central position of syntax in the language ("lexical insertion") that was common in early generative models of morphology and that has generally been abandoned in modern morphological theory.

The distinction between possible (unlisted) and existing (listed) words is appealing, because it provides an explanation for the many contradictory findings in earlier psycholinguistic experiments. At the same time, however, this distinction is problematic, as a clear-cut two-way distinction cannot be made with regard to these concepts. For instance, Meijs allocates the word *vulbaar* ("fillable") to the possible, but non-existing group and *slechtheid* ("badness") to the existing, listed group. Choices like these are rather arbitrary and may vary from speaker to speaker and from context to context. Therefore Meijs specifies that the model is to be seen as "a strictly-synchronic reflection of the idealised language-user's lexical store, as well as his complex-word potential at an arbitrary, fixed point in time, M" (Meijs, 1985: 77). However, the disadvantage of this solution is that it explicitly creates a static model that is inherently unable to account for language processing as a dynamic process. In a footnote, Meijs mentions a tentative solution to this problem by introducing "a kind of threshold level associated with mental traces left by productive/interpretive occurrences, beyond which it becomes economical to create a new full entry in the IFL for some possible combination, which is thereby promoted to the status of listed complex word" (Meijs, 1985: 77). But in this way the problem is shifted rather than solved, because it remains unclear how and by which factors such a threshold level should be determined.

This last question has been central to many other studies investigating the mental lexicon. When assuming a serial model of language processing, one of the most important questions is whether different types of morphological knowledge undergo differential processing. White et al. (1989), for instance, first make a distinction according to the type of affix: they claim that in the case of suffixes the context is used to guess their meaning, whereas in the case of prefixes the meaning is looked up in memory. Then they assume that familiar words are always retrieved directly, whereas unfamiliar words are “stripped”. Their first distinction is motivated by their observation that suffixes change the syntactic category of their base, while prefixes do not. But the validity of this criterion is doubtful, as not all suffixes are class changing. Their second criterion is also problematic: it is hard to define familiarity and it is not clear from their argumentation whether the distinction works in two directions (does it leave the possibility of familiar words to be stripped?). Another distinction could be drawn between inflection and derivation: derivational processes might only be used when we are forced to apply them, while inflectional processes could be assumed to be used whenever we have to understand or produce a sentence or word (Miceli & Caramazza, 1988). In Aitchison’s (1994) model the distinction between inflection and derivation is used as the main criterion for the way words are processed: words containing inflectional affixes are assumed to be decomposed, whereas words containing derivational affixes are accessed and produced as whole words. But since the distinction between inflection and derivation is not always obvious, especially when it concerns languages other than English, it is difficult to maintain this position (see 2.5.5 for a discussion of this issue). Stemberger & MacWhinney (1988) propose a model of spoken production processes in which the criteria are regularity and frequency: all irregular forms are stored, whereas regular forms are generated by rule, except for regular forms that are very frequent. Here, as in the model proposed by Meijs, the problem is to account for the (individual) threshold: at which frequency will words start to be stored?

To solve this apparent problem, Bybee (1985, 1995) introduces the notions of “lexical strength” and “lexical connection”. When the meaning and phonology of an input form is successfully matched to a lexical representation, this representation is strengthened. Hence, lexical strength varies as a function of frequency. Partial mappings, on the other hand, will create lexical connections between the (partially) mapped forms. The lexical connections, reminiscent of Jackendoff’s (1975) redundancy rules, ensure that information about morphological complexity is accounted for by the internal structure of the lexical representations, without having to postulate the separate storage of morphemes, and thus evading the problem of storage or non-storage of bound morphemes. The real solution to the problem of when to store and when to analyse lies in the interaction of lexical strength and the lexical connections. Frequently occurring regular morphologically complex forms will have a high lexical strength and will therefore be less dependent on lexical connections, while low frequency forms will be more dependent on lexical connections and will therefore create stronger lexical connections. Bybee uses diachronic facts to support her model. For instance, frequent derived forms will have the tendency to show semantic drift, whereas infrequent derived forms tend to maintain a close (semantic and form-based) relation with their base. In this way, a continuum can be presumed in which productivity, frequency and transparency interact. On one extreme end of the scale we find forms with the strongest lexical connections (between phonologically and semantically transparent pairs such as *clever* and *cleverness*); on the other extreme end we find opaque pairs like *awe* and *awful*, which have weak lexical connections and high lexical strength. The position on the scale is affected by the token frequency of the derived form (higher frequency weakens connection and increases lexical strength of the derived form), the type frequency of the morphological relation (high type frequency will strengthen the connection) and phonological and semantic similarity (transparency strengthens the connection). What is particularly attractive about this model is that it principally treats regular, irregular, transparent, opaque, inflectional, derivational, productive and unproductive formations in the same way. Moreover, the model is not limited to a particular language module. A possible problem for this model is that it may be hard to make accurate predictions in terms of processing time for the various procedures, as it is not clear how (new) words are being processed. A more serious problem for this model, however, is the validity of the link between connection in processing and diachronic change: although Bybee more or less takes this link for granted, the two types of language development are not inherently linked. Nevertheless, Bybee's model is a valuable attempt to incorporate all relevant variables into a single system.

The lexical models of Meijs and Bybee contain elements and concepts, like Item-familiarity, Type-familiarity (Meijs), lexical strength and especially the role of frequency and transparency (Bybee) that are very valuable and that will be adopted in the model proposed later in this book. Moreover, Meijs's representation of the mental lexicon provides an accurate picture of the role of morphology in the mental lexicon and is in line with some of the psycholinguistic models that will be discussed below. However, neither of these models is geared towards explaining the (development of) acquisition of L2 morphology, which requires a model that can account for dynamic language processing. In the rest of this section, I will therefore discuss some models in which the processing time is the primary concern. These are models assuming parallel processing, postulating that both direct access and decomposition is attempted simultaneously, and that the search ends as soon as one of the processes manage to retrieve the desired form.

One of the first proposals for parallel processing was that of Stanners et al. (1979), formulated as a response to Taft & Forster (1975) and mentioned in 2.4.1. Essential to their model is that some words (those with free morphemes) will access both the unitary representation and the representation of their root: *untrue* will access both *untrue* and *true*. Words with bound roots, however, will access both the unitary representation and the words they share a prefix with: *progress* will activate *progress*, but also *regress* and *ingress*. In this way, it is not necessary to assume storage of bound roots (*-gress*), while the possibility of "affix stripping" is maintained. Although the idea of parallel processing is very appealing, by concentrating on the roots this model does not say anything about the exact function, storage and retrieval of productive affixes, and is therefore unable to account for the productivity problem. This problem is largely evaded by concentrating on prefixes only, which appears to be the least productive of morphological types.

Focusing on productivity in language production, Anshen & Aronoff (1988) stipulate that three processes are at work simultaneously: speakers search their lexicons for words needed, attempt to build the words by rule and construct them from analogy. The authors suggest that the success of the strategy be determined by the productivity of the combination. The model can be seen as a “rat race” with the different processing routes as competitors: as soon as one of the processes has been successful, the other processes will be blocked. A variety of types of evidence, experimental, historical and statistical, the authors claim, support these hypotheses. To determine which strategies of lexical access are used in production, they conducted an experiment in which subjects wrote down all words they could think of ending in a particular sequence of letters (e.g. *-ment*, *-ness*, -ity). In the results, attention was paid to only to *-ibility* vs. *-ibleness*, and *-ivity* vs. *-iveness*, as these would represent a difference in productivity (see 2.5.1 for discussion). The results show that for forms ending in *-ness* more nonce forms were used and less often the same word was used, indicating more forms being created constructively. This leads the authors to conclude that, based on a difference in productivity, *-ity* forms are stored separately from their bases (and picked from a fixed set), while *-ness* forms are not stored with their bases, but constructed by rule as they are needed. The experiment is of extreme simplicity and one may wonder whether a test like this can at all be related to real-life production; focusing attention on a particular form can have (and in fact will have) many disadvantages. An alternative explanation for the large number of nonce forms for *-ness* produced by the subjects in the test, for instance, could be that the subjects felt that they had to produce an equal number of forms for each affix. Since -ness is not as frequent as *-ity*, more nonce forms were likely to be produced.

The “threshold” that Meijs refers to and the “lexical strength” mentioned by Bybee are represented in most modern psycholinguistic models of the lexicon in terms of “activation”, a term borrowed from neuropsychology. In itself, activation does not solve the problem of determining which strategy is used for which words and under which circumstances. But it offers a tool to express and to quantify the chance that a particular strategy is used. The problem can thus be rephrased into finding the factors that affect activation of either the whole word or the constituents of words. Of these factors, transparency, frequency and productivity are frequently mentioned. To close off this section, three models are discussed that try to account for the choice between decomposition and direct access in terms of activation. Based on this discussion, a tentative preference will be expressed for the last of these models, Schreuder & Baayen’s “Meta model” to be used as the foundation for a model of morphological processing in L2.

Productivity plays an essential role in the Augmented Addressed Morphology (AAM) Model of word recognition (Chialant & Caramazza, 1995; Caramazza et al., 1988; Burani & Caramazza, 1987; Laudanna & Burani, 1985). This model postulates that processing is guided by an orthographic surface form. The lexicon is accessed through “access units”, which comprise whole words and morphemes, and which are activated by the input strings. The degree of activation of access units depends on the graphemic similarity between the input string and the stored representation: the input string activates all “similar” access units: whole words, morphemes and orthographically similar forms. For instance, the input string *walked* will activate the access units of the whole word, *walked*, the morphemes it comprises, *walk+ed*, and orthographically similar forms like *talked* and *balked*. An important assumption of the AAM model is that for “known” words whole-word access units will always be activated, whereas novel and unfamiliar morphologically regular words will activate morphemic access units. Hence, transparency and frequency play a crucial role in the activation of the access units: for all orthographically transparent forms both access units for whole-word and morphemes will be activated “to an extent which is directly proportional to the frequency of the access unit” (Chialant & Caramazza, 1995:63). Indirectly, this means that the independence of roots and affixes varies according to their productivity; regularly inflected forms will thus be stored in a morphologically decomposed format.

The AAM model is able to explain the most important empirical findings. The model is in line with the observed effect of root frequency (Taft, 1979): reaction times for morphologically complex words are affected not only by the frequency of the entire word, but also by the cumulative frequency of the forms that share the same root. This effect can be explained by morphological decomposition as in Taft & Forster (1975), but also by assuming the existence of decomposed access units. Also the observed effect of morphological priming (by, for instance, Stanners et al., 1979), showing facilitation for morphologically related words, points to the likelihood of the existence of decomposed access units.

A point of dispute remains, though, concerning the predictions about pseudo-prefixed words. Taft (1994), defending his serial “interactive activation model”, argues that since the AAM model does not allow for morphological decomposition of pseudo-prefixed words (their is no access unit for non-existing roots), these words will have to be processed in the same way as non-prefixed words. This, however, would be incompatible with the observed delay in responding to pseudo-prefixed words. Chialant & Caramazza (1995) refute this alleged weak spot in the AAM model by pointing to methodological weaknesses of the experiment involving pseudo-prefixed words in Taft & Forster (1975) (see below, in 2.5.6), ignoring the fact that Taft’s later and improved experiments (Taft 1981) showed the same effect. Another potential problem for the AAM model is that it takes the orthographic representation of a word as a starting point for lexical access, disregarding the central position of word meaning. Although transparency is crucial to the model, the exact role of semantic aspects at the level of access units has yet remained unclear. This also leads to problems concerning the activation of semantically related forms that are not orthographically regular, like irregular past tenses of verbs and regular spelling features: it is not quite clear how *blurred* should activate the access units *blur-* and *-ed*, or how *deluded* should activate *delude-* and *-ed*. Finally, It is not unambiguously clear whether the AAM model should really be considered as a parallel model, as the lexical search is completed when the access unit that first reaches a pre-set threshold activates its corresponding lexical representation. Frauenfelder & Schreuder (1992) point out that since whole-word representations will always be activated faster than the morphemic constituents of a word, and since this model does not allow an overlap in the temporal distribution of the processing times, the access of morphologically decomposed representations must be seen as a back-up procedure for the processing of new words rather than a route that is actually “competing” with direct access.

A model that is more distinctly parallel is Frauenfelder & Schreuder's (1992) Morphological Race Model (MRM), which was based on Baayen's (1992, 1993) Race Model. The guiding principle in Baayen's Race model is productivity'; the basic assumption is that all morphologically complex words have a full listing entry and a "decomposed" entry. In that sense this model can be compared to the model of Meijs (1975, 1981b) outlined above. An important difference, however, is that Meijs has limited the words that can be accessed "item-familiarly" to "regular" items, which is a concept that is hard to define. Baayen's (1992) starting point is that morphologically productive forms are parsed, whereas unproductive forms are processed through direct access. The processing procedure is assumed parallel; the two routes start simultaneously, and the one that first reaches completion yields the output. The difference with the AAM model is that the two routes may overlap and that, as a consequence, low frequency forms can be recognised by either route. The inclusion of productivity is very appealing, yet the obvious problem with this approach is the difficulty to express the degree of productivity in terms of a processing mechanism. Baayen has attempted to solve this by linking productivity to frequency: words with unproductive affixes tend to be more frequent than words with productive affixes. However, this solution is not satisfactory, as not all low frequency words are productive and parsable.

Frauenfelder & Schreuder (1992) extend Baayen's Race Model by considering the factors that influence the parsing route. They determine the time that is necessary for a word to be recognised for both routes, in which the "resting activation" of a word is crucial. For the direct route, the recognition time depends on the token frequency of the word: the resting activation depends on how often a word is encountered. Words that are more frequent will thus be recognised faster, which is in accordance with empirical findings of whole-word frequency effects. The recognition time for the parsing route is affected by the phonological transparency of the word, its semantic coherence, and the resting activation level of its root and affixes. The model further postulates a unique one-to-one relation between access representations and meaning representations, enabling direct recognition of surface forms and parsing based on meaning representations of roots and affixes. For morphologically simple or opaque words the parsing route will fail, and these forms will be stored and accessed directly. For morphologically complex words, the situation is different. Once such a word has been parsed successfully, the resting activation of the morphemes it comprises will increase, while the resting activation of the whole word will increase even more. In this way it can be explained that the more often a word has been encountered, the higher the resting activation level of the whole word will become and gradually the direct route will be faster than the parsing route. For words with a high surface frequency, the direct route will usually win the race, as these words will have a high whole-word activation level, irrespective of their internal structure. For morphologically complex low-frequency words the fastest route will depend on the activation levels of the root and affixes relative to the activation level of the whole word, which in turn is determined by the number of successful parses and therefore dependent on the degree of transparency of the word. In this way, Frauenfelder & Schreuder have managed to incorporate productivity into the model. After all, productivity coincides with low frequency, and by introducing transparency as a necessary condition for productivity, the problem of low frequency word forms with unproductive affixes has been solved: as the success of parsing is dependent on the transparency of the word, parsing will not be successful for these words and the direct route will win the race.

The MR model is appealing in that it gives insight into the way morphological parsing may actually take place and in the way some essential variables (frequency, productivity, transparency) may interact in determining which route is faster in a parallel model of word recognition. However, it is yet not much more than a rough sketch of this complex system, with many assumptions that will have to be tested and some properties that will have to be refined. Especially the idea that after a successful parse the whole-word entry is activated more than the constituents of the word seems an arbitrary solution to fit the model to a generally observed phenomenon. Moreover, the problem of determining the degree of productivity has been shifted to determining the degree of transparency rather than solved.

The MR model has recently been refined, culminating in Schreuder & Baayen's (1995) "Meta Model". A logical next move after making transparency central to a model is to concentrate on the meaning of the word, and this is indeed what Schreuder and his colleagues have done: the Meta Model focuses on calculating meaning. Unlike the AAM model, it is not limited to visual word recognition. It postulates that morphological processing takes place in three stages: segmentation, licensing and combination (see Figure 6). Further assumptions are that morphologically complex words that are not transparent and very frequent transparent morphologically complex words will have their own lexical representations. The first stage, segmentation, links intermediate access representations to normalised access representations. The assumption of an extra intermediate access representation solves the problem of spelling rules and phonological rules mentioned in the discussion of the AAM model: *blurred* and *deluded* will at this stage be mapped to the access representations *blur*, *delude*, and *-ed*. The access representations will activate one or more concept nodes, which represent abstract concepts with no particular form. In the licensing stage, the activated concept nodes are linked to separate semantic and syntactic representations, which check the possibility to combine concepts in case more than one concept has been activated. In the combination stage, the lexical representation of a complex word, if licensed, is calculated as a function of the semantic and syntactic representations of its constituents. As mentioned above, transparent morphologically complex words can have their own lexical representation. Whether they actually do acquire their own representation is determined by a trade-off of computational complexity and frequency. Following Pinker (1991), Schreuder & Baayen argue that when computation is very simple, even the most frequent complex words will always be coined rather than given their own representation. Regular plural formations, for instance, will be computed, since the only computation that has to be done is to unite the lexical representation of the noun and the plural. When more computations have to be applied, however, a new concept node will always be created. The retention of the new concept will depend on frequency: very frequent forms will retain their own representation, whereas infrequent forms will decay.

The power of this model lies in the mechanism of activation feedback, indicated by the bi-directional arrows in Figure 6. In fact, this system is an elaboration of the ad hoc solution Frauenfelder & Schreuder (1992) used to create a possibility for transparent morphologically complex forms to have their own lexical representations. Activation feedback allows for activation at all levels of the processing mechanism to be affected by all other levels. Access representations not only activate concept nodes, but activation will also flow back to the access representations, affecting the way this access representation will be processed when encountered again. For a transparent morphologically complex word for which a new concept node has been created, this means that the whole word will receive more activation than its constituents. The same occurs at the level of concept nodes: after a successful licensing stage, activation will flow back from the semantic and syntactic representations to (the concept nodes of) the constituents of a transparent morphologically complex word. This, then, is where productivity comes in: "the activation level of the concept node of an affix is a function of the number of semantically transparent formations in which that affix occurs and of the frequencies of those formations" (Schreuder & Baayen, 1995:142).

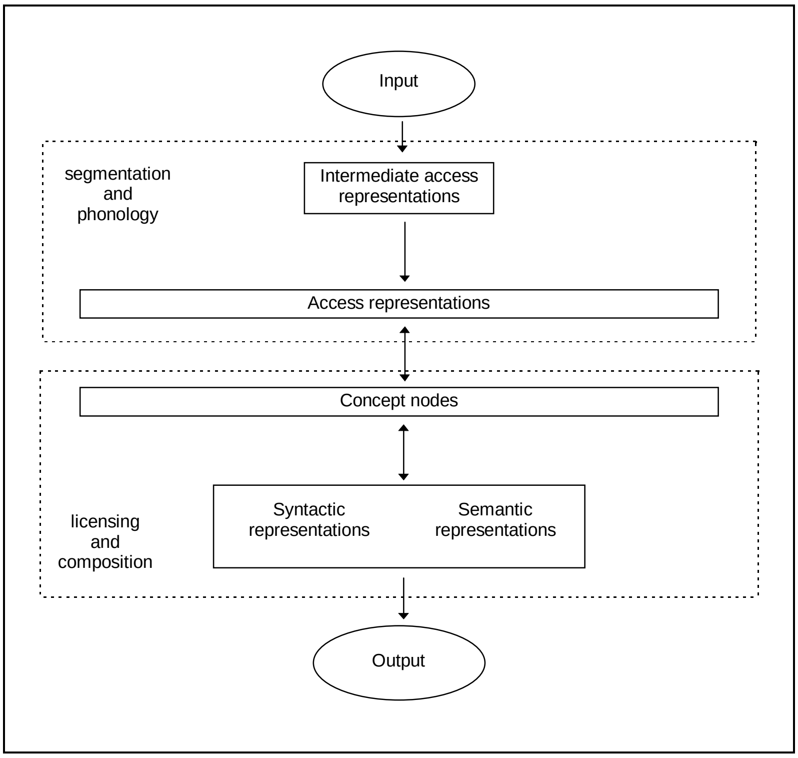

Figure 6. The Meta model as proposed by Schreuder & Baayen (1995)

The Meta model combines aspects from several other models, like the MRM, the AAM, Pinker's (1991) linguistic rules, and McClelland's (1987) and Taft's (1991, 1994) interactive activation model. Also, traces of linguistic theory can be recognised, like the incorporation of syntactic subcategorisation frames in the syntactic representations, which enables the model to account for, among others, bracketing paradoxes. Due to its generalistic principles, it can account for the most substantial observations from psycholinguistic experiments, like the root-frequency effect, the whole-word frequency effect, pseudo-affixation and the productivity problem. Moreover, the model is applicable to word recognition in all language modalities, can explain morphological processes in a variety of languages, and holds for inflection as well as derivation[12].

The obvious disadvantage is that it needs further development in many aspects. For instance, this model positions both the syntactic representations and the semantic representations under the concept nodes, which is not in line with widely asserted views of the lexicon in language production models. In Levelt's model (Levelt 1989, 1993), for instance, the syntactic information referring a lexical representation plays a role at a different moment in language processing than semantic information (see 2.5.3). Other specification is required concerning the precise nature of the semantic representation and the exact procedures taking place between the intermediate access representation and the access representations proper. It is, for instance, not clear how the intermediate access representations are specified for the different language modules. As the access procedures will be quite different for each module and between production and comprehension, major adjustments will be required. In sum, the model must be further specified to enable predictions that can be empirically verified. Yet, it is well motivated by taking productivity as its starting point and can therefore provide a sound foundation future research.

The discussion thus far shows that a model exploring the role of morphology in the lexicon must account for unitary access as well as decomposition. Moreover, producing and understanding (morphologically complex) words is a dynamic process that cannot be captured by static theories lacking the time dimension. Therefore, we need a dynamic model of language processing. Dynamic models postulating parallel processing have as a major advantage over serial models that no principled choice is required that determines in advance which route is to be taken. The relative success of either route will be individually determined for a particular word at a particular moment by the resting activation of its root and its affixes. Resting activation should reflect the productivity, the frequency and the transparency of both morphologically complex words and the constituents it contains. The interrelation of these variables and some other issues relevant to morphology and the lexicon will be elaborated on in the next section.

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[12] It should be noted, though, that this model has primarily been designed to account for Germanic languages. It is, for instance, not obvious how phenomena like Arabic broken plurals can be explained in terms of this model. This need not be problematic, because the model does not purport to be universal: it is not necessarily true that the structure and access of the mental lexicon is independent of language typology.

2.5 Issues in morphology and the lexicon

After a review of the most important models proposed in the literature, this section will revisit the most relevant issues that briefly came up in the previous sections. These issues will be discussed in view of their role in a model of morphological processing. Based on this discussion, I will express my preference for one particular model that is most suitable to serve as the foundation for modelling the role of morphology in the L2 lexicon. First, frequency, productivity and transparency are reviewed. The discussion will focus on the interaction of these three factors. Second, the controversial linguistic relation between meaning and form is discussed and applied to psycholinguistic models. Third, a comparison is made of the nature of the lexical representations as they are proposed in different models, from which a set of requirements is established that should be met by a model of morphology. Fourth, it will be determined to what extent the models that have been focused on comprehension can be applied to production. It will be argued that the core of the lexicon is neutral between comprehension and production, and that the activation-spreading model introduced in the previous section can be applied to production too. Fifth, the pros and cons of distinguishing inflection and derivation are discussed, again with regard to the application of this distinction to a model of morphology. Finally, some methodological issues are discussed that have affected psycholinguistic research in the past.

2.5.1 Frequency, productivity and transparency

Morphological productivity, frequency and transparency are concepts that are clearly interrelated. All three have played a major role in modelling the role of morphology in the lexicon. Opinions differ, however, about how they are related and what their respective role is in morphological processing.

Reaction time experiments have provided compelling evidence that words that are more frequent are recognised faster. Whaley (1978), for instance, found an extremely powerful effect of word frequency in many reading tasks. This is generally interpreted as evidence that frequent forms require less processing and are stored by their full form. Besides this surface frequency effect, it is widely accepted that access time is positively affected by “root frequency”, which is defined as the cumulative frequency of all the words that share a root. Taft (1979) found a difference in response time between, for instance, *sized* (faster) and *raked* (slower): as both have a low surface frequency, the difference in reaction times can only be explained by the higher root frequency of *sized*. Although Taft (1979) interprets this observation as evidence of prelexical decomposition, this effect is not necessarily a result of lexical search, and might as well arise as a result of postlexical processing. At any rate, the root frequency effect is evidence of morphological decomposition at some stage of lexical processing[13].

[13] The concept of root frequency could be refined by not only considering the cumulative number of occurrences of the root, but by also taking into account in how many different

Frequency effects have also been found in L1 acquisition. Children are sensitive to frequency and show better knowledge of words presented to them more frequently than of less frequent words (Schwartz & Terrell, 1983). Children are also sensitive to type frequency: in the order of acquisition of affixes, children acquire the most frequent affixes first (see Chapter 3 for a more elaborate discussion of this issue). This observation confirms findings from reaction time experiments that both root frequency and type frequency play an important role in our perception and use of morphologically complex words. This points to the necessity to presuppose separate storage of roots and affixes, in combination with the storage of whole words. Of the models discussed in the previous section, especially the Meta model appears to have great explanatory power in this respect. Roots, affixes and whole words are stored in this model, and the relative activation of these elements depends on their individual frequency.

Besides frequency, productivity is a major variable affecting morphological processing. Since productivity is a crucial factor in the model that will adopted for the current study, some elaboration is required with regard to the definition of productivity and the instruments to quantify it.

The productivity of affixes may range from highly productive to totally unproductive, and anything in between. Attempts to categorise affixes of different degrees of productivity into classes, or "levels" as proposed in more recent approaches to level ordering, are not satisfactorily motivated for productivity, as no differentiation within the categories is possible. In a division of affixes into three levels (Kiparsky, 1983), the affixes at level one (e.g. *-ity*, *-ize*, *-al*, *-ic*) are claimed to be less productive than those at level two (e.g. *-er*, *-ness*, *-able*), while level 3 contains the most productive ones (including all regular inflection). But, as Clark (1993:128) rightly points out, affixes that are marginally productive in general may be more productive within specific domains (Clark mentions the productivity of *-ic* in technical domains). Productivity must therefore be seen as a cline with, for instance, regular plural formation at one extreme end and unproductive affixes like nominalisation by adding *-th* at the other. The position of an affix in the continuum may vary along different domains.

Much debate has been going on about how the exact position of an affix on this continuum can be determined. A first characteristic of morphological productivity is that the meaning of a word coined by a productive morphological type can be predicted on the basis of the meanings of its constituents. In other words, transparency is a necessary condition for productivity. To illustrate this, consider the affixes *-ful* and *-ness*: although transparent words may be created with *-ful*, many derivations with *-ful* will not be fully transparent (*grateful*, *songful*[14], *lawful*, *awful*); derivations formed with *-ness*, on the other hand, will usually be transparent (*abstractness*, *brightness*). *-ness* could therefore be considered more productive than *-ful*. How-

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words the root occurs. This measure, the *relative root frequency* can be calculated by dividing the number of different roots by the cumulative root frequency.

[14] *Songful* is a common term in American English, meaning “given to or suggestive of singing: MELODIOUS”. (Webster’s Ninth Collegiate Dictionary)

ever, transparency alone is not enough to define productivity; although transparency is a condition for productivity, the reverse is not true: transparent forms are not necessarily productive. The nominalising suffix *-th*, for instance, may be transparent (*width*, *length*), but cannot generally be applied to form acceptable nouns from adjective (**poorth*). In other words, productivity is essentially related to production. Moreover, production is always related to a particular moment in time. After all, at the time when *length* was first coined, *-th* nominalisation might have been a (more) productive process[15]. Morphological productivity can thus be defined as the probability that the combination of a root plus an affix will lead to an acceptable and transparent word at a certain moment in time. The acceptability of a newly formed word will depend on the judgement of the language community. From this it can be deduced that the productivity of an affix is a reflection of its actual use by a language community at a particular moment in time, or, in other words, the frequency of actual use in that language.

Since productivity, reflecting the collective preferences of a speech community, is inherently dynamic, it is difficult to measure. Several approaches have been undertaken to measure productivity in a consistent and reliable manner. These attempts range from theoretical views to experiments involving production and assessment by judges and to frequency counts from dictionaries and corpora.

The lack of a clear definition of productivity has been shown to provide insurmountable problems for theoretical approaches using word formation rules. To account for the productivity problem (the fact that word formation rules cannot be stopped from over-generate non-existent forms like **arrivation*), Aronoff (1976) advances the concept of "blocking". But to allow legal over-generated forms like *aggressiveness*, which is not blocked by *aggression*, he argues that blocking cannot occur for WFRs that are fully productive. As productivity must be regarded as a continuum, this line of reasoning will not wash. Working in the different framework of redundancy rules, Jackendoff (1975) attempts to account for the productivity continuum by calculating the productivity as a function of the cost of referring to a redundancy rule:

> The cost of referring to redundancy rule R in evaluating a lexical entry W is $I_{R,W}$ x $P_{R,W}$, where $I_{R,W}$ is the amount of information predicted by R, and $P_{R,W}$ is a number between 0 and 1 measuring the regularity of R in applying to the derivation of W.
>
> Jackendoff (1975: 666)

The obvious disadvantage of this definition, however, is that it shifts the real problem to determining the "regularity" of the redundancy rule in applying to the derivation of the word. But if this regularity can be measured objectively, it can contribute to the solution of quantifying productivity.

Anshen & Aronoff (1981) attempt to measure productivity. They determine productivity by taking the ratio of actual words of a given pattern to possible words of that pattern: the more productive a pattern is, the greater the ratio of actual to possi-

[15] This is not very certain; *-th* is probably a loan from old Norse or Dutch, as the Old English form was rare.

ble words. They conducted two experiments to investigate the role of productivity by testing the acceptability of affixes by native speaker judgement. In their first experiment, they compared the acceptability of words ending in -*ness* (generally regarded to be very productive) to words ending in -*ity* (regarded less productive) in an Xive environment: Xivity vs. Xiveness. The results showed that the -*ness* words were more often accepted. They conclude, however, that this might be due to phonological transparency, as the -*ity* forms affects the stress pattern of the word and -*ness* does not. Therefore, a second experiment was set up, testing the same affixes in a Xible environment: -*ity* is very productive with -*ible*, although phonological transparency would predict that -*ness* is more productive with -*ible* (no stress change). The results indeed showed a preference for Xibility forms over Xiveness. Anshen & Aronoff interpret this as evidence that the productivity of an affix is dependent on the combination with the base. However, these results may be largely due to a difference in processing of the two words and on word-internal frequency: because of the high frequency of the combination, the occurrence of -*able* will activate -*ity*. This goes to show that the degree of productivity should reflect the subtle interrelation between frequency and transparency.

Schultink (1961) has defined morphological productivity as the chance that language users unintentionally coin a new word of a particular type. The number of formations of that type is, in principle, infinite. Baayen (1989, 1992, 1993) has quantified this concept of morphological productivity in terms of frequency by expressing it in an objective statistical measure, comprising the total number of types of a particular affix (all words in a large corpus containing that affix: N) and the number of "hapaxes" (types that contain that affix and occur exactly once: n_1)

$$P = \frac{n_1}{N}$$

P is an estimate of the conditional probability that a new type with a particular affix will be encountered when the size of the corpus increases. Using Baayen's formula, productivity is defined in terms of frequency with transparency as an inherent condition: a hapax will always be transparent. The relevance of productivity for models of morphological processing is obvious from the discussion in 2.4 above: an integrated notion of morphological productivity enables us to make a clear distinction between, to use Meijs's (1975, etc.) terms, type-familiar access and item-familiar access. Calculations using this measure of morphological productivity with a large corpora of English (the CELEX database) carried out by Baayen & Lieber (1991) confirm Anshen & Aronoff's (1981, 1988) empirical findings about productivity. The P-value of -*ity* (405 types, 29 hapaxes = 0.0007) is indeed much smaller than that of -*ness* (497 types, 77 hapaxes = 0.044). Although this measure may be limited by its emphasis on structural conditions of productivity only, it provides a very objective and accurate prediction of morphological productivity.

2.5.2 Meaning discrepancies

The relation between the form of an affix on the one hand and its syntactic functions and semantic properties on the other, has been a source of disagreement among (psycho-)linguists. However, the apparent discrepancy between surface form and meaning[16] must be accounted for in a model of morphological processing. The discussion of this issue becomes particularly relevant if it is extended to second language acquisition (in Chapter 3) and the factors that are important for the bilingual mental lexicon. As this issue will be referred to extensively in later chapters, it is worthwhile reviewing the main positions taken and to determine which of the models discussed in 1.2 and 1.3 can most adequately explain the facts observed.

(Generative) grammars of derivational morphology usually take the form as the basis of description (Halle, 1973; Jackendoff, 1975; Aronoff, 1976; Booij, 1977; Lieber, 1981), and emphasise the regularity of combinations of words plus affixes by postulating rules generalising these combinations (see 2.3). Logically, the advocates of a full-listing hypothesis usually adhere to the view that form and meaning must be separated because the connection between the two is inconsistent and possibly even coincidental. Bloomfield (1933), who regards the lexicon as “a basic list of irregularities” is very clear about this: “the meaning of each morpheme belongs to it by an arbitrary tradition”. (274). Essentially the same position is expressed by Butterworth (1983:266): “Derivational compounds where the major category is changed by the derivational process in general have unpredictable semantics and thus constitute a problem for a model of LR (lexical representation) which rejects to FLH (full listing hypothesis).” Butterworth illustrates the idiosyncrasy of derivation by referring to Latinate forms that have *-duce* as their roots, as discussed in 2.4.2. Also the affixes with which *-duce* can combine indeed seem entirely random, as illustrated in Table 1.

Table 1 derivatives of -duce words

	?	-ion	-ment
educe	*		
adduce	*		
conduce	*		
produce		*	
reduce		*	
deduce		*	
introduce		*	
traduce			*
seduce		*	*
induce		*	*

[16] For a detailed discussion of the lack of isomorphism, see Matthews (1972).

Likewise, Meijs (1981a), argues that there is "a lack of parallelism between morphological and semantic relations" (Meijs, 1981a: 134), and that it is more adequate to adopt a semantic/syntactic base along which morphological forms may vary. Meijs illustrates the lack of consistency in the relation between form and meaning as represented in Table 2 and Table 3:

Table 2. Meijs (1981a) illustrates the fact that one form may have several different meanings.

form	**meaning**	**example**
	abstract result of V	agreement
	body of people who V	government
-ment	act of V-ing	establishment
	concrete result of V	settlement

Table 3. Meijs's (1981a) illustration that one meaning can be represented by several different forms.

form	**meaning**	**example**
-ation		expectation
-ment		resentment
-ion	abstract result of	appreciation
-al		approval
0		regret

These examples show that both polysemy and synonymy occur at affix level. Beard (1984) refers to this phenomenon as “morphological asymmetry”: “The ability of a single suffix to reflect several meanings while several such suffixes convey any one such meaning” (Beard, 1984:50). To solve this problem, Beard postulates a (generative lexicalistic) model that distinguishes Lexical Extension Rules (L-rules) and Morphological Rules (M-rules). The deep-level L-rules operate completely independently of the surface-level M-rules that mark it with affixation. Affixation (M-rules, which assign the affixes to the output of the L-rules), Beard argues, is an extremely simple process. Its only complexity lies in the choice of the affix, since M-theory is obliged to posit only one suffix insertion rule. In cases where constraints such as the transitive-intransitive condition cannot be discovered, the root must “carry some ‘diacritic’ feature to trigger proper morphological insertion” (Beard, 1984: 57). Other linguists also insist on a distinction between form and meaning. Matthews (1984), for example, argues that affixes may be considered each other’s rivals for the same meaning: “The rules of word formation, if they are properly called rules, are not stated of morphemes, but of formations (...) directly. These are in general neither contrastive nor non-contrastive. Instead they can, and widely do, compete.” (Matthews, 1984: 91/92).

Others maintain that form and meaning in morphology should not be separated and introduce solutions to account for morphological asymmetry that consist of constraints to limit the number of cases to be properly considered as derivations. Zwanenburg (1984a, 1984b), for instance, argues that "it is only correct to speak of word formation when a possible derived word has a form-based as well as a semantic relation to the word serving as its base" (Zwanenburg, 1984a:131). Instead of regarding apparently similar affixes as rivals, Zwanenburg claims that the different meanings a complex word can have must be seen as a core meaning plus a set of derived meanings, and that form and meaning of a complex word, though inseparable, must be described in different components of the grammar. Likewise, Booij (1986) argues that there is no basis for a systematic distinction between form and meaning of affixes. With regard to synonymous affixes Booij adheres to Aronoff's one-affix-a-rule hypothesis: purely synonymous, competing affixes do not exist as such, since they differ at least with respect to productivity and distribution: "The poly-interpretability of certain affixes also shows a certain systematically, once we distinguish between productive and unproductive interpretations." (Booij, 1986:515). Booij accounts for polysemy in derived words by assuming there is one prototypical meaning for a certain word formation process and that other meanings are derived by extension rules. As an example he mentions *-er* agentive and argues that "Agents" should be extended to "personal agents", "impersonal agents" and "instruments". Of these three, the personal agents are prototypical. By structuring "agent" in this way, Booij argues, an important part of the polysemy of *-er* deverbal nouns can be accounted for. He considers all other interpretations of *-er* as marginal, unproductive and/or idiosyncratic (e.g. *doordenker*, *bijsluiter*, *misser*, *afknapper*, *dijenkletser*), and argues that these cases cannot be used as arguments for a principled separation of form and meaning in morphology.

The pros and cons of a principled distinction between form and meaning for affixation will have to be weighed carefully, as it concerns an essential underlying assumption for theories of morphology. A decisive factor in this must be how the relation between form and meaning can be mapped onto an acceptable model of morphological processing.

The concept of rival affixes for a particular function or meaning is often overrated. Booij certainly has a point in claiming that a detailed analysis of seemingly rivalling affixes may reveal that much of the rivalry can simply be accounted for by a difference in properties of the base and the affix, especially regarding distribution and productivity. The famous rivalry between *-ity* and *-ness*, for instance, can partly be attributed to properties of the root: *-ity* usually attaches to Latinate roots, while *-ness* preferably attaches to native roots (*acidity, adversity, affinity*; versus *deafness, fatness, coldness*. Moreover, the use of the affix is also restricted by its morphological context or sub-domain: Baayen & Lieber (1991) have convincingly shown that *-ity* is more productive than *-ness* after *-able* / *-ible*, whereas *-ness* is more productive after *-ed*, *-ful*, *-less*, *-some* and *-ish*. Also when we closely consider the rival affixes mentioned by Meijs (1981a) (see Table 3), differences in the productivity of the affixes are revealed: *-al*, for example, is barely productive; Baayen & Lieber,

1991) and is strongly restricted as to the bases it can combine with[17]. *-ation*, on the other hand, is much more productive and has only few restrictions. The marginal productivity of *-ment* is very clear from Table 2. *Document* and *settlement* are opaque, *government* and *establishment* are also barely transparent, and almost all *-ment* forms are very frequent: 44,419 tokens at 184 types and only 9 hapaxes (data from Baayen & Lieber, 1991).

On the other hand, however, the assumption of prototypical meanings for homonymous affixes cannot hold. Although this may account for agentive and instrumental *-er*, it will not hold for all homonymous affixes. For instance, it will be very difficult, if not impossible, to find a common core for the diminutive and the agentive use of *-ee*, for the two types of *-ful* (as referring to quantity —*spoonful, mouthful*— and referring to a characteristic —*tasteful, fearful*—), and for the deverbal and the denominal types of *-al* (*arrival* versus *nominal*). These forms rather seem to represent different "types", appropriately labelled "derivation type" (Beard, 1981,1984; Baayen, 1989).

Advocating the full listing hypothesis, Henderson (1985) argues that the relation between meaning and form is very inconsistent in derivation. He uses a very productive word formation device (*un-)* in an attempt to demonstrate the unpredictability of derivation, by mentioning several examples of derivations with *un-*. He points to the ambiguity of *doable*, meaning either "able to be undone" or "not able to be done", and further points to the different meanings of the *un-* affix in *unarmed* and *unfrocked*. However, Henderson's example of the ambiguity in the bracketing paradox *undoable* ([[undo]able]] or [[un]doable]) and the variable meaning of the other two examples, can easily be explained by considering the two meanings of *un-* as different but homonymous derivation types with different subcategorisation frames. One of the types that takes *un-* as its form attaches to verbs, and has the meaning of *de-*: "make undone whatever is done by the verb" (e.g. *to unscrew*). The other type taking *un-* as its form attaches to adjectives, and serves as a negation: it reverses the meaning of the adjective (NOT doable).

Further evidence for the position that purely synonymous derivation types do not exist is found in the acquisition of L1. The fact that children refuse to accept pure synonymy in language is an essential principle in the explanation of language acquisition. It is because of perceived synonymy that children are motivated to drop their own coinages in favour of more productive adult morphological types (see Chapter 3).

In view of the evidence, a one-to-one relation between type (including phonological, syntactic, and semantic/pragmatic cues) and form must be adopted for productive derivation types. Linking this to the models of morphological processing discussed in 2.4, most present-day models will be able to explain these observations, but especially those models that emphasise the importance of morphological productivity, like Bybee's connectionist model and Schreuder & Baayen's Meta model, can account for them simply and straightforwardly. In Schreuder & Baayen's (1995)

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[17] According to Marchand's (1969) extensive and thorough typology, for instance, *-al* combines with Latinate bases only, and the last syllable must be stressed.

model, for example, only the morphologically complex words that are based on (very) productive types will be decomposed; all other forms will have their own lexical representation. The (pseudo) compositionality of words like *government* or *document* is irrelevant to this model, as very little activation feedback will flow back to the affix *-ment* due to their lack of transparency and high surface frequency. Neither is homonymy problematic: similar to Booij's proposal, in monomorphemic words, homonymous affixes of different derivation types will have separate access representations. A further advantage of the Meta Model is that it is able to deal with syntactic information through the separate syntactic representations mediated by the concept nodes: in this way it can also account for the different subcategorisation frames of the two types of *un-* mentioned above. Although the notion of morphological types has not as such been incorporated in this (or any other) psycholinguistic model, it is compatible with, for instance, the Meta Model. A morphological type must be seen as a lexical representation relating a particular (morphemic) concept to its semantic/pragmatic, syntactic and orthographic/phonological properties, very similar to other lexical representations.

2.5.3 The nature of lexical representations

The content of the lexicon presumed, in the form of Lexical Representations (LRs), largely depends on the framework of morphological processing adopted. However, speakers/listeners will need a minimum amount of information at several different levels to be able to correctly produce or comprehend words for morphologically complex as well as monomorphemic forms. Miller (1978) (quoted in Butterworth, 1983: 258) summarises the most essential properties of LRs in a list, categorised for the different modalities:

A. Pronunciation
- phonology (including stress features)
- morphology (including inflected and derived forms)

B. Syntactic categorisation
- major category (N,V,A,P)
- subcategory (syntactic contexts)

C. Meaning
- definition (concept expressed; relation to other concepts
- selection restrictions (semantic contexts)

D. Pragmatic constraints
- situation (relation to general knowledge)
- rhetoric (relation to discourse contexts)

Now let us compare the items in this list to the way LRs are represented in some present-day models of morphology in the lexicon. Obviously, this list is geared to supporting a full-listing hypothesis, and has to be adjusted to account for morphological decomposition as an integrated part of the lexicon, as postulated in most models. Consequently, morphology should not reside under pronunciation, but should be given a more independent status. This can be accomplished either by including information about the compositionality of morphologically complex words in the lexical entry ([*un*[[*reach*]$_V$[*able*]]$_A$]$_A$), as proposed by Bybee, or by assuming a morphological parser at the level of access representations (MRM, AAM, Meta Model).

The phonological information of a word form is indeed essential for the correct pronunciation of the word, but less essential for its recognition. In the Meta Model, the phonological information is not included in the LR, but is taken care of at the level of segmentation. In this way the Meta Model enables filtering of the raw input forms to the Access Representations (by assigning stress patterns and recognising morphological bases), which, as we have seen, poses a problem for the AAM model. Morphologically simple words can have unpredictable stress patterns that seem to be lexically determined, and it may be argued that phonological information should be stored at the same level as syntactic and semantic information, i.e. at the level of lexical representations. For comprehension, there are often other ways to select the right concept. For instance, the voicing of the final fricative in the word *house* differs between the noun and the verb, which is lexically determined. The Meta model can account for this without referring to the phonology by assuming differential access representations for the verbal and the nominal form. But if the model is extended to language production, the need for phonological information being available beyond the level of the access representations becomes more pressing. However, this does not necessarily imply that this information must be stored as part of the lexical entry. This point will be elaborated on in 2.5.4.

The syntactic categorisation of a word is essential to achieve correct recognition and production. For morphological processing (sub-)categorisation information is important: at this level information must be stored about the morphological category affixes can attach to. The syntactic properties that are included in the lexical representations must contain the syntactic category of all lexical elements. They may include subcategorisation frames, as proposed by Lieber (1981) (see 2.3.1), but may also take the form of an argument structure. The affix *-able*, for instance, only attaches to verbs with an external argument[18]. The Meta Model postulates lexical representations that comprise separate syntactic and semantic representations that interact through the concept nodes. Other models are far less explicit about this. In Bybee's model, the syntactic information will be stored with the lexical representation, but in the AAM model, being modality specific, syntax and semantics are assumed to be processed separately by different modules, while the links among the modules remain obscure. For morphology, interaction between syntactic and semantic nodes is particularly important at the level of licensing: the co-activation of semantic properties has to be licensed by subcategorisation frames or argument structures.

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[18] This observation generally holds: *washable, readable,* but not **laughable, *dieable.* However, the productivity of this affix seems to increase judging from new coinages like *microwaveable* (as in "a microwaveable dish"), where [microwave]$_N$ has been converted to a (transitive ?) verb to form a legitimate base to attach *-able*.

Meaning should obviously also be incorporated in the LRs. In the MRM, the Meta Model and Bybee's model, semantic information is treated similar to syntactic information, while the AAM again shifts meaning to a separate module. As has been argued in 2.4.3 above, placing the semantic and the syntactic specifications of a LR at the same level is not in agreement with Levelt's widely accepted model of language production (Levelt 1989, 1993). This implies that adjustments will have to be made to this position if this model is applied to language production. If the model is limited to comprehension, a minimal requirement is that the relations between concepts in Miller's (1978) list are linked in an interactive network that might consist of direct links or of links among semantic and syntactic representations mediated by concept nodes. None of the models discussed so far have anything to say about the exact nature of the semantic information, and opinions differ according to the different semantic theories adhered to.

None of the models explicitly mention pragmatics, even though pragmatic information is very relevant for the choice of the most appropriate word in a particular context (the register is likely to affect the activation of a set of words associated with that register), and is clearly lexically determined. In Bybee's model, this could easily be incorporated in the LRs, and in the Meta Model pragmatic representations can simply be regarded as part of the semantic properties of a lexical representation. The AAM will have to assume links to other modules to account for the essential interaction between morphology, syntax and semantics/pragmatics.

The difference in nature between visual and auditory recognition and production of words is regularly mentioned in the literature about lexical processing. De Bot et al. (1995), for instance, plead in favour of different theories and models to explain visual and auditory lexical processing. They point to evidence from cognitive neuroscience, which shows differential dysfunctioning of the two modalities in cases of aphasia and that visual and auditory inputs stimulate different parts of the brain. The model that is most strongly constrained by modularity is the AAM model, which only deals with word recognition in reading. However, if we assume that the LR comprises a full representation of all relevant information, differential processing of different modalities is not very likely. If the LR were considered the nucleus of the lexicon, it would indeed be uneconomical and illogical to assume that each module has a similar set of LRs. It makes more sense to assume that each module has its own interface to access the central and nuclear LRs.

Finally, two more issues are of concern in relation to LRs: the order or grouping of LRs and the distinction between inflection and derivation. The distinction between inflection and derivation is discussed in 2.5.5 below. The idea that the lexicon, or in this case the lexical representations it contains, is ordered according to some guiding principle like their position in the alphabet, their frequency, their acoustics properties, or whether they are function words or lexical words (Bradley, 1980), must be regarded as a reflection of our concrete way of dealing with words and is probably a gross oversimplification of the complex and abstract network of relations that the lexicon is likely to be. The questions about the ordering of lexical representations will become irrelevant if activation is used as the starting point of morphological processing. Words or concepts with strongly activated links will inherently form highly abstract groups based on their pragmatic properties (like the formal/informal register), other aspects of meaning, syntax, morphology or sound. These groups will be interrelated, and will to a certain extent be individually determined in a system that is constantly changing. Indirectly, frequency may be considered the only guiding principle at work, as activation inherently depends on the frequency of forms occurring.

In sum, it can be said that (1) all concepts (related to words and morphemes) can have their own LR, (2) LRs must contain or must be linked to phonological, syntactic, semantic/pragmatic information, (3) interactive relations must be assumed among all these information types for each LR and among LRs themselves, leading to an abstract and complex lexical network, (4) in which the most strongly activated items are most readily available, and (5) LRs, representing the nuclei of the lexicon, should not be regarded modality specific.

2.5.4 Comprehension and production

A distinction that is pertinent to lexical processing is the one between production and comprehension. This distinction is reflected in the different sizes of passive and active vocabulary: passive vocabulary, used for comprehension, largely exceeds active production vocabulary for most people. In addition, acquisition data show that children's comprehension vocabulary may not only be larger than their production vocabulary, but may also be essentially different (see Chapter 3). Based on observations from diary studies, Clark (1993) postulates separate representations for production (P-representations) and comprehension (C-representation). However, for the same reason that it is unnecessary to assume differential representations for each module, it is not probable that lexical representations for comprehension and production have their own independent representations. The seemingly different sizes of passive and active vocabulary can be accounted for in terms partially developed "concept nodes" for particular lexical entries. LR that have not (yet) been fully specified do allow for (global) interpretation, but not for production, as production requires more fully specified LRs. Secondly, it may be presumed that only highly activated LRs are eligible for production. This would account for the observation that (especially) language learners tend to "echo" words they have recently heard to be used in their own production; listening to speech results in the activation of recent utterances, which increases the chance that precisely these words are used in speech. These issues are further discussed in the chapter about lexical acquisition (3.2.2). The conclusion is that no separate lexicons will have to be assumed for production and comprehension.

To account for production and comprehension making use of the same lexicon, it is necessary to look beyond models of the lexicon and to consider language processing in a more general framework. In the influential model proposed by Levelt (1989, 1993), the lexicon constitutes the core of information processing. This model is generally recognised in all its aspects, and a detailed discussion of it will go beyond the scope of this study, as morphology is not a central issue in this model. However, a schematic overview of this model, clearly reveals the central position of a lexicon that is neutral between production and comprehension (see Figure 7). The simplified description of this model presented here will focus on the role of the lexicon.

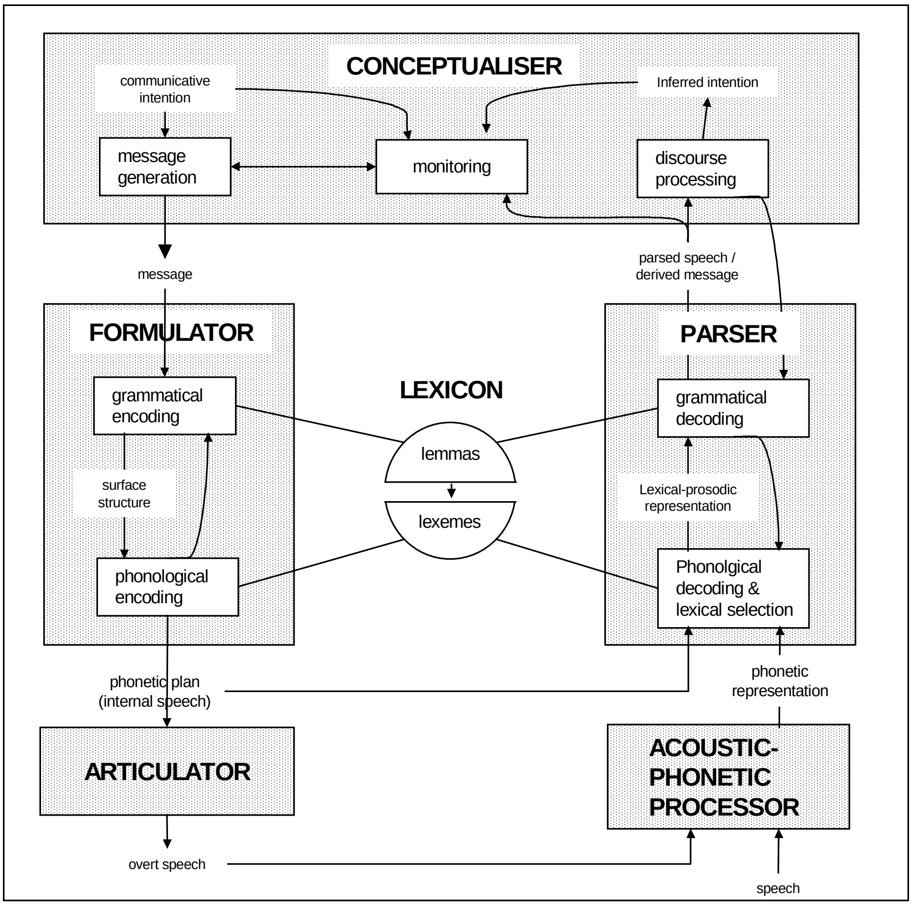

Figure 7. Schematic representation of the processing components for the comprehension and production of spoken language (After Levelt, 1993).

In Levelt's model, the production of speech takes place in three relatively distinct stages. The starting point of lexical access is the Conceptualiser, generating a preverbal message that triggers a set of conceptual characteristics. The co-activation of these conceptual characteristics leads to the activation of a particular node, which in production studies is conventionally called the "lemma". The lemma thus activated is associated with a set of syntactic properties that determine its syntactic category and its argument structure. The interactive association of lemmas and their syntactic properties to combine into well-formed sentences is labelled "grammatical encoding". Grammatical encoding can be compared to, as Levelt puts it "solving a set of simultaneous equations" (1993:4): the eventual output of the process of grammatical encoding, the "surface structure", satisfies all the syntactic properties of all the lemmas selected. The surface structure has not yet been specified for its phonological characteristics. This is taken care of in the next stage, "phonological encoding", where the phonological information associated with the selected lemmas is matched to phonologically encoded word frames. This procedure takes place in two steps: first an empty skeleton is generated which is then filled with the segmental content retrieved from the lexicon. Hence, the lexical representation in Levelt's model comprises two elements: the lemma, containing semantic and syntactic information, and the phonological form associated with that lemma, which is used at a different moment in speech processing; the latter is conventionally labelled "lexeme". In Levelt's conception of the lexicon, morphology is included at the level of the lexeme. Speech comprehension can broadly be regarded to involve the same steps as production in reversed order, although the two directions have their own specific problems. A problem for comprehension that has not yet been satisfactorily solved, for instance, is the segmentation of speech to account for the accurate activation of access representations. For production, the problem that is pertinent to the current discussion is the mapping of concepts to lexical structures. In the remainder of this section, these two problems will briefly be elaborated on. Finally, the position of morphology in this model will be discussed.

Comprehension

It has been argued in the previous sections that access representations are modality neutral, and that different interfaces have to be presumed to account for the activation of access representation. For the visual modality, this does not cause many problems, as words can easily be visually recognised. Only spelling rules, like doubling consonants in, for instance, *clapped* may complicate segmentation into clap and *-ed*. But it can be assumed that this is solved by a supra-lexical spelling parser as far as this concerns regular processes, while in case of real idiosyncrasy unitary access will take place. Phonological segmentation may not be equally straightforward, as words are not normally pronounced separately. One solution to this problem is the assumption that word-initial cohorts play an important role (see Marslen-Wilson & Tyler, 1980). An initial cluster, like [tr], will conjure up a range of possible words. Upon the perception of subsequent sounds (for instance [treɪ]), this range is narrowed down (train, trade, trail, trace, train, etc.). In the course of speech, the listener constantly narrows down the range of possibilities, eventually coming to an identification of access representations. Another solution to this problem is found in prosodic cues (see Cutler & Norris, 1988 and Cutler, 1994). Cutler (1994), for instance, stresses the importance of rhythmic segmentation, which is language specific and independent of previous (successful) parsing and the frequency of occurrence of forms in the input. Evidence for this position is found by the observation that pre-linguistic children develop sensitivity to rhythmic structure to enable them to solve the segmentation problem. The latter solution is particularly appealing, as it is in line with the view that prosodic frames play an important role in production too. The details of these solutions will not be discussed here; the main point is that either approach is compatible with the Meta Model of morphological processing. Particularly the idea of prosodic segmentation is attractive, since this does not require the interaction of phonological and semantic cues at the level of what Schreuder & Baayen (1995) called the intermediate access representations.

Production

With regard to production, one of the problems that have to be solved concerns the matching of concepts to lemmas. The selection of a concept triggered by the conceptualiser must eventually converge into the activation of one particular lemma. To attain this, it could simply be assumed that there is a one-to-one relation between conceptual representations and lemmas. Although this might be the case for concrete nouns, a one-to-one relation probably cannot hold for concepts that are more abstract. The activation of several conceptual primitives converges into the selection of one particular lemma. However, the consequence of this position is what Levelt calls "the hypernym problem": "When lemma A's meaning entails lemma B's meaning, B is a hypernym of A. If A's conceptual conditions are met, then B's are necessarily also satisfied. Hence, if A is the correct lemma, B will (also) be retrieved." (Levelt 1989: 201). In other words, the mechanism of convergence cannot account for the selection of more specific lemmas: if *cat* is selected, then *animal* will automatically also be selected. Recently, two interesting solutions for the hypernym problem have been proposed. One (Roelofs, 1992, 1993, 1997) argues in favour of a strict one-to-one relation between concepts and lemmas, thereby avoiding the hypernym problem, the other (Bierwisch & Schreuder, 1993) postulates an additional stage between the conceptualiser and the formulator to solve the problem.

Roelofs's (1992) proposal entails that all concepts in the lexicon are related by conceptual links that express the relation between the concepts. For instance, the concepts *cat* and *animal* are linked by a conceptual link specifying that an IS-A relation between the concepts. Through activation spreading, the activation level is enhanced of a particular concept node is enhanced, causing an activation spreading to the associated lemma. This proposal has been convincingly tested for the lemma selection of concrete nouns. However, defining the specific conceptual links for abstract nouns and verbs may be problematic. Moreover, the ultimate purpose of the present book is to account for morphology in a second language. It will be argued later (in Chapter 3) that lemmas are language specific, but conceptual structures are not: there may be considerable conceptual overlap between similar lemmas across languages, but hardly ever will they form a complete match. The partial overlap between lemmas and the different ways in which the same concept can be expressed makes that a model that advocates a one-to-one relation between concepts and lemmas is not very suitable for the current purpose.

The starting point of the proposal by Bierwisch & Schreuder (1993) is that the meaning of lexical entries is composed of multiple primitive elements. The core of their proposal is an elaboration of Levelt's (1989) model in which the mapping processes (from conceptual structures to semantic forms and vice versa) interact with the grammatical encoder and the mental lexicon. This is done by postulating an interface between the purely non-linguistic conceptual structure (the "output" of the

Conceptualiser) and the linguistic semantic form (the semantic properties of a particular lemma): the Verbaliser. Their main reason to do this is that linguistic information is potentially ambiguous, while conceptual information, by its very nature, is not.

In Figure 8 an outline is presented of their proposal. The conceptual structure (CS) contains the non-linguistic semantic information that the speaker wants to express. The function of the Verbaliser (VBL) is to "split up CS into chunks that can be lexicalised" (Bierwisch & Schreuder, 1993: 43) and to pass on these chunks to be matched to the semantic form of the appropriate lexical entries (E_i). Together with the selection of the SF of a lexical entry E_i, also the argument structure, AS(E_i), and the grammatical functions, GF(E_i) of the lemma are selected and made available to the formulator. The integrated semantic form of the entire utterance (SF) is assembled on the basis of information from the selected lemmas combined with information from the VBL, mediated by the Formulator. The possibility of feedback is created by an interpretation mechanism (INT), which also accounts for speech comprehension. The output of the formulator, the surface structure (SS) forms the input of the articulator, which in conjunction with the phonetic information contained in the lexicon generates the phonetic form (PF).

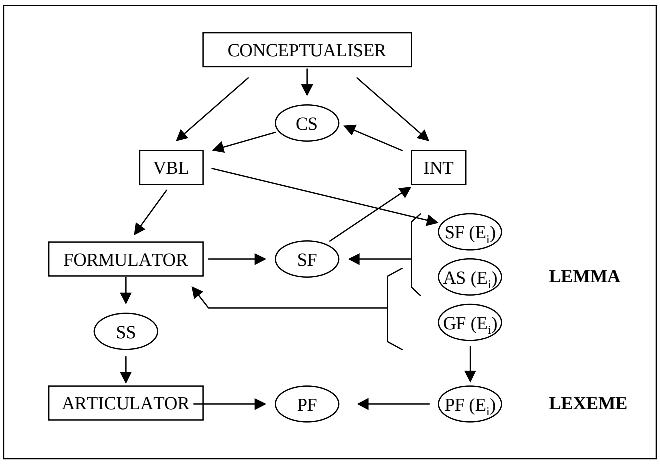

Figure 8. Representation of the interaction of the components in language production (after Bierwisch & Schreuder, 1993). It should be noted that the arrows in this figure do not represent the actual flow of information in time, but represents the way in which the different elements of the system depend on each other.

A problem for this approach (and for that of Levelt, for that matter) is what Bierwisch & Schreuder call "the chunking" problem, which is a consequence of the modular nature of their model (similar to that of Levelt). Since the conceptualiser has no access to the lexicon, no information is available to the conceptualiser about the availability of semantic forms in the lexicon. Similarly, no interaction is possible between the formulator and the conceptualiser, so that no feedback is possible either. Consequently, it is unclear how the elements in the CS are identified that can actually be lexicalised. Bierwisch & Schreuder postulate an interface between the Conceptualiser and the lemma: the Verbaliser. The Verbaliser translates the non-linguistic information in the CS into elements in the SF that can be verbalised. Contrary to the Conceptualiser, therefore, the Verbaliser must have knowledge about which information chunks can be lexicalised. This mechanism is a first step in finding a solution for the chunking problem, though it shifts the major problem from the Conceptualiser to the Verbaliser. It is still not clear how chunking takes place. Bierwisch & Schreuder acknowledge this and argue that the chunking problem cannot yet be solved, as little is known about the precise nature of the processes underlying conceptualisation. Possibly, some mechanism of activation feedback is involved. Similar to the function of the access representations in comprehension (see 2.4.3), abstract semantic primitives could be postulated at the level of the Verbaliser. Upon a successful match of a SF to a lemma, activation may flow back to the primitives contained in the Verbaliser. Of course, this is an oversimplification that says nothing about the actual translation from conceptual chunks to verbalisable chunks in the Verbaliser. But it does provide a metaphor to express the interaction between the non-linguistic information originating from the Conceptualiser to the selection of lexical elements.

An additional problem in Levelt's model is that the conceptualiser is directly responsible for the selection of lemmas. This, we have seen, leads to the hypernym problem. The solution that Bierwisch & Schreuder offer is to be found in the introduction the Verbaliser. As has been argued above, contrary to the conceptualiser, the Verbaliser is not blind to language-specific information. The following processing principle could be formulated upon this basis:

> "An SF(i) triggers Lemma (m) if and only if there exists complete match of all structures in SF(i) with all structures in the semantic representation of the lemma." (p. 51).

This principle enforces a one-to-one relation between the semantic form and the lemma, given the non-existence of pure synonyms. It implies that the semantic properties of the lemmas to be selected must have precisely those characteristics that are contained in the chunks of the CS. This will include pragmatic information, like the choice of register.

Morphology

In Levelt's model, morphological information of the lemma is positioned at the level of the lexeme, similar to phonology. However, in the previous sections it has been argued that lexical representations should include morphological types. As Bierwisch and Schreuder (1993) acknowledge, "affixes combine with major lexical entries to create combinations that are again lexical items" (p. 29). Therefore, it is necessary to account for an infinite number of "virtual" lexical entries in the lexicon. In section 2.4.3 the representation of the lexicon by Meijs (1975, 1979, 1981b, 1985) gives a clear impression of this. Moreover, productive morphological types have a conceptual interpretation and must be represented in the conceptual structure of the message; these types are constantly used to accomplish complete matching of lemmas onto the semantic form (SF) of the entire message. This implies that productive morphological types should be regarded as declarative rather than procedural knowledge, very similar to lemmas. Meaning can be expressed and interpreted by the activation of morphological types. However, contrary to other lemmas, morphological types that have been activated will have to be combined with the root they are to be attached to. Following Schreuder & Baayen's (1995) model of morphological processing in comprehension, this combination has to be licensed on the basis of the syntactic properties of the affix and the root. A crucial role in the licensing of combinations of roots and affixes is played by the argument structure of the lemma. In the proposal of Bierwisch & Schreuder, the semantic form of the message not only triggers the semantic information contained in the lemma, but also the argument structure. Argument structures, they argue "are clearly based on the conceptual content to be associated with the lexical entry" (p.29). It is the argument structure of the lemma that specifies the syntactic arguments required or licensed by the lemma. In the case of morphology, the argument structure associated with the lexical representation of the affix type determines whether the combination of root and affix are legal. Furthermore, the argument structure of the resulting combination will inherit the argument structure of the morphological type. One of the possible accounts of this process is the one presented by Lieber (1981), discussed in 2.3, which takes the subcategorisation frames (i.e. the predecessor of argument structure) as the starting point for the coinage of morphologically complex forms. The central issue here is that the argument structure of all the morphemes in a word must be satisfied.

This approach has great advantages in that it accounts for the apparent conceptually determined nature of morphological types. Moreover, the independent position of morphology has a great explanatory power in accounting for type-familiar and item familiar access of morphologically complex words in language comprehension (see 2.4.3). Yet, for language production one problems remains to be solved. Some morphological types cannot be uniquely selected based on their conceptual characteristics, while the strict modular organisation of the main elements in Levelt's model blocks the possibility of feedback or lookahead. For instance, consider the selection of a morphological type expressing the conceptual structure of "the quality of being X". The lexicon contains two entries that match this conceptual representation: -*ity* and -*ness*. How can the system make a choice? Different from the hypernym problem, there seems to be no conceptual ground for the selection of one of these affix types. However, these types can be distinguished on the basis of lexical criteria. For instance, -*ity* attaches to Latin roots, while -*ness* normally does not. The selection can also be morphologically conditioned: -*ity* can productively be used in combination with -*able*, while -*ness* is more productive in most other contexts. If it is assumed that the conceptual structure cannot "look inside" the lemmas before selection takes place, these lexical criteria cannot be used to distinguish between these two affix types. Unfortunately, no solution to this problem is found yet without affecting any of the principles advocated here. One solution is that the matching mechanism does not "blindly" select a lemma, but negotiates with the syntactic properties of the lemmas to be selected and takes account of other lemmas that have been selected to verbalise the message. Another solution is to assume a loop that returns a failed licensing attempt to the Verbaliser. The Verbaliser can then select a new affix type, or after several failed attempts, may even rechunk the message. Both of these solutions affect the strict modularity of the system. However, some form of interaction between the Verbaliser and the lemma must be assumed to account for this apparent problem and the latter solution is the least radical. Further need for the existence of a feedback mechanism between the Formulator and the Verbaliser is motivated by language acquisition (see 3.2.3 and 3.3.2). It should be noted that, the chance of choosing the "wrong" affix type can be reduced by assuming that initially the affix type is selected with the highest level of resting activation.

In sum, morphological types must be regarded as having their own lexical representation containing declarative knowledge. The selection of a morphological type is motivated by the matching of conceptual chunks in the preverbal conceptual structure to the lexical representation of the affix type. The combination of a morphological type and another lexical entry is driven by the argument structure of a selected morphological type. For instance, consider the production of the morphologically complex word *greyness*. The starting point is the conceptual structure that is passed on from the Conceptualiser, mediated by the Verbaliser. Bierwisch & Schreuder's matching principle will ensure the selection of precisely those lexical representations that accomplish full matching between structures in the semantic form with the semantic properties of the lemmas selected. If *greyness* is present as a unitary representation in the lemma, matching will be accomplished and *greyness* will proceed into the system. However, if *greyness* is not present, matching can only be accomplished by selection of the lemma *grey* and the morphological type -*ness*. The argument structure of *grey* will fulfil the requirements expressed in the argument structure of -*ness*, and the combination will licensed to enter the Formulator for further processing. Whether unitary representation of morphologically complex words are present in the lexicon depends, as has been argued in the previous sections, on the level of resting activation of the morphological type relative to that of the morphologically complex words that contain them. The level of resting activation, we have seen, is determined by the frequency of the morphological type relative to that of the whole word. This entails that the presence of an independent representation of a morphological type in the lexicon is determined by the perceived productivity of the type, based on the input. In this way, the production of morphologically complex words is indirectly affected by type familiar comprehension of words containing the type. Finally, to account for cases where a combination cannot be licensed, a feedback mechanism must be assumed that returns information from the formulator to the Verbaliser. This mechanism must be seen as safety net that is only used when the most likely solution (i.e. using the most productive morphological type) fails to result in a licensed combination.

Interaction

For comprehension, the processing of words starts with segmentation based on phonology and spelling, as described in section 2.4.3. Morphologically complex words that are opaque will have their own lexical entries; morphological types with a relatively high type frequency will also have their own representation in the lexicon.

Production will start with a conceptual structure that, mediated by the Verbaliser, triggers the activation of a set of lexical properties, which is matched to the semantic form of a particular lemma. The result of this process is that that one particular lemma receives the highest degree of activation and is, in this way, "selected". The "lemma node" is the representation of the lemma that contains a link to the semantic form of the lemma, to the syntactic properties of the lemma and to the lexeme. Lemma nodes are essentially neutral between comprehension and production. This implies that an interaction can be postulated between comprehension and production: activation of lemma nodes due to the frequency of forms in the input will affect production. Evidence for this interaction (facilitation and inhibition) is found in many empirical studies involving picture naming (see, for instance, Roelofs, 1993), in which the subject has to name a picture (for instance of a tree), while a distracter word (for instance *dog*) is presented simultaneously. The type of error that is common in these experiments is that the subject says *fish* instead of *dog* in naming a picture of a dog presented simultaneously with the word *fish*. This can be interpreted as a result of the activation of lemma nodes: the lemma node that has the highest level of activation is used in production, even if the activation is not conceptually driven. Further support for this model will be presented in Chapter 3, where the current discussion is extended to language acquisition processes.

2.5.5 Inflection, derivation and compounding

Traditionally, in the literature on morphology a distinction is made between inflection, derivation and compounding. Two questions must be answered with regard to this distinction: is it possible to make a clear-cut and unambiguous theoretical distinction between inflection and derivation, and what will this distinction imply for models of morphological processing?

Proponents of the distinction between inflection and derivation usually point to the greater regularity, semantic transparency and productivity of inflectional affixes. While inflection mostly leads to words that can easily be interpreted on the basis of their morphological constituents (stem + case, number, tense, etc.), words containing a derivational affix are often not semantically transparent (*wholesome*, *handsome*, *mindful*). This would be reflected in the productivity of the affixes; the *P*-values of inflectional affixes indeed turn out to be generally higher than those of derivational affixes. However, not all inflection is fully regular and not all derivation is idiosyncratic. The difference in productivity between the least productive inflectional affix and the most productive derivational affix will be minimal. There may even be an overlap between inflection and derivation in terms of productivity. Especially when languages other than English are taken into account, the distinction based on regularity cannot hold: agglutinating languages have a very productive system of derivation. So, although regularity and semantic transparency, as expressed in productivity, may contribute to the perceived difference between derivation and inflection, this does not support a principled dichotomy of the two.

The distinction between derivation and compounding is often based on the same principle of transparency. Henderson (1985) claims that the semantic composition of compounds is rather unpredictable (*honeymoon*), and that derivational forms are more predictable than compounds. Here too, however, this is by no means true for all cases of derivation and compounding. While derivations can be completely opaque (*handsome*), compounds may be completely transparent (*dark blue*; *house-boat, salad dressing*). Moreover, in terms of productivity compounding will generally be more productive than derivation. Here too, compositionality cannot serve as a sound basis to distinguish these concepts.

A further observation that will balk the hopes of a neat division into inflection, derivation and compounding, is the lack of clear dividing lines: there are many cases where these concepts overlap. An example of a borderline case of derivation and compounding is the nominal head *man* in many root compounds (*postman*). This form, occurring in a weak syllable, is less and less likely to be interpreted as "male human being", and it is doubtful whether this form should be regarded as a free root; as compounds only take free morphemes as their constituents, *-man*, might be seen as an affix. The same holds for the first constituent in the compound (?) *cranberry*: as *cran* is not an independently occurring free morpheme, it might be considered as a prefix instead. Also, consider forms like *red-haired*. The compound status of this word would be based on its analysis as $[[\text{red}]_A[\text{haired}]_A]_A$. But as *haired* in itself is not an independently occurring word, the only valid interpretation of this word would be its interpretation as a "derived" compound: $[[\text{red hair}]_N\text{ed}]$A.

Another common argument for distinguishing inflection from derivation (and compounding) is that inflection is "part of syntax" whereas derivation is not. This is based on inflectional affixes like English third person singular *-s*: inflection creates forms of words that have a syntactic function (agreement in this case), rather than "new" words. But, many affixes that are traditionally regarded as inflectional affixes do not seem to be syntactic, because they involve change of syntactic category like the creation of particles, gerunds and infinitival forms. Matthews (1974:53) give examples of this: the adjectival *-ed* participle in

a very crowded room

is generally seen as a derivational, whereas the same participle in

a well heated room

is generally considered inflectional. The argument that inflection tends to organise in paradigms, while derivation does not, is rejected by Spencer (1991:194), who shows that Spanish derivation may in some cases be organised paradigmatically. So, although the syntax argument is intuitively appealing and partly true, this too cannot lead to a clear, consistent and systematic distinction between inflection and derivation.

In arguing in favour of the distinction, Scalise (1988), lists nine differences between inflexion and derivation. As his starting point is a rule-based system, Scalise labels them Inflection Rules (IR) and Derivation Rules (DR) respectively:

1) DRs but not IRs, change the syntactic category of their base.

2) Inflectional morphemes are peripheral with respect to derivational suffixes.
3) Derivational suffixes are heads, where inflectional suffixes are never heads.
4) DRs and Irs ”do” different things (DRs are more powerful rules).
5) DRs allow recursivity, IRs do not.
6) Readjustment rules (RRs) that operate on the output of IRs are different from the RRs that do so on the output of DRs.
7) Productivity in derivation is restricted to a number of very subtle types of restrictions. productivity in inflection is more ”blind”.
8) Inflection and derivation behave differently with respect to the prediction made by the atom condition: derivation can be sensitive to prefixation, whereas inflection cannot.
9) The structure of an inflected word is probably different from the structure of a derived word.

Some of these arguments have already been refuted in the discussion above, and some are extremely vague (4,7,9). However, these observations do point toward an observed difference between inflection and derivation (and compounding). But this cannot take the form of a clear-cut dichotomy and should be regarded as a cline with gradual transitions and with wide borders where the concepts overlap.

In some models of morphological processing, the distinction between derivation and inflection does play an important role. In Aitchison’s (1994) model inflection is regarded rule-based and is applied at the same level as syntax, while derivationally complex words are stored in the lexicon with a “backup store” containing morphological information that is used when everything else fails. In parallel processing models the distinction is sometimes seen as determining the route to process morphologically complex words:

> Inflectional processes might be called upon each time that we understand or produce a sentence, but derivational processes might be called upon only when we have to manipulate particular lexical forms.
>
> Chialant & Caramazza (1995: 71)

Since we have seen that a sharp distinction on these grounds is not tenable, it is unlikely for this distinction to play a determining role in the route taken. In other models, like Bybee’s (1985) connectionist model and Schreuder & Baayen’s (1995) Meta model, no principled distinction between inflection, derivation and compounding is made. The latter, for instance, always takes the distributional properties of an affix as a starting point, regardless of the nature of the affix. Since words containing inflectional affixes will usually be very transparent and require little computation they are likely to be decomposed rather than stored. But in spite of the high transparency, also regularly inflected forms may be stored if their token frequency is sufficiently high. The same position is taken by Meijs (1981b) and Bybee (1995). In this way, it can also be explained why some (stored!) plural forms are more frequent than their singular counterpart, as in words like *legs* and *horns*. Similarly, very transparent derivations (Schreuder & Baayen mention Dutch diminutives) will not be stored, but will be computed, as little computation is required.

In terms of the terminology used for morphological generalisations, as presented in the discussion about the relation between meaning and form, it is more correct to speak of “morphological types” than of derivation types. Morphological types capture both inflectional and derivational generalisations in the lexicon that are used to comprehend and to produce morphologically complex words.

2.5.6 Methodological issues

Studies investigating the mental lexicon have yielded many contradictory results. One of the causes of the inconclusive findings is the wide variability of the methods used. The famous discussion about Taft & Forster’s (1975) prefix stripping model, for instance, has mostly been focused on methodological issues. Even recently, in Schreuder & Baayen (1995), more methodological flaws of Taft & Forster’s study have been revealed. Since methodological issues have been crucial in models of morphological processing, this section will briefly elaborate on the most relevant points of discussion. Two of the main points are the definition of terms and the (non-) use of control conditions, leading to weaknesses in validity and reliability respectively.

A powerful experimental device to investigate access procedures in the mental lexicon is the use of non-words or pseudo-words. Apart from the terminological confusion (see the discussion about this in section 2.2), the use of these words has been criticised for reasons of validity: presenting subjects with pseudo-words will create an artificial situation that may induce morphological decomposition that might not be used otherwise. It is therefore unclear to what extent findings from studies using this device can be generalised to normal word processing. In addition, Henderson (1985) points to the inconsistency in studies involving pseudo-affixed words concerning the different definitions used for pseudo-affixation, which could explain the variability in the results. In some studies (Manelis and Tharp, 1977; Rubin et al., 1979) the criterion used for affixedness is that the root of the derivative is a free morpheme, while this has not been a criterion for all. Taft (1981), for instance has limited his choice of prefixed items to roots that do not enter into other word formation (monogamous roots, like *trieve* in *retrieve*) while others (Henderson et al., 1984) have only used polygamous roots for prefixed words, the root not necessarily being a free morpheme. Since most of the studies are based on the difference in latencies between affixed and pseudo-affixed words, this is an important consideration. Moreover, it limits the possibilities to compare studies investigating reaction time differences between affixed and pseudo-affixed words.

Some controversy can also be found in the selection criteria for words and pseudo-words. Taft & Forster (1976) report that it had been difficult to determine whether a word is morphologically complex or not (admit, devout, infant). To solve this dilemma, they relied on their own intuition, using as a leading cue whether the prefix contributes to the meaning of the whole word (645). This, of course, is an arguable criterion that has been severely criticised. In a later study (1981), Taft presented the words to 10 judges who were asked to assess them on morphological complexity beforehand. Although this must certainly be seen as an improvement, the reliability of such judgements has also been questioned. Smith (1988), for example points out that when judges are given explicit instructions, they are likely to give back what they were instructed, which is not necessarily their own instructions. Henderson (1985:63) also points to the inaccurate selection criteria that Taft & Forster (1975) used for their words and pseudo-words. Taft & Forster report that words that were the bound roots of prefixed words (like *-juvenate* for the word *rejuvenate*) took longer to reject than non-morpheme end portions (*-pertoire* for the word *repertoire*). But they did not take into account that many of the bound roots they used were polygamous (for the bound root *-semble*, based on *assemble*, they neglect the coexistence of *resemble*, *dissemble*, etc.). In response to Taft & Forster (1975), Schreuder & Baayen (1995) propose a motivated set of criteria for pseudo-stems, relating to their syllabification, length, transparency and their participation in productive word formations. Objective selection criteria like these are essential in conducting reliable and valid experimental studies. Finally, the criteria for the selection of pseudowords should include the "neighbourhood" of the pseudo-word. Coltheart et al. (1977) demonstrated that the more words that are one letter different form a non-word, the longer the lexical decision responses to that non-word tend to be.

Many studies have failed to incorporate variables like word length and frequency as a control variable, though these, and frequency in particular, turn out to be major variables affecting word recognition. On the other hand, frequency should not be confused with familiarity: frequency figures are not necessarily reflecting the familiarity of words. A word like *sleet* (Cobuild/CELEX lemma frequency = 1), for instance, might be more familiar than a word like *fen* (Cobuild/CELEX lemma frequency = 57 tokens) or *bailiff* (Cobuild/CELEX lemma frequency = 56 tokens). The latter observation has hardly been taken into account in psycholinguistic experiments, mainly because no objective measure of familiarity is yet available.

2.6 Requirements for a model of morphological processing

The aim of this chapter has been to establish a set of requirements that an adequate model of morphological processing should comply with. The ultimate purpose is to make a motivated choice for a particular model that can be adopted (and adapted) to account for the processing and development of L2 morphology. Out of all the models that have been discussed in the previous sections, only few remain that can explain all the data observed.

It is sometimes argued that morphology should be regarded as part of the periphery of language processing. Henderson (1985), for example, maintains that "morphological rules have been incorporated into the systems for reasons of convenience rather than necessity" (Henderson, 1985: 65). However, a careful examination of the linguistic theories of the lexicon in combination with an evaluation of the main findings of experimental studies investigating the mental lexicon reveals that the contribution of morphology in verbal processing is more important than Henderson assumes.

Linguistic theories have provided insights into several aspects related to morphology, but no suitable model has been proposed. Theories using word formation rules cannot adequately account for the productivity problem and other models usually provide synchronic pictures of the lexicon that are unable to account for dynamic language processing. Some theoretical implications, however, may contribute to the formation of an adequate model of morphological processing. The productivity problem, for instance, provides us with another argument to include a mechanism of (de)composition into a model of morphology. The same problem also shows that this should probably not take the form of word formation rules. Another outcome of linguistic theory that can be directly applied to modelling morphological processing is the idea of subcategorisation frames. Subcategorisation frames, or argument structures provide a typical example of the type of syntactic information that lexical representations should contain.

The main question of this chapter concerns the preferred access strategy of morphologically complex words. With regard to this, it can safely be concluded that the two systems, direct access or decomposition, are not mutually exclusive. The argument of efficiency is often mentioned as the main reason to compose words rather than store them. Indeed, it seems highly inefficient to store regularly formed words like *read*, *reader* and *reads*. However, the same argument of efficiency can also be used against the application of rules: in order to correctly produce a morphologically complex word according to some rule, the language user will have to apply rules at three different levels: syntactic, semantic, and (morpho-) phonological / orthographic. It follows from this that before an affix can be attached to a base form, knowledge is required about the syntactic category of the base form and of the target form, and of the correct phonological / orthographic representation of the desired target form (as determined by morpho-phonology). It is obvious that for a process like this to operate successfully and efficiently, only the most productive and most frequent complex morphological items are likely to be (de)composed. Furthermore, with regard to decomposition, transparency will be of great importance; only fully transparent complex items can be decomposed unambiguously. For this reason it is most likely that the language user has the competence of (de)composing morphologically complex words, but will not always use this ability. One of the major problems in the current discussion is the extent to which “rules” are used, and which factors determine whether a word will be (de)composed or not. The answer to these questions is most likely to be found by referring to the activation metaphor, in which the level of activation encompasses a complex interrelation between different variables, like transparency, productivity, frequency and processing complexity.

The main conclusions of this chapter are summarised in the following requirements:

1. Direct access and (de)composition are not mutually exclusive. Whether words attain their own representation is dependent on their individual activation level. The activation level is determined by transparency, productivity, frequency and processing complexity. Productivity varies as a function of transparency and frequency.
2. For comprehension, access procedures serve as filters for the access of lexical representations, taking care of spelling and phonology.

3. Lexical representations should contain or refer to properties defining syntactic, semantic/pragmatic information. The syntactic properties can be seen as (sub-)categorisation frames or argument structures of the lexical representation.
4. Morphological regularity in the lexicon is not organised as procedural knowledge, like Word Formation Rules, but is driven by the argument structure of the lexical representations. The lexical representation of morphological constituents is organised in morphological types that are expressed in terms of their semantic/pragmatic, syntactic and orthographic/phonological properties.
5. Lexical representations should be considered modality-neutral. Different access procedures must be assumed for the different modalities.
6. Lexical representations are neutral between comprehension and production; production can roughly be seen as the reverse of comprehension. The interaction between production and comprehension must be accounted for.
7. A model of the role of morphology in the mental lexicon should fit into an overall account of the production and comprehension of language.
8. Although there are some clear practical differences between derivation and inflection, no principled distinction between inflection and derivation can be made

Two models that were discussed in this chapter most clearly satisfy these criteria or can easily be modified to account for them: Schreuder & Baayen's (1995) Meta Model and Bybee's (1995) connectionist model. These models are essentially of a different nature; Bybee's model has great explanatory power, but is more theoretical in nature, and therefore less testable and thus not suitable for the current purpose, while Schreuder & Baayen's Meta model is geared towards computation and is more likely to be empirically testable. However, in the Meta model not all points mentioned above are accounted for or made sufficiently explicit. Therefore, some alterations and additions to this model are proposed, the result of which is presented in Figure 9. After these adjustments, the model meets all the necessary requirements listed above. The schematic overview in this figure is simplified in several respects, and the arrows represent the way in which the elements in the model depend on each other rather than a processing sequence. One of the simplifications, for instance, concerns the interaction between the lemma nodes and grammatical encoding and decoding and the nature of the lemma nodes. It has been argued in section 2.5.4 that word coinage is driven by the argument structure of the morphological type. Yet, in this figure no argument structures have been represented at the level of the lemma nodes. A representation of the elements contained in a lexical entry is given in Figure 10. This figure shows which elements a lexical entry must consist of and how these elements interact with each other and with the conceptual structure as generated by the Verbaliser. A morphological type is presumed to have a representation that is very similar to that of a lemma. In the remainder of this section, this model will be discussed in terms of the requirements postulated above.

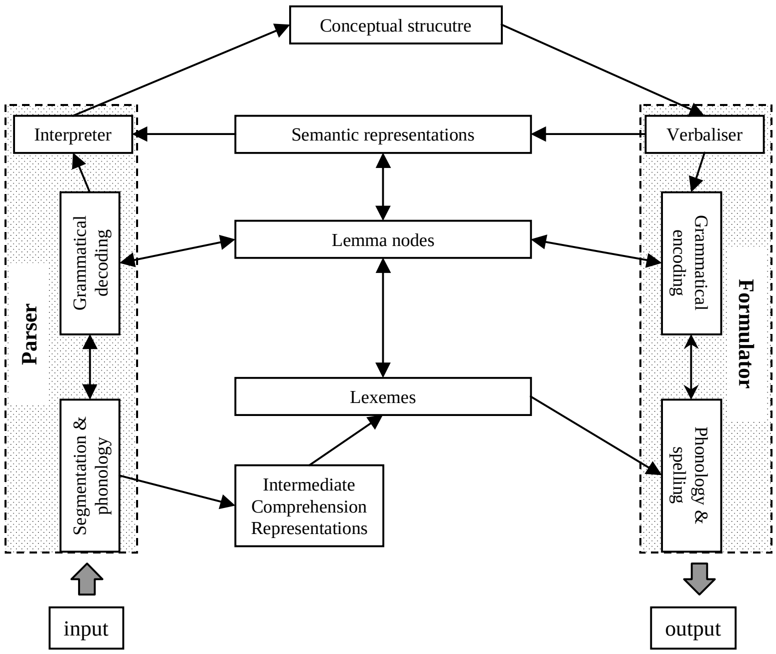

Figure 9. The Lexicon in a model of language processing

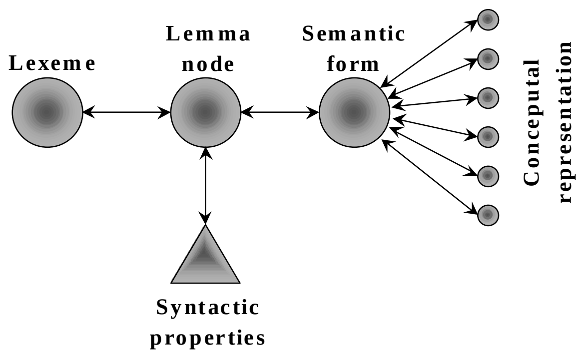

Figure 10. Schematic representation of the elements of a lexical entry and their interaction with the conceptual structure

That this model meets Requirement 1 can be illustrated by some simple lexical examples. In Figure 11, the differential processing of three morphologically complex words has been worked out for recognition: *frankness*, *darkness*, and *grateful*. It will be shown that the processing of these words can be accounted for in terms of transparency, frequency and productivity. For all these words, the examples represent a particular moment in time for a particular speaker. It should be noted that the representation in this figure has been abbreviated by omitting the semantic form attached to the lemma nodes. Since a one-to-one relation between the lemma node and the semantic form can be assumed, the semantic form has been left out.

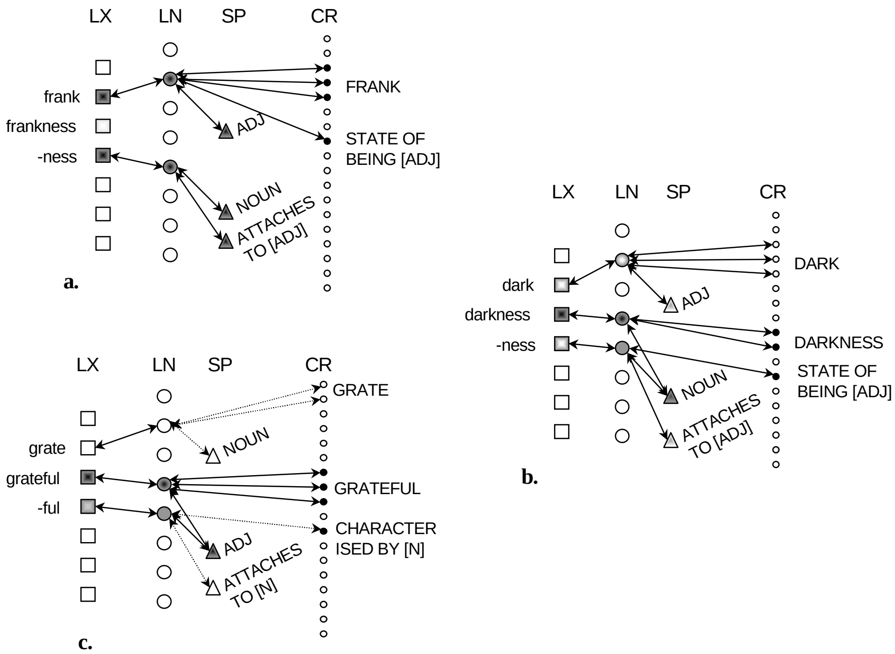

Figure 11. Processing of the words frankness, darkness, and grateful according to the modified Meta Model. Activation spreads between the Lexemes (LX), the Lemma Nodes (LN), the Syntactic Properties (SP) and the Conceptual Representations (CR). The level of activation is represented by the degree of shading of the nodes. The dotted lines represent potential links that are not currently activated. This figure has been abbreviated by omitting the "semantic form".

Frankness (a. in Figure 11) is fully transparent and based on a productive morphological type. This can be illustrated by some simple lexical statistics. The root *frank-* occurs in five different forms: *frankincense*, *frankly*, *frankness*, *frank*, and *franking machine*[19], with a cumulative root frequency of 511. The surface frequency

[19] All data have been taken form the CELEX lexical database; the frequency figures refer to the cumulative COBUILD frequencies for written and spoken sources. As the purpose of the data presented in this section is to illustrate a point, these data have not been carefully verified (for instance for double occurrences due to the selection criteria).

of *frankness* is 44. The relative frequency of the surface form as a function of the root can be expressed by calculating $F_{frankness}$ / F_{frank-} = 0.09. However, -*ness* occurs with 1353 different roots, and has a cumulative type frequency of 20.179. In terms of activation, this implies that -*ness* will have a high resting activation, because it occurs with many different roots and is very productive. The productivity can be expressed by calculating the average frequency of the different types, so by dividing the cumulative type frequency (F_{type}) by the number of different types (N_{type}), resulting in the average type frequency (F_{av}), which is 14.9. A more adequate measure of productivity can be computed by taking into account the number of hapaxes and calculate $P=n_1/N$ (see 2.5.1). For the corpus used, this amounts to $P=0.011$. The combination of the low relative surface frequency of *frankness* and the high type frequency of -*ness* will make it unlikely that the surface form has an independent lexical entry. The word will therefore be processed type-familiarly.

The same line of argumentation can be applied to the next word in Figure 11, *darkness* (b.). If we look at the statistics, however, we will have to conclude that *darkness* has much more chance to be given its own lexical entry, although it is fully transparent. The root -*dark* occurs in seven different forms, and has a F_{root} of 4815. The surface frequency of *darkness* is 969. So the relative surface frequency of *darkness* is 0.20 (the number of occurrences of the word *darkness* accounts for 20 per cent of all words containing the root *dark*). The data for -*ness* are, of course, the same as those of *frankness*. This means that for -*ness* we find again a high type frequency, but this time combined with a high relative surface frequency. Compared to *frankness*, the chance that *darkness* will have its own lexical entry is much bigger. In Figure 11 this is indicated by the high activation of the lemma node of *darkness* and the conceptual representation it is connected to. This figure also shows that there will be some activation of the constituent morphemes, *dark*- and -*ness*. Since the suffix -*ness* is responsible for the syntactic category of the whole word, the lemma node of -*ness*, including its syntactic properties, is activated. It should be noted, though, that (unlike -*ness* in *frankness*) the conceptual representations of the suffix receive very little activation. Activation feedback will flow back to the lexeme connected to the whole word, and to a lesser extent to its constituents (due to the activation of the syntactic category, more activation feedback will flow to the suffix than to the root).

The third word in this example, *grateful* (c. in Figure 11), has a cumulative root frequency of 117 and a surface frequency of 80. The relative surface frequency is 0.68 (the form *grateful* makes up 68 per cent of all words containing this root, including the root itself!). In addition, the productivity of the suffix is considerably lower than that of -*ness*. The suffix occurs with 15823 different roots, which seems to indicate productivity, but the N_{type} is only 117 (The form *beautiful* alone accounts for 2075 tokens), resulting in a F_{av} of 135. There are no more than eight hapaxes, so that $P = 5 \times 10^{-4}$.[20] The combination of a high relative root frequency with low pro-

[20] The productivity of this type may well be low because the form of the affix represents many homonymous different morphological types. Webster's Ninth gives four different, though semantically related interpretations: "1: full of <eventful>; 2: characterised by <peaceful>; 3: having the qualities of <masterful>; 4: tending, given, or liable to <mournful>". The in-

ductivity will make it very unlikely that this form is given its own lexical entry. Activation feedback will largely flow back to the whole word, and no activation will flow back to the root, because the root *grate* is not semantically related to *grateful*, so that licensing and composition will not yield a positive result; in other words, the word *grateful* is not transparent[21]. Some activation will flow back to the suffix due to the activation of its syntactic properties.

The three examples worked out in Figure 11 demonstrate that both direct access and decomposition may be used in lexical processing. The choice between the two strategies is determined by the productivity of the word, which is expressed by an interaction of the relative root frequency, the type frequency, and the transparency of the affix type.

The second criterion ("access procedures serve as filters for the access of lexical representations, taking care of spelling and phonology") is a basic assumption to the Meta model. The lexical representations, consisting of the semantic representations plus the syntactic properties that are associated with a lemma, can only be accessed if the lexemes are regarded as "normalised" forms. This is taken care of by assuming additional intermediate access representations for comprehension. The lexemes may be modality neutral, but the intermediate access representations are not. It is at this level that differential representations for visual and auditory recognition may be distinguished (requirement 5).

The lexical representations in the Meta model are attached to syntactic and semantic information (requirement 3). In the modified model (Figure 9) pragmatic properties can be assumed at the level of the semantic representation associated with a particular lemma to account for pragmatic differences between otherwise synonymous forms. For example, for the correct interpretation and production of words information is required about the register to which the word belongs. Activation feedback can also account for partial co-activation of several properties. Even if a morphologically complex word is not semantically compositional, the syntactic properties of an affix in that word may be activated, resulting in activation flowing back to the lemma node of the affix type and eventually to the lexeme associated with that affix type. This has been exemplified in Figure 11, where co-activation takes place of some of the syntactic properties of the affix *-ful* and the whole word. Although the affix in this case does not contribute to the semantic representation of the word, it does determine its syntactic category. It may even be argued that only the syntactic information of the affix is used, and that the lemma node of *grateful* does not refer to a syntactic category of its own.

Rather than defining morphological regularity in terms of traditional word formation rules, the Meta model allows us to express morphological regularity in terms of frequency and productivity of morphological types (requirement 4). A morpho-

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terpretation indicating "the number or quality that fills <roomful>" is left out of all analyses.

[21] Transparency should be interpreted as a synchronic phenomenon. Speakers who have some etymological knowledge or speakers who know Latin may realise this from is derived from obsolete *grate*, meaning "pleasing", from Latin *grâtus.*

logical type is no more or less than the observed generalisation of an affix to attach to a particular kind of root. If licensing and combination on the basis of an affix is successful, the affix will receive activation feedback. In this way, affixes, like words (and roots, for that matter) can be given their own lexical entries.

Comprehension and production make use of the same lexical entries (requirement 6). Although the discussion thus far has primarily focused on recognition and comprehension of morphologically complex words, there is no reason to assume that production processes are essentially different. The model sketched in Figure 9 is fully compatible with the Meta model on the one hand and with generally accepted production models on the other. In both comprehension and production, phonological decoding and encoding are external to the lexicon. The lexemes (which in the original Meta Model are labelled "access representations"), however, will contain phonological information that has been derived from comprehension and that can be used to fill the phonological frames that are established by the formulator.

Requirement 7 states that a model accounting for the production and comprehension of morphologically complex words should fit into an overall account of production and comprehension. The overall model that has been adopted for this purpose is Levelt's "Speaking" model, as this model has great power in explaining empirical facts and allows for the neutral position of the lexicon between production and comprehension. However, some tension occurs between requirement 4 and requirement 7. Placing morphological types at the level of lemmas creates a problem for the selection of morphological types, because morphological types are not always conceptually unique; they may differ only with regard to their syntactic properties. In Levelt's model, conceptual uniqueness is a requirement for the one-way selection of lemmas: lemmas are selected on the basis of conceptual information only. In the original Meta Model this problem did not occur, as this proposal was limited to comprehension only. Moreover, this problem is avoided in the original Meta Model by positioning syntactic characteristics at the same level as conceptual properties. Generalising the model to production and adjusting it to fit Levelt's model of language processing causes this problem to surface. The solution proposed was to assume a loop from the Formulator back to the Verbaliser that can be used when the licensing of a morphologically complex word fails. Although this compromise goes against the strict modular nature of Levelt's model, it conveniently solves the current problem. Moreover, a similar feedback mechanism is required to account for the acquisition of this system of language processing (see Chapter 3).

Finally, the model should not make a principled distinction between inflection and derivation (requirement 8). This requirement is not problematic for the Meta Model, as this distinction is not used as a criterion for the access strategy that is applied. Fact is that the application of inflectional affixes is usually extremely productive, as regular inflectional affixes will occur with an infinite number of different roots. Therefore, no separate processing procedure will have to be assumed for inflection. Also, exceptions can easily be accounted for by assuming that these forms have their own lexical entries. For instance, irregular plural formations, like *children* and *oxen* may have their own lexical entries.

2.7 Conclusion

The theories and models reviewed in this chapter led to the choice of one model, Schreuder & Baayen's Meta Model to be adopted to account for the processing of morphologically complex words. Several adjustments to this model were proposed. The most important adjustments were to make it account for the neutral position of the lexicon between production and comprehension and to suit it to a general model of language processing. One of the differences compared to the Meta model is that in the modified model the original "concept nodes" do constitute part of the information contained in the lexicon, and that the syntactic characteristics associated with a lexical entry cannot be represented at the same level as the semantic information. One of the consequences of this operation is an adjustment of the terminology that was utilised for the Meta model. The "Access Representations" in the Meta model are labelled "Lexemes" in the modified model, the "Concept nodes" have become "Lemma nodes", "Syntactic nodes" have become "Syntactic Properties" and the "Semantic nodes" have become "Semantic forms". Further adjustments concern the terminology used for the general model of language processing, adapted from Levelt (1993). Following the proposal by Bierwisch & Schreuder (1993), an additional component (the "Verbaliser") was added to Levelt's Formulator, which mediates between the lexical form of the lemma and the purely conceptual information resulting from the Conceptualiser. Furthermore, the possibility of feedback from the Formulator to the Verbaliser could not be excluded.

In the chapters that follow, the modified Meta Model as presented in this section will be used as a starting point for further development. In Chapter 3, this model will be put to the test of language acquisition data from L1, and it will be adjusted to account for observations about the bilingual mental lexicon and L2 morphology. The final version of the model will be presented at the end of that chapter.

Chapter 3

Morphology and the lexicon in acquisition

3.1 Introduction

If the discussion in Chapter 2 is extended to language acquisition, one of the major questions is whether the learner acquires roots and morphological rules or morphologically complex words as wholes. Considering the large amount of irregularity in the lexicon (and therefore in the input the learner receives) one may wonder how learners manage to attain the mechanisms to form new words. Or, in other words, how do they acquire the features like subcategorisation and allomorphic conditioning of all lexical entries? In a purely rule-based system exceptions and ambiguities are likely to frustrate the rule-learner's hypotheses. For the comprehension of morphologically complex forms, for instance, the lack of transparency of many lexical items may confuse the rule-learner; a drawer is not always a person who draws and a drawing room is not necessarily a room in which one draws. On top of that, such a model would require a complex mechanism for reorganising lexical storage if a derived form is acquired before its base. On the other hand, a pure storage position is not adequate either, as all adult speakers of a language are able to apply morphological regularity in their formation of new words on the basis of existing, familiar words. Hence, similar to the situation in adult language usage, a compromise position is most likely to explain learner data, as it will be able to account for the acquisition of regular productive word formation devices while at the same time allowing for the occurrence of idiosyncrasies. This chapter will investigate which factors play a role in the acquisition of morphology, and the models discussed in Chapter 2 will be tested against facts of language acquisition.

For the central issue of this study, the acquisition of L2 morphology, additional questions will have to be answered with regard to the transferability of lexical properties and the differences between child acquisition and adult acquisition. However, research on the acquisition of L2 morphology is sparse and mainly focuses on acquisition orders, while specific models focusing on the role of morphology in the L2 learner's mental lexicon have not yet been developed. Initial observations will therefore have to be drawn from other areas of research. Three fields that have ground in common with this issue will be discussed in this chapter: the acquisition of the L1 lexicon and L1 morphology, the organisation of the L2 (and bilingual) lexicon, and second language acquisition theory. Section 3.2 deals with the acquisition of L1 morphology. Observations from this area are mainly found in case studies of child L1 acquisition. These data show a pattern in children's analysis of newly encountered words and in their formation of innovative coinages indicating that three principles of acquisition are at work: transparency, contrast and conventionality. After some adjustments, the model that is proposed in the previous chapter appears to be able to account for all major data on the acquisition of morphology and the lexicon. Section 3.3 discusses the evidence from studies on the organisation of the bilingual lexicon. On the basis of this discussion some more adjustments to the model are proposed, resulting in an alternative to the models of the bilingual lexicon proposed thus far. This new model introduces interlingual activation in a mixed system that includes language properties as part of the information of a lexical entry. In this way the major findings reported in the literature about empirical research investigating the bilingual lexicon can be explained. The third area, second language acquisition theory (3.4), is extremely broad, but the literature relevant to morphology is mainly limited to a discussion about the order of acquisition of grammatical morphemes. These data show that there is a fixed sequence of acquisition of grammatical morphemes, irrespective of the L2 learner's native language background. This sequence can largely be accounted for in terms of productivity and frequency, while the learner's native language plays a predominant role in the perception of transparency of morphologically complex words in the second language. The observations elaborated on in the first few sections of this chapter will accumulate into the model of interlanguage morphology that is fully worked out in the final section of this chapter, 3.5.

3.2 The acquisition of the L1 lexicon and morphology

Though sinners sin
And thinners thin
And paper-blotters blot;
I've never yet
Had letters let
Or seen an otter ot.

From *The biology of Algae* by R. Lewin,

From the moment children start uttering their first words around age one, they steadily work on their vocabulary to extend it to about 500 recognisable words when they are two years old. From then on, they will acquire about ten new words a day, working towards an average of 14,000 words in their vocabulary at age six (Carey, 1978) and eventually to the 20,000 to 50,000 words that adult speakers of English have actively at their disposal (Nation, 1993; Clark, 1993; Aitchison, 1994). The eventual passive knowledge of words may even be as high as 250,000 (Diller, 1978). Being faced with the extraordinary task of acquiring all those words in a relatively short period of time, it is only logical that children will apply any means available to them to extend their lexicon. Clearly, morphology provides a powerful way to extend one's lexicon, and morphological generalisation may partly explain the rapid vocabulary growth in the elementary years, i.e. age 4-13 (Wysocki & Jenkins, 1987;

White et al., 1989)[22]. The ability to interpret words on the basis of morphological analysis was found to explain the relatively large vocabulary of superior students in a test conducted by Freyd & Baron (1982). Moreover, first graders' reading comprehension was accurately predicted by the score on a morphological production task (Carlisle, 1995), indicating a significant relation between morphological awareness and reading achievement in early school years[23]. This should come as no surprise considering that 86 per cent of the derivationally suffixed words in printed school English are semantically transparent (Nagy & Anderson, 1984)[24]. Further evidence for the relevance of morphology in vocabulary acquisition comes from diary studies. These studies show that children are extremely inventive when it comes to creating new words on the basis of old: children in the early stages of language acquisition use productive word formation devices on a large scale.

An important test for all models of morphology and morphological processing in the lexicon, from both language theory and psycholinguistics, is that they should be able to account for L1 acquisition data. Only then can they be considered psychologically real. However, by no means all models meet this requirement. Acquisition data can therefore be helpful in winnowing models of morphology. This is a necessary first step to take before considering models describing the acquisition of L2 morphology.

3.2.1 Acquiring morphological relations in the L1 lexicon

Young children use morphology on a large scale to expand their vocabulary. Qualitative studies of children in the very early stages of language acquisition provide ample evidence of lexical innovations. Innovative nouns are mostly compounds:

(1) D (1;8,5, playing with a spoon and cup, then put spoon in cup): *Orange juicespoon.*
(2) D (2;4,7, looking at a picture of a cake with candles): *That a candle-cake*.
Mo: What's it for?
D: *For a birthday.*
(Clark, 1993:99)

Innovative verbs mostly exhibit some form of conversion (or zero-derivation):

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[22] In an intervention experiment Wysocki & Jenkins (1987) found that subjects' success in deriving the meaning of unfamiliar words was affected by "prior experience with related words" and by "the strength of the surrounding sentence context" (p. 66). The evidence for morphological generalisation was not very strong, but provides some support for the relevance of morphological generalisation for vocabulary growth in the elementary years.

[23] Reading achievement, in turn, has been shown to be related to vocabulary size (Anderson & Freebody, 1985; Anglin, 1993)

[24] In a follow-up study, White et al. (1989) found that in their sample 40 per cent of the morphologically complex words were not analysable on the basis of their constituent morphemes. When the second and third familiar meaning of the root morphemes are taken into account, this figure drops to only 19 per cent (p. 289).

(3) D (2;6,23, of two pencils, to Fa): *I sharped them*.
(4) D (2;9,1, of a sock, to Mo): *And did you needle this*? [=mend with a needle]
(5) D (2;8,5 after talking about seeing some boats*): And we might see a man oaring a boat with oars*. [=rowing]
(Clark, 1993:101)

Children tend to regularise their language. This is shown in the examples above, where D. creates new coinages: in all cases the child forms new words which are regular and transparent. Clark (1993) convincingly demonstrates that transparency of meaning and simplicity of form, together with productivity, can make accurate predictions about the acquisition of word formation across languages.

Transparency is perhaps the most important principle to guide the child's innovations. Children's most favourite word formation device, compounding (as in (1) and (2)), for instance, leads to more transparent novel forms than affixation, both semantically and phonologically, because both constituents are meaningful, known roots. Moreover, unlike many instances of affixation, compounding leaves the root(s) of the word (phonologically) intact. The relative importance of transparency is further illustrated by the early use of compounding: young children who have not yet mastered the -er agentive rule (*read-er*), fill this gap in their vocabulary by using compounds (*read-man*) or a form in between compounding and affixation. Clark (1981) found many forms like *puller wagon* in children's speech for "someone pulling a wagon". This indicates that transparency (the compound forms like *-man*) takes precedence over productivity and frequency (agentive *-er*): even though *-er* suffixation occurs more frequently in the input speech, the child's first word formation rule acquired is compounding, due to its semantic transparency.

The verbal innovations in (3) to (5) exhibit the same features of regularisation and transparency. Zero-derivation is regular and productive, and leads to transparent new forms. In addition, the child's use of zero-derivation in *sharped* in (3) over adult *sharpened* shows the preference for simple forms over complex ones. Simplicity of form relates to the number of changes a form will undergo in affixation, including phonological change. Clark's (1993) data show that children will always prefer simple word formations over complex ones. This is exemplified by zero-derivation in (3) to (5): as this type of word formation requires little or no form change[25] in terms of form, it is the most simple means to create new words. Qualitative (diary) studies show its immense popularity among young children.

Diary studies also reveal that children analyse words into their constituent parts. The instances of compound coinages in (1) and (2) may show different functions, but both are transparent compounds in which the first constituent stands in an "IS-A" relation to the second. At this stage, the child shows to have acquired a sense of right-hand headedness of English compounds. These coinages may therefore be interpreted as evidence for prior analysis of IS-A compounds and perhaps even of dif-

[25] Although some cases of zero-derivation (or 'conversion') involve some phonological change, as in *house (N) - to house, safe (N) - to save* and *proof (N) - to prove*. I have come across no data that provide insight in the use of these forms by young children.

ferent types of these compounds: *Orangejuice spoon* may indicate the analysis of words like *teaspoon*: a spoon with a particular function (e.g. to stir) orange juice. In (2) the child formed a more basic type of IS-A compound, specifying the type of cake by its outward appearance rather than its function (birthday cake), in spite of being familiar with that function. Other instances of analysis are shown in the examples of zero-affixation, (3) to (5), which may be the result of the child's analysis of pairs like *mail - to mail*; *hammer - to hammer,* etc. Zero derivation is, after all, a very productive morphological type. The child's analysis of words is also clearly revealed by the innovative adjectives in (6) to (8).

(6) D (2;6,22, of the wet newspaper): *It's all soaky. The paper is soaky*. [=very wet, soaked].
(7) D (2;7,5, driving home in the dark after a dinner out): *It's very nighty.* [It's pitch dark].
(8) D (4;1,1, objecting to Mo's removing a stick cut from a Diefenbakia stem): *No, it's not poisony*.
(Clark, 1993:103)

Clark (1993) reports that after a period of using the adult forms of adjectives (*dark*, *nice*, *cold*) D. (2;2) suddenly started to add *-y* to all adjectives (thereby identifying the *-y* ending as belonging to the adjective category): *dark-y*; *nice-y*; *cold-y*. Next, D. (2;4) started to coin new adjectives by adding *-y* to nouns (*crack-y*). These observations clearly indicate the child's analysis of words into their constituent parts. Further evidence for this can be found by children's repairs and by their observations about language. Already at an early age, children show (sometimes even metalinguistic) awareness of their innovations: Dutch Ewout (2;7), for instance, used *handsokken* ("handsocks") for "handschoenen" (gloves). He shows awareness of this fact by saying: *Ik zeg handsokken, hè mam?* ("I say 'handsocks' , don't I, mum?") (personal record). So even though this child has apparently been made aware of his deviation from the adult convention, he is not yet willing to give up his own, more transparent, coinage. Analysis of language utterances is crucial to the acquisition of language. But analysis can only be successful if these utterances are regular and semantically transparent.

Once morphologically complex words have been analysed, the forms of the constituents will have to be mapped onto meanings. That mapping is often troublesome is demonstrated in an experimental comprehension study by Freyd & Baron (1982), who found that learners (fifth and eighth graders) were well able to analyse complex forms into bases and affixes but often failed to attach meaning to the affix. Apparently, patterns can be recognised on the basis of the form of the affix, but, the authors argue, the lack of knowledge of the (semantic/syntactic) effects of a derivative is responsible for the relative “difficulty” of complex words that was found in their study (p. 293). However, the suffixes used in their study comprise a seemingly random selection and do not always make regular transparent words. In addition, many of the suffixes in their test involve phonological or orthographic irregularity (and are thus not morphologically ”simple”). Finally, neither frequency nor productivity was included as a variable in this test. Nevertheless, these findings indicate that the acquisition of morphology had not yet been fully completed by the subjects in their test (age 10-14). This is in accordance with Smedts's (1979) conclusion that the acquisition of morphology is by no means complete at the onset of puberty (see also 3.2.2). And when the meaning or function of a particular affix is not yet known to an individual, that affix cannot be interpreted by that individual at that moment. Hence, words containing that affix will not be transparent for that individual learner. For an affix to become "known", learners will have to assign meaning to word forms. In the case of morphologically complex words, meaning can obviously only be mapped onto forms when the relation form-meaning is consistent and regular. In other words, semantic transparency is a condition for the successful mapping of meanings onto forms.

A further factor in the acquisition of morphology is productivity. Productivity is dependent on transparency, as mentioned in Chapter 2 (see 2.5.1): transparency is a necessary condition for productivity. This means that productive word formation devices will always lead to transparent coinages, but not the other way round; transparent morphologically complex words are not necessarily formed by a productive morphological type. As productivity is defined as the preferences of a speech community at a certain moment in time, all adult members of that speech community will be aware of those preferences. Children will therefore need to acquire these preferences or conventions. The child's acquisition of productivity can be explained by looking at the characteristics of productivity. Productive word formation devices are characterised by the occurrence of many different forms with a low token frequency. The child's input will therefore contain many different types of productive formations with few tokens, whereas the child will encounter many identical tokens of types that are less productive. The number of different words containing the suffix *-th*, for instance, will be largely outnumbered by the different words containing, say, *-ness*. This will lead the child to assume that the usage of the unproductive suffix *-th* is limited to a fixed set of roots, while productive affixes like *-ness* can be attached to (almost) any (in this case adjectival) root. The exact mechanism of the child's "conclusions" can be further explained in terms of resting activation and activation feedback (see section 3.2.3.2). Once children have acquired the relative productivity of different word formation devices, they will be able to select the more productive affixes in the case of synonymy: when a child can choose out of more than one simple and transparent word formation to express the same meaning, she will opt for the most productive alternative. Clark (1993) argues that the principles derived from these observations, conventionality and contrast, can explain children's development of word formation.

3.2.2 Developmental issues

Most progress in the study of morphology can be expected by trying to explain, and even predict the development of this type of knowledge over time. With regard to the development of morphology in L1 acquisition two questions must be distinguished. First, how does the child manage to acquire knowledge of morphological regularity and productivity, and second, what is the sequence of development of morphological knowledge over time and how can that sequence be explained. These questions address different notions of development, but are not unrelated: in the answer to both questions semantic transparency plays a key role.

3.2.2.1 Development of lexical knowledge

One way of explaining the development (lexical) of knowledge is by assuming a gradual analysis of forms and a subsequent matching of forms to meaning (see, for instance Karmiloff-Smith's (1986) phases of skill development). This approach is widely used in models of language acquisition that draw on cognitive psychology. The process of lexical development is clearly illustrated by the subsequent utterances of one-year-old Adam, described by Barrett (1983, 1986). Adam used to shriek "dut" as he knocked a yellow toy duck off the edge of the bathtub. But he only used this word in this particular context. Adam's meaning of "dut" should be related to knocking a toy duck off the edge of the bathtub, rather than to the adult meaning of "duck". Only in later stages, Adam used the word to refer to his toy duck in other contexts (like in answering one of his parents' question "what is that", while pointing at the toy duck). Later again, the word "dut" was used to refer to real water birds, like ducks, geese and swans, to be further specified in yet another stage to ducks only. Aitchison (1994) divides this process into three stages: labelling, packaging, and network-building. The first stage, labelling, refers to the labelling of all kinds of objects in the child's environment. It is difficult to interpret the exact meaning of the child's labels, as the example of "dut" illustrates. The next stage, packaging, refers to the classification of objects under a particular label. At this stage, over-extensions like "dut" for geese and swans are likely to occur as a result of over-generalising prototypes. In the final stage which "may continue throughout a person's life" (Aitchison, 1994: 180), words are linked to other words, forming collocations and semantic fields.

This process also provides an appealing explanation for the acquisition of morphology and the lexicon. Initially, learners will acquire and use newly encountered morphologically complex words as unanalysed wholes. Upon repeated exposure to a particular morphological type, say *-able*, the learner will start to recognise the constituents of words containing *-able* and subsequently match this form to its functional and semantic categories. The underlying steps are further worked out in section 3.2.3.2. Two conditions will have to be met to complete this process. Firstly, the words to be analysed must be fully transparent and regular. If there is no clear one-to-one relation between the form of a word formation device (affixation, compounding), and its meaning, no mapping of form onto function or meaning can take place. It could even be argued that semantic transparency must be seen as a major operating principle of language acquisition, as children (but also adults in L2 acquisition) will constantly be looking for transparent structures in the language by striving for "an ideal or optimal linguistic code [which] will be one in which every surface unit, typically a morpheme, will have associated with it a clear, salient, and reasonably consistent meaning or function and every semantic element in a sentence will be associated with a distinct and recognisable form" (Langacker, 1977:10). Transparency can thus be seen as a central principle guiding the acquisition process. Secondly, the learner's motivation to acquire a particular word formation device is to fill lexical gaps: the learner must be in need of a particular word formation device to express or understand concepts otherwise incomprehensible. This in turn implies that the learner must be cognitively “ready” for the acquisition of the new concept. For example, as long as the notion of syntactic categories has not been acquired, there will be no need for zero-affixation changing the word’s syntactic category. Striving for transparency is motivated by the learner’s need to map meaning onto newly encountered forms.

The analysis of morphologically complex words and the mapping of meaning onto form is also apparent in the diary data quoted in 3.2.1. Children analyse words into parts and apply the newly discovered structures to form new coinages. Evidence for this can be found in children’s reflections about language and in the over-generalisation of transparent structures, as in the example of innovative adjectives where the child adds *-ly* to any adjective. However, eventually children will end up using the forms that are prescribed by the language community they live in. In many cases this means that they will have to drop their over-generalisations and adopt the conventional adult forms. Clark (1993) argues that this observation can be explained by two guiding pragmatic principles: conventionality and contrast. Diary data show that children tend to reject the co-occurrence of pure synonyms; they will always assume a one-to-one relation between meaning and form (instigated by the transparency principle)[26]. Diary data also show that children give priority to established forms. Clark illustrates this by referring to the *fis* phenomenon: although children themselves pronounce the word *fish* with a alveolar rather than a palato-alveolar final fricative, they favour the adult pronunciation of this word. This observation is confirmed by an experiment in which three-year-olds were able to identify no more than 50 per cent of the target words when these were pronounced using their own pronunciation, but correctly identified almost 100 per cent when the adult pronunciation was used (Dodd, 1975). When a child is confronted with an adult form (e.g. *sweep*) that does not contrast with the child’s own coinage (*broom*), the principle of contrast will lead the child to drop either of the synonymous forms[27]; the conventionality principle predicts that the child will give preference to the conventional adult form. Since productivity is defined as a reflection of the preferences of a speech community, the conventional adult form will in many cases also represent the most productive morphological type.

3.2.2.2 Sequence of acquisition

The second developmental issue is how morphology develops over time. Children start using morphology for the creation of new words at an early age: Clark’s (1993) diary data show compounding and zero-derivation as from age 2;4. On the other

[26] Note that this does not hold for homonymy: children readily accept that a form can have different meanings. Clark (1993:70), for instance, reports that children experience no difficulty in acquiring plural and possessive forms on nouns (*-s* and *-‘s* respectively).

[27] Children also rely on contrast in their acquisition of subtle differences between seemingly synonymous forms, like the difference in register between *begin* and *commence* and *mum* and *mother*.

hand, most children have not yet fully completed the acquisition of morphology at puberty. If the principles guiding the acquisition of morphology also hold for the developmental sequence, this sequence should be explainable in terms of simplicity and transparency. Also productivity will play a role at this level: for word formation devices that are equally transparent and simple, the more productive morphological type will be acquired first.

Acquisition data indeed show that the word formation devices requiring the least change of the original forms and that are most transparent, like zero-derivation and compounding, are acquired relatively early. In a study of derivational morphology using judgement techniques Derwing and Baker (1979) found that there is an increasing capacity for morpheme recognition with age. Older subjects generally performed better than younger ones, though not with regard to compounding. Furthermore, younger children were found to be more sensitive to orthographic or phonetic similarities, whereas adults were far more sensitive to the semantic aspect. Both of these observations support the crucial role of transparency: compounding is extensively used by children, while adults will have acquired more cognitively demanding morphological types. The greater importance of semantic similarity for adult speakers also indicates that for adults more forms are transparent.

Early work on L1 acquisition shows that children follow a fairly fixed order of acquisition. Data on the order of acquisition of English morphemes reveal that inflection is acquired relatively early. Children in kindergarten and first grade are in the final stage of acquiring inflection[28] (Berko, 1958; Brown, 1973). Some researchers suggest that inflection and derivation have a rather different role in language acquisition and language use. Inflection is often considered a global feature, whereas derivation is more peripheral. One could say that derivation is optional or "local", while inflection is indispensable for the learner (see, e.g.. Bardovi-Harlig & Bofman, 1989; Burt, 1975; VanPatten, 1984). This distinction should be supported by acquisition data, as global features are acquired earlier. However, a different explanation of this finding is that inflection is typically the part of morphology that is most productive, and leads to regular, transparent formations. Also the most productive derivational affixes are acquired at this stage. Jones (1991) found that first graders are able to recognise roots in morphologically complex words. The children in this test were asked to delete a segment of the word and then to explain the meaning of the word that remained. They were very well able to perform this task for simple, fully transparent (not necessarily productively formed) words (like *eighth*), but not for less transparent and complex derived items (like *pressure* or *natural*). The acquisition of the latter forms starts when children are in the third or fourth grade (Carlisle,

[28] The acquisition of the individual morphemes also follows a number of stages. An example of this is the widely attested U-shaped behaviour in the acquisition sequence of morphology. First, the child uses a form correctly, but unanalysed (e.g. *went*). In a later stage the child has regularised the formation of the past tense and produces over-generalised forms like *goed*, followed by a stage in which the exceptions to the rule have been acquired (*went* again). This may contribute to the difficulty in determining when a morphological rules has been acquired.

1988). Tyler & Nagy (1989) distinguish three types of morphological knowledge: relational (indicating formal relations between root and derived words), syntactic (concerning the syntactic (sub)categorisation of affixes) and distributional (concerning the distributional constraints of affixes). The results of their experiments suggest that these types of knowledge are acquired at different moments in time. Basic relational knowledge of derivatives and base forms has been acquired by fourth grade, but "major gains in the amount and nature of distributional knowledge occur after eighth grade, and these gains clearly differentiate the learning of Neutral and Nonneutral suffixes." (p. 665) The type of knowledge that the authors label "distributional", can also be seen as productivity: certain affixes are (more) productive in a particular context. *-ity*, for instance, is very productive if it is preceded by *-able* (see 2.5.2). Since the acquisition of productivity is dependent on the frequency of the type-familiar use of an affix, it is not surprising that subtle differences in productivity (i.e. distributional features) are acquired at a later stage. The difference found between Neutral and Nonneutral suffixes can be attributed to differences in transparency and simplicity: Nonneutral suffixes often involve vowel change, are often not transparently related to their roots, and often attach to bound morphemes.

In spite of the early start of morphological analysis, it takes many years to complete the acquisition of the morphological system[29]. In a test involving morphological production and perception tasks including 1300 13-year-old Belgian children acquiring Dutch, Smedts (1979) found that only 51 per cent of all word formation types in their test had been acquired at this age. Apparently, the acquisition of word formation is far from completed at age 13. In a follow-up study Smedts (1981) included a group of 16-year-olds and an adult group. The conclusion from this study is that the lexical morphological skills of the 16-year-olds is about 25 per cent higher than that of the 13-year-olds, but that their performance is still well below the adult level. However, differences were found between the types of test and among the word formation devices tested. Of all categories of derivation tested most correct scores were found among rules concerning the formation of nominal agents (71 per cent) and the lowest scores were found among the rules concerning the formation of adjectives, particularly concerning intensifiers (only 5 per cent of correct answers). Again, this confirms the claim that simple, transparent and productive word formations are acquired first; after all, agentive *-er* is simple, fully transparent and fully productive[30].

Another issue relevant for the discussion of the sequence of acquisition of morphology is the distinction between knowledge and awareness. Morphological awareness is the metalinguistic awareness of the morpheme structure of words and the ability to reflect on that structure. Knowledge of morphology refers to the (uncon-

[29] The data in this paragraph are based on languages that have a limited morphology and that show much morphological irregularity. The figures may be quite different for languages which have a more fully productive and regular system of morphology, like Turkish.

[30] Strictly speaking, this conclusion is not fully justified on the basis of Smedts's results, as Smedts is concerned with accuracy orders. Accuracy scores do not necessarily reflect acquisition (see section 3.4).

scious) ability to produce and comprehend morphologically complex words. Morphological knowledge can only be measured by analysing (spontaneous) language data to determine the accuracy of applying morphology. This is the type of analysis used in diary studies and studies using elicitation techniques (e.g. Berko's 1958 picture naming task). The outcomes of these studies cannot be directly compared to studies in which the subjects are asked to reflect on the morphological complexity of words or to manipulate words. There is, however, a relation between the two: morphological awareness is dependent on morphological knowledge. It can be assumed that in sequence of acquisition knowledge of morphology precedes awareness[31]. It is hard to determine the moment at which children start to acquire morphological awareness, as most tests investigating this are not appropriate for young (pre-school) children. Young children do occasionally exhibit morphological awareness (as exemplified on page 75), but the extent and consistency of this is unclear. Carlisle (1995) conducted a longitudinal study of morphological awareness involving children from kindergarten and first grade. She found a significant improvement of the children's performance on a production task between these two groups of subjects, which she sees as "an indication that children are in a transition from implicit to explicit morphological awareness in these years." (p. 205) But considering the high error rate and patterns of guessing that were found in the data of the kindergarten group, this conclusion may not be justified: the task that the subjects had to perform may well have been too difficult and cognitively demanding for children in this age group. The conclusion that remains is that children as from the first grade show they have acquired some morphological awareness. The start of this awareness is a matter of speculation, but it can safely be assumed that awareness of simple, transparent and productive word formation devices is acquired first, while the ability to analyse and produce complex and less transparent words arrives later and may last until adulthood. A close relation can be expected between the acquisition of morphology and the stages of cognitive development, which is probably what causes the age difference. This is particularly clear from the observation that more abstract and more formal tasks, and in particular the ability to reflect on language, are acquired latest. However, the scope of the current study leaves no room for an extensive discussion of the stages of cognitive development.

3.2.2.3 Production and comprehension

For the acquisition of morphology and the lexicon a distinction between production and comprehension must be made, for in all acquisition data describing the acquisition of morphology or the lexicon (e.g. Smedts, 1979; Clark & Hecht, 1983; Straight, 1986) comprehension and production are shown to be asymmetrical. Empirical evidence shows that comprehension normally precedes production (see, for instance, Freyd & Baron, 1982). Children often show comprehension of phenomena they do not yet accurately produce. Three-year-olds are able to appropriately inter-

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[31] Awareness, in its turn, can be subdivided into implicit and explicit awareness, where implicit awareness refers to the intuitive awareness of the structure of words, while implicit awareness refers to the actual ability to think and reflect about that structure.

pret the -er affix as agentives, but in their production these same children form agent nouns by producing compounds with *-man* (Clark & Hecht, 1982). Another example is that children under five place verb roots in the leftmost element of compounds they produce themselves (*throw-ball* for someone who throws balls), but at the same time can accurately interpret right-hand headedness in comprehension: Clark, Hecht & Mulford (1986) show that, for instance, *climb-rope* was interpreted as a kind of rope, not as a person who climbs a rope. To account for this, Clark (1993) posits the existence of separate representations for comprehension (C-representations) and production (P-representations) in the mental lexicon. She argues that learners first set up a (auditory) C-representation of a newly encountered word, onto which meaning will be mapped. These representations may also contain information about the internal structure of words. Once a C-representation has been stored in memory, children can start trying to produce the word. For this purpose they will need to set up a P-representation, containing all articulatory information necessary to produce that word. Monitoring its own production attempts will enable the child to compare its P-representation to the corresponding C-representation and to correct the P-representation accordingly. Clark (1993) concludes that "this view is incompatible with all accounts that simply take for granted that there is a single set of representations in memory, neutral between comprehension and production." (p. 251) However, the view of a single central lexical representation is not necessarily incompatible with differential representation for comprehension and production: the distinction between C-representations and P-representation can be attributed to different access procedures to the same lemma node that is neutral between the modalities and to which both C-representations and P-representations are linked (see section 2.5.4 in Chapter 2). Since both types of representation will share a large amount of their content, it seems only logical that this information is stored only once. In the order of acquisition, it does make sense that comprehension precedes production: new lexical entries can be expected to be set up upon the perception of a particular word. Only if meaning has been mapped onto these representations can they be used in production. In this, it must be noted that the meaning that the child has attributed to a particular form need not coincide with the adult meaning of that form. This issue will be further addressed in 3.2.3.2.

3.2.2.4 Summary

In this section, two questions have been asked: (1) how does the child manage to acquire knowledge of morphological regularity and productivity, and (2) what is the sequence of development of morphological knowledge over time and how can that sequence be accounted for.

The answer to the first question must be sought in the interaction of operating principles. The child's constant desire to discover meaning in messages, the principle of transparency, provides an urge to analyse words. The analysis of words can only occur if the condition of semantic transparency has been met. After analysis of (transparent) word forms, mapping of meaning onto form will take place for all analysed constituents of words. The principle of contrast will lead children to reject pure synonyms, thereby differentiating between seemingly synonymous forms. If the child has to choose between its own coinages and conventional words, the principle of conventionality predicts that the child will adopt the conventional form at the cost of her own coinage. The acquisition of morphological productivity can be explained by the frequency of occurrence of affixes in relation to whole words containing that affix. Children are sensitive to the frequency of morphemes: morphologically complex words with a high type frequency and low token frequencies will lead the child to assume productivity of that morphological type.

The answer to the second question must be considered at different levels. First, production must be distinguished from comprehension. Second, knowledge must be distinguished from awareness. Within these levels the order of acquisition is consistent: comprehension must logically precede production, and knowledge must logically precede awareness. But the order of acquisition of morphemes, which has been found to be fairly fixed, runs across these levels. At a particular moment in time, a certain learner may have acquired some morpheme only at the level of comprehension, while she has productive command of another morpheme and is able to consciously reflect on the usage of yet another. The acquisition of morphology starts at an early age, which is difficult to determine for comprehension and awareness, but can be set to approximately age one for the production of regular transparent complex words (e.g. noun plurals). Comprehension of plural morphemes will start before that and awareness will probably rise well after that. Completion of the acquisition of morphology may last until well into puberty for the awareness of less transparent word formation devices. Both within and across levels, the sequence of acquisition can accurately be predicted by simplicity and transparency: simple, transparent morphological types are always acquired before complex and less transparent ones.

3.2.3 Acquisition and models of morphology

Similar to the main question discussed in Chapter Two about the processing of morphology by the adult speaker-listener, a major question with regard to the acquisition of an L1 morphological system is whether language learning relies on rule learning or on memorisation. Berko (1958) was one of the first researchers to demonstrate "rule governed behaviour" in the acquisition of English inflection and derivation. She found that children are able to produce derivations of pseudo-words (like the agent noun *a wugger* derived from the pseudo-verb *to wug).* Her findings were confirmed in later experimental studies investigating this phenomenon (Derwing, 1976; Derwing & Baker, 1977). There is also plenty of evidence in Clark's (1981, 1993) diary data that real rule-learning is involved in morphological acquisition, since novel compound formations like *hitter-man* regularly occur in children’s speech, but rarely occur in adult speech (as in *fisherman*). This demonstrates that children exhibit rule-governed behaviour in (derivational) morphology as they do not only over-generalise “adult” rules that are present in their input[32], but even create their

[32] It is probably better to speak of "potential input" (Derwing and Baker (1977)) since "it is the child who eventually determines what the nature of the data is which actually get inside the model, and that these data may be incomplete, faulty, or even completely wrong from the standpoint of the adult or trained linguistic observer" (p. 93).

own rules. These rules always lead to fully transparent and simple formations and will later be replaced by (usually less transparent) forms, as predicted by the principles of conventionality and contrast.

But are the rules that children appear to learn and the rules that adult speakers (and listeners) appear to use the same as the rules proposed in models of morphology? This is an issue that has traditionally been brought up by psycholinguists to question he psychological reality of linguistic rules in general and, applied to morphology, to the psychological reality of word formation rules of the kind by (early) linguistic models of the lexicon (e.g. Aronoff, 1976). With regard to acquisition, a related issue is the "learnability" of morphological rules: linguistic rules are often criticised on their inability to account for acquisition data. This is a relevant point, as a description of language should always be able to account for the way language is actually used and acquired. Rules that cannot be "learnt" can be considered of merely theoretical value and have lost the important link to (psychological) reality. But not only linguistic rules must be learnable and psychologically real; the same holds for psycholinguistic models of the lexicon. This section will test both types of models for their psychological reality.

3.2.3.1 Learnability and psychological reality of Word Formation Rules

Rules postulated in linguistically oriented models of the lexicon have been exposed to much criticism concerning their psychological reality. Yet, the outcomes of studies investigating the general issue of psychological reality are strongly dependent on the research method used and on the "rules" tested. Derwing and Baker (1977), for example, discuss the psychological reality of some "potential morphological rules". They distinguish four types of rules, for instance Word-level Syntactic Rules (which are fully regular) and (irregular) Lexical Generalisations. They argue that the psychological reality of morphological rules may differ between these categories. For example, for one of the rules in their test, the Word-level syntactic rule for English plural formation, they conclude that "the psychological process of pluralization in English is a productive or rule-governed one even from a very early age" (p 100). But with regard to Lexical Generalisations, they conclude that there is no evidence that a rule deriving e.g. *decision* from *decide* can be said to be psychologically real. However, a few remarks must be made about this conclusion. Besides the unclear status of the distinction between these types of rules, the validity of their experiment can be questioned. The task subjects had to fulfil in the experiment on recognition of derivational morphemes, for instance, clearly taps on awareness rather than knowledge:

1. Do you think that the word *teacher* comes from the word *teach*?
2. Have you ever thought about that before?

Obviously, these questions will relate to the learners' ability to reflect on rules rather than the actual knowledge of the rules. Not making this distinction certainly blurs the results. Moreover, the reason why the derivational relation between words in pairs like *decide* and *decision* is not found to be psychologically real, is very likely to be due to the low degree of productivity of this relation as compared to pairs like *teach* - *teacher*. Yet, productivity as such is not a variable in their experiment. The conclusion must be that it is not possible to generalise "morphological rules" and then to determine whether these rules are psychologically real.

The question of learnability is an important matter concerning models designed in the traditional linguistic framework. Considering the fact that incorrect utterances in the child's input are not normally marked as such, and that the child is not systematically told which utterances are correct, she will not be able to rely on "negative evidence" for language acquisition[33]. If regular morphologically complex words are consistently formed on the basis of word formation rules (as, for example, proposed by Aronoff, 1976 - see section 2.2), then it is essential that the child acquires differences in the productivity and the distribution of word formation rules: some word formation rules will consistently lead to possible words (think of *-ness*), but others will not (for instance, *-al* leads to a correct formation in *arrival*, but not in **derival*). But how can the degree of productivity be ascertained within a framework of word formation rules that also allows (over-)generalisation? In the absence of negative evidence, the child would be unable to determine that **derival* is not a word of English. This problem could be evaded by rejecting the possibility of different degrees of productivity altogether and claiming that all word formation rules are fully productive. All morphological processes that are not fully productive can then be seen as derivational relations that are taken care of by redundancy rules. Redundancy rules express the formal or morphological relations which exist among the words listed in the lexicon, but do not make any statement about the semantic relation that may exists among these words. A proposal along these lines is made by Walsh (1983). Walsh argues that this type of model would solve the learnability problem of the models proposed by Aronoff (1976) and Allen (1978). She claims that morphological processes can be acquired on the basis of positive evidence only:

> The child begins by simply "storing" or "listing " each word as he learns it. As he abstracts generalizations from the set of words he has learned, he would distinguish between two types of lexical relations: those relations where the properties of one word are totally predicable from the properties of another word and an affix, and those relations which are purely formal.

Walsh (1983: 71)

However, it remains unclear how the child distinguishes between the two types of lexical relations. It may be hypothesised, as does Walsh, that the child assumes the second type of relation as soon as a complex word of a particular type is encoun-

[33] This assumption, referred to as "the logical problem of language acquisition", is not entirely uncontroversial. First, the input does not contain many ungrammatical utterances. Second, children may be provided with "indirect" negative evidence: children avoid producing certain ungrammatical constructions because they never hear anyone produce them (see, for instance, Hirsh-Pasek et al., 1984; Randall, 1985). Yet, the evidence that children primarily rely on positive evidence is abundant (see, for instance, White, 1990) and this position will be maintained here.

tered that does not meet the requirement of a semantic relation for that type to be fully productive. For example, the consistent semantic relation of *approve-approval* and *arrive-arrival* that the child may have initially assumed, will be proven wrong when pairs such as *recite-recital* and *revive-revival* are encountered. But this explanation is unsatisfactory, as idiosyncratic relations can be found among even the most productive morphological types in English as a result of lexicalisation (think of forms like *valuable*). Moreover, the existence of different degrees of productivity is an empirical fact that must be accounted for. The only alternative, then, is to abandon the idea of two types of rules and assume that only redundancy rules are at work. The disadvantage of that position is that only lexical relations within the lexicon can be assumed and that it will be hard to account for new formations on the basis of these rules. This is a serious problem for models postulating (linguistic) Word Formation Rules. As yet, only psycholinguistic models postulating different degrees of resting activation can adequately account for the learnability of degrees of productivity (see 3.2.2) without giving up the possibility of the creative construction of morphologically complex novel forms.

A practical problem for linguistic theory is that it (notably UG) is difficult to falsify. It is hard, if not impossible to determine whether the learner's linguistic behaviour is or is not in accordance with UG. The learner's variable behaviour can easily be regarded as performance variability if it is not in line with the theory proposed. Here, too, psycholinguistic models are better suited to be empirically tested.

As to the psychological reality of morphological rules, it can be concluded that the traditional word formation rules as proposed by Aronoff (1976) and Allen (1978) cannot be fitted into a learnability-based model of language processing. A different type of rules, redundancy rules (of the kind proposed by, for instance, Jackendoff, 1975) are learnable, but lack the power to account for the formation of morphologically complex novelties.

3.2.3.2 Acquisition and psycholinguistic models of the mental lexicon

In Chapter 2 the main conclusion after the discussion of psycholinguistic models of the lexicon was that the most satisfactory model is one that allows both full listing of morphologically complex words and (de-)composition. This position is supported by language acquisition data. As from age three children are able to decompose transparent compounds (Clark, 1993; Berman, 1985). In production, children use conventional, opaque morphologically complex words, but also make extensive use of word formation types to fill lexical gaps. This suggests that children acquire and store complex words as single units that may later be analysed into their constituent morphemes, accounting for the acquisition and subsequent use of roots and affixes. The discussion in 3.2 revealed that the main principles underlying the acquisition of morphology and the lexicon are transparency and simplicity, in combination with pragmatic principles like conventionality and contrast. Similar to linguistic models, psycholinguistic models should be able to account for these findings from language acquisition data and should also be able to explain the processes underlying the acquisition of morphology. This rules out some psycholinguistic models of language processing. Static models, for instance, can describe the separate stages of acquisition, but cannot account for the transitions between the stages. Therefore these models (for example Meijs (1975, etc.)) are not very suitable for the current purpose. The models that remain are models regarding morphology as a mere toolkit, only used in case all other methods of lexical access fail, and the models postulating parallel processing. One model representing each of these groups, Aitchison's (1994) toolkit model and the model for which I expressed my preference in Chapter 2, based on Schreuder & Baayen's (1995) Meta-model, will now be put to the test of language acquisition.

Aitchison (1994) explicitly distinguishes between inflection and derivation, and claims that "inflections are mostly added to words as we speak" (p. 126) and that derivationally complex words are only decomposed into morphemes if strictly necessary (in case a complex word is needed and the "normal memory" for the word is not found, if a complex task has to be performed, and if a long, complicated word has to be analysed). In that case, people will make use of their "backup store." For the creation of new words, an additional "toolkit" is postulated, which contains word formation rules reminiscent of the type proposed by e.g. Aronoff (1976) ("ADJECTIVE + -ness ⇨ NOUN). Aitchison views the development of the acquisition of words similar to the cognitive approaches described in 3.2.2.1 above: first, utterances are acquired as unanalysed units, which are gradually analysed (not before age one) and mapped with meaning. This in itself also provides a reliable explanation for the acquisition of morphology, but Aitchison does not go into the underlying mechanisms of the acquisition of the toolkit and the word formation rules posited in her model. Regarding the similarity of her word formation rules to Aronoff's, and regarding the doubtful learnability of these rules, the lack of a satisfactory explanation for the acquisition of word formation rules is a serious omission in Aitchison's theory.

In accounting for their Meta model, Schreuder & Baayen (1995) do elaborate explicitly on the implications for acquisition of their model. They argue that the acquisition of morphology, which they label as the "affix discovery procedure", takes place in two stages. Underlying these stages is the idea that the learner is constantly monitoring the mental lexicon for consistent correspondences between form and meaning, which is in agreement with the cognitive principles of language acquisition discussed above. The first stage of the acquisition process is the detection of patterns of co-activation of semantic representation. At this stage a separate lemma node is created for the newly discovered pattern. In the second stage, a new representation at the access level can begin to develop. The authors demonstrate this process by referring to the acquisition of the noun plural morpheme in Dutch. I will use the acquisition of a derivational type (*-ness*) to illustrate their argument and I will use the terminology proposed in Chapter 2 after some amendments to the Meta model (see Figure 12).

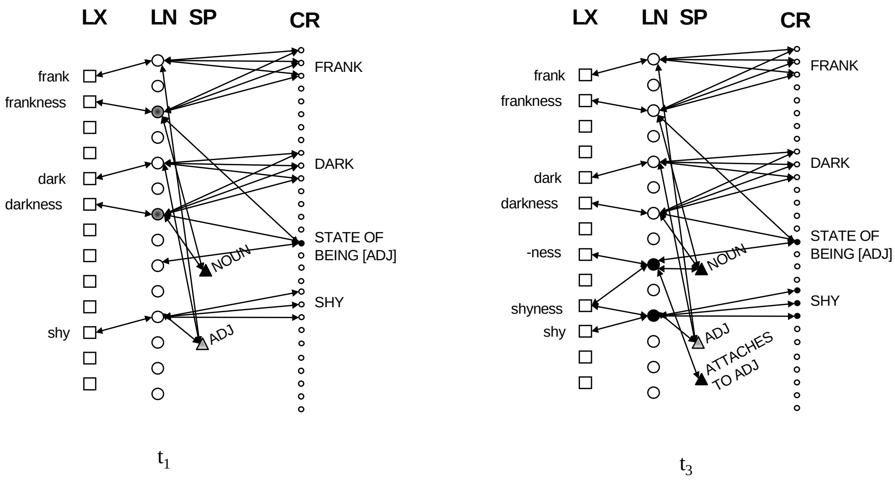

Figure 12. The acquisition of the suffix -ness at two moments in time. Lexemes (LX); Lemma nodes (LN) with Syntactic Properties (SP); Conceptual representations (CR). The level of resting activation is indicated by the shading of the nodes.

Based on the existence of transparent *-ness* words in the lexicon, the co-activation of the sub-pattern *-ness* with a set of semantic and syntactic nodes is noted by the learner (indicated by the darker colour of these nodes at t_1). As a result, a temporary separate lemma node for *-ness* is created, which is matched to additional semantic and pragmatic information necessary for the correct interpretation of the concept, and is provided with the appropriate syntactic information (at t_2, not in figure). Subsequently, the pattern of co-activation will lead to the creation of a separate lexical entry for *-ness*. This implies that at this stage the establishment of new lemmas and morphological types in the lexicon may coincide with the establishment of new conceptual representations if these do not yet exist. The meaning of newly encountered lemma showing the same pattern (*shyness* in the example) will be computed through the combined activation of the lemma nodes for *shy* (which is assumed to be a familiar word in this example) and *-ness* (t_3). As this formation is fully transparent, the new lexical entry for the "old" complex form, *shyness*, will only be weakly activated, while the lexical entry associated with its constituents will be strongly activated. In the course of time the same will happen to other transparent complex forms, including the ones for which a separate lexical entry had previously been set up, resulting in the eventual loss of the lexical entries representing the whole words.

Figure 12 provides a simplified picture of this mechanism. If we consider the adjustments with regard to the syntactic and semantic/pragmatic nodes (as proposed in Chapter 2) a more complete picture emerges. Taking gradual, step by step affix discovery as a starting point, it is probable that the child first acquires a limited set of properties of an affix and gradually fills out the full concept that adult speakers have at their command, by discovering and setting up more conceptual representations that can be matched to the lemma nodes. The moment of completion of the acquisition of a morphological concept will be determined by the interaction of operating principles, and can be expressed in terms of simplicity, transparency, frequency and productivity, as discussed in 3.2.1. An additional complicating factor for the acquisition of any form is homonymy: the occurrence of homonymous types will contribute to the computational complexity of that form. The dominance of the competitive homonymous forms will be determined by frequency and transparency. An example of partial activation is illustrated in Figure 13. The word in this example (*divinity*) has several homonymous readings:

1. The state or quality of being divine.
2. a. Divinity. godhead; God. b. A deity, such as a god or goddess. Used with the.
3. Godlike character.
4. Theology.
5. A soft, white candy, usually containing nuts.34

The second is one of the most frequent readings, but is not very transparent. However, the suffix in this word (*-ity*) may still contribute to its overall concept. Although not semantically compositional, (part of) the syntactic information of the suffix can be used, resulting in the partial co-activation of the suffix and the whole word. After all, the syntactic category of *divinity* is determined by the suffix only. Besides the syntactic information, also the pragmatic information, especially about the distribution of the affix (it only attaches to +Latinate roots) may be relevant. The activation of the root *divine*, however, is marginal, due to the limited transparency of the whole word.

This situation can also be seen as a stage in the process of discovering any affix type. In this case, only the syntactic properties of the affix type have yet been acquired. In later stages of acquisition the semantic and pragmatic characteristics may be discovered. In the intermediate situation sketched here, activation will flow back from the activated syntactic properties to the affix type by activation feedback, resulting in the activation of the lemma associated with the affix. If no such lemma exists, it will be established, simultaneously with the establishment of the conceptual representation of this lemma. Repeated exposure to the morphological type will cause an increase in the activation level of its syntactic properties and its semantic form, and consequently of its lexeme.

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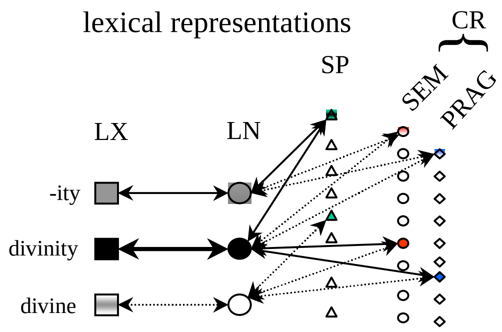

Figure 13. Levels of activation for lexemes (LX), syntactic properties (SP) and conceptual representations (CR) as a result of partial co-activation of some of the properties. The level of activation is reflected by the degree of shading of the symbols.

This model is in line with the acquisition data discussed in the previous section. The principles of lexical acquisition can be accounted for in terms of computational complexity. Also the order of acquisition of morphemes found in L1 acquisition studies corroborates the main principles of this model: the more simple and transparent word formation devices will be acquired before less simple and less transparent ones. The more syntactic and conceptual properties of a morphological type there are to be acquired and the more (conceptually) complex these properties are (for instance in their level of abstractness), the later the affix is to be found in the sequence of acquisition. Moreover, the additional assumption of partial acquisition of affix types can account for the finding (Freyd & Baron, 1982) that learners are able to recognise morphological types, but often fail to attribute meaning to these types: the syntactic properties of an affix type may be acquired, while its semantic specification is incomplete.

Language acquisition data (Clark, 1993) point towards an asynchrony of the lexicon for production and comprehension. In section 3.2.2.3. it was argued that the existence of C-representations and P-representation is not, as Clark claims, incompatible with a model postulating lexical representations that are neutral between production and comprehension. By assuming differential access procedures for production and comprehension, similar to the difference in access procedures between speech and visual word recognition, the model proposed here can accommodate both. This is illustrated in Figure 14.

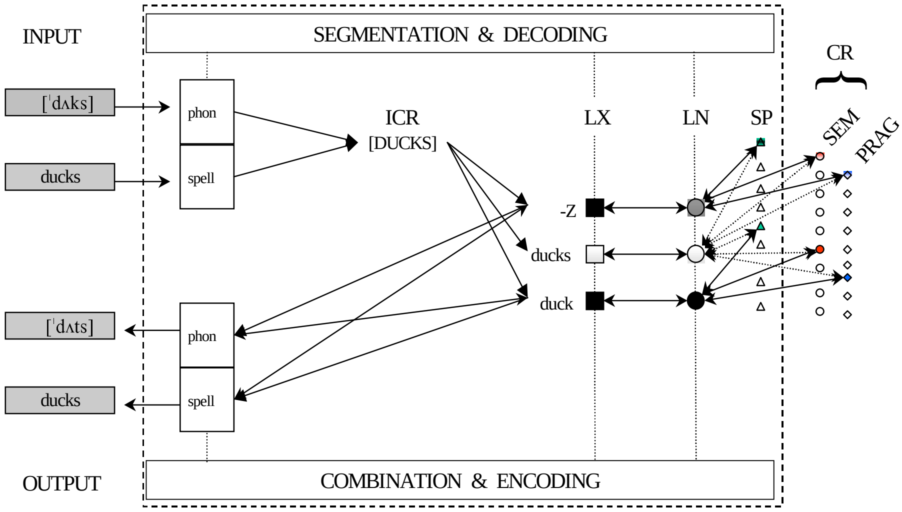

Figure 14. Production and Comprehension in a model of lexical access, exemplified by the production and comprehension of the word ducks.

For comprehension, words in the input will be decoded by the application of phonological rules (speech) and spelling rules (visual word recognition) to modality neutral forms. These forms, the intermediate comprehension representations (ICR), are specific for comprehension, and activate lexemes of both the whole word and the constituent morphemes of that word. The lexemes (LX) activate the relevant lemma nodes (LN) that mediate between the syntactic information associated with the lemma and semantic form of the lemma. The semantic form, which has been omitted in this figure, is matched to the conceptual representations (CR) triggered by the Verbaliser (see 2.5.4). The CR specifies the decomposed semantic and pragmatic characteristics of the lemma. This process is driven by the resting activation of the elements it contains and by activation feedback. Successful parsing will enhance the level of activation of the constituent morphemes by activation feedback, while little or no activation will flow back to the whole word entry. In this way, transparency constitutes the major drive behind this mechanism: for fully transparent forms, the parsing route will be most successful, causing an increase in the activation of the morphemes, and making a separate lemma node for the whole word redundant. Conversely, for opaque forms the lemma node of the whole word will receive maximal activation, while the activation flowing to the constituent morphemes will be marginal. In Figure 14 this is illustrated by the access of the fully transparent form *ducks*: both the plural morpheme (-*Z*) and the root (*duck*) will be used to compute the meaning of the word, as the lexemes associated with this lemma have the highest level of activation. After a successful parse has taken place, activation feedback will flow back to these morphemes, resulting in an even higher activation level, while little activation will flow back to the complex form (*ducks*) .

For production, a similar situation occurs. This time, the starting point is the conceptual representations chunked by the Verbaliser that trigger the selection of the relevant lemmas and types by matching the conceptual information to the semantic form of the lemma. In this case, the plural form *ducks* does not have its own lexical representation, resulting in the selection of the lemma *duck* and the morphological type for *plural*. The combination of the lemma for *duck* and the morphological type for plural will be licensed, because the syntactic information of *duck* satisfies the argument structure of the plural marker. The compositional information is passed on to the lexeme and to the modality-specific encoding mechanisms (see 2.5.4).

In acquisition, the intermediate comprehension representations (ICRs) are set up on the basis of the learner's input. These representations will bring about the establishment of initial lexical representations. Meaning will be mapped onto these forms, resulting in the creation of the relevant lemma nodes representing some conceptual structure. This may involve the establishment (or "discovery") of new conceptual representations. The lemma nodes that are set up in this "labelling" stage may have a very limited set of syntactic properties and their semantic form may relate to inferred conceptual information that is quite different from those of an adult's conception of the same lemmas. Many lexical entries in the child's lexicon can be considered incomplete from an adult point of view. Upon repeated exposure to a particular form in several contexts, more and different syntactic properties and conceptual representations will be established and matched to the lemma node. At this stage the semantic forms of the child's lemmas may be subject to constant change and may relate to different conceptual information from those of an adult (native) speaker. After some time, the child's own generalisations will be gradually modified (as described in section 3.2.2), eventually resulting in adult-like semantic forms and lexical entries. This development can be witnessed by utterances produced by the child. Once a lemma node has been set up to communicate a particular conceptual representation, the child may attempt to start producing that form. Naturally, the child's production is at the most a reflection of the (incomplete) semantic form at a certain moment in time. Hence, the earliest form *dut* that Adam (Barrett, 1983; 1986) used, need not reflect the same concept that adults normally think of when they say *duck*, but could be interpreted as "What a pleasure it is to knock my toy duck off the edge of the bathtub". The stage of unstable and changing concepts (which Aitchison, 1994, labels the "packaging stage") is characterised by over-extensions and under-extensions in the child's production. The actual output may further be affected by an imperfect command of motor skills. That is, the child's lexemes may refer to an adult form like [ˈdʌk], yet the output may still sound like [ˈdʌt] due to lacking motor skills or a failing command of phonological encoding. This observation is exemplified by the *fis* phenomenon, quoted above: the child rejects her own pronunciation of a word when imitated by someone else, yet is not able to produce the correct pronunciation herself. In the final stage of acquiring lexical production, the network of all conceptual characteristics related to the semantic form of a lemma is completed and will gradually start to overlap with the conventional adult concepts.

The acquisition of morphological concepts follows the same sequence. The moment of completion of the acquisition of morphology is strongly variable, depending on the complexity, transparency and productivity of the morphological type, but also on the individual learner.

Applying these facts of language acquisition to the model advocated by Levelt (1989, 1993), it must be concluded that a mechanism is required to account for the acquisition of lemmas and conceptual representations. New conceptual representations can be inferred on the basis of lexical processing, as newly discovered words and morphological types must be given meaning. This implies that the information in the lexicon must be able to affect the information in the Verbaliser. In Levelt's model, this is accounted for by a monitoring mechanism that allows parsed speech to affect the generation of messages. However, no direct feedback mechanism has been included between the formulator and the conceptualiser (though a feedback mechanism is included between the conceptualiser and the parser). Yet, in the unstable situation of acquiring the connections between the lemmas in the lexicon and the conceptual information in the Verbaliser, only a more direct link between these two elements is able to account for the constant and intense interplay between verbalisation and lemma selection. This link may take the form of a loop that allows for the Verbaliser's rechunking after an instance of failed grammatical decoding of the lemmas selected.

3.2.4 Conclusion

The application of morphological regularity is an important tool for the expansion of vocabulary that contributes to the rapid vocabulary growth in children between age two and six. The acquisition of morphology is first of all driven by the principle of transparency: the child's urge to analyse forms in the language. Once morphologically complex words have been analysed into their constituent morphemes, meaning will be mapped onto the forms of these morphemes. For this process to be successful, the words must be fully transparent. The morphemes thus analysed and conceptualised, will be used in the formation of the child's own coinages, which may show tendencies of over-generalisation. If the child comes across an adult form that is identical to her own coinage, the principle of contrast predicts that one of these forms will have to be dropped, and the principle of conventionality predicts that the child's own coinage will be dropped at the cost of the conventional adult form. The developmental sequence of acquisition must be defined differentially for production and comprehension and for knowledge and awareness. Comprehension precedes production and knowledge of morphology must logically precede awareness. Within these dimensions, the developmental sequence of word formation types can be predicted on the basis of transparency and simplicity.

These tendencies and observations can be accounted for by the model of morphological processing (after some adjustments have been made) advanced in the previous chapter. First, this model predicts the importance of regularity and transparency: no separate representation will be set up for morphological types that do not consistently lead to transparent lexical items. Fully transparent lexical items will lead to successful parsing which in turn, through activation feedback, results in a higher activation of the constituents involved. Eventually, upon repeated exposure to these constituents, this may result in the setting up of separate lexical entries. Second, the mechanism of mapping form onto meaning, as proposed to account for the acquisition of words, is fully compatible with the model, as it can account for the establishment of lemma nodes: new forms will be mapped onto syntactic properties and conceptual representations, mediated by the lemma nodes and the semantic form associated with a lemma. If the mapping procedure consists of a simple union of two lemma nodes (like regular plural formation) no separate lemma node will be created; but if the mapping procedure requires more complex computation of meaning, a new lemma node will be created. The sequence of acquisition of morphological types is determined by transparency and simplicity: complex words that are not fully transparent or that require more complex mapping (involving complex computation of meaning due to multiple links to the conceptual representations) can be considered more cognitively demanding and can therefore be expected to be acquired later. Third, the metaphor of lemma nodes holds for the child's rejection of synonymous forms. Pure synonyms can be interpreted either as lemma nodes for which the syntactic properties and semantic form are identical or as "competing" lexemes linked to the same lemma node. The first option will imply that one of the lemma nodes can be deleted, as there is no sense in maintaining identical lemma nodes. The second option will lead to ambiguity of the system. It will therefore have to be accepted that no two lexemes can be linked to the same lemma node[35]. Fourth, the fact that children will eventually drop their own coinages to adopt the productive word formation devices of the society in which they live, can be accounted for along the same lines. After repeated exposure to conventional adult forms for which a lexical entry is already resident, the child will be forced to make a choice. The principle of conventionality will induce rejection of the child's own coinage. Finally, by attributing the differences between production and perception to the level of modality-specific processing of lexemes, the current model can accommodate the need for differential representations for production and comprehension, without having to abandon the appealing position of a single lexicon at the level of the lexical representations. The differences between the modalities can be regarded as a difference in the access procedures to the lexical representations rather than to a difference in the representations themselves.

In sum, the model that was described in the previous chapter provides an explanation for the mechanisms underlying the gradual analysis of words, culminating into the acquisition of morphemes. It can explain both the acquisition of morphological knowledge and the sequence of acquisition. Some adjustments had to be made to this model, allowing for the partial acquisition of lemma nodes and incomplete semantic forms. The model was further adjusted to accommodate both production and perception in the visual as well as the auditory modality. It is this model that will be further used to account for the acquisition of morphology in the bilingual lexicon.

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[35] This also explains the non-occurrence of lexical gaps in the adult mental lexicon, while at the same time allowing over-generalisation as long as the conventional form has not been encountered.

3.3 The bilingual lexicon

3.3.1 Introduction

A considerable number of studies have been dedicated to the organisation of the bilingual lexicon. As the whole discussion on morphology thus far has shown to be strongly related to the lexicon, the structure of the bilingual lexicon[36] is highly relevant for the current discussion. In this section, I will review the main positions with regard to the bilingual lexicon and discuss the implications from this area of research for a model of morphology. The major issue in the discussion about the bilingual mental lexicon is whether it consists of separate systems for the two (or more) languages, or as one integrated system in which knowledge from both languages is shared. After an evaluation of the different possibilities, a preference will be expressed for a mixed system in which the selection of lexical entries is determined by the level of activation.

3.3.2 The organisation of the bilingual lexicon

Traditionally, two types of organisation of word knowledge in bilinguals are distinguished: one unified system for the two languages and two separate systems. Some researchers have proposed modifications to this view. Weinreich (1953), for instance, distinguishes three different types of organisation: coordinate organisation, subordinate organisation and compound organisation. According to the system of coordinate organisation, the lexicons of the two languages are completely separate; in the subordinate organisation, the second language can only be accessed via the first language; and in the compound organisation one lexicon is assumed, which is shared between the two languages. Weinreich assumes that the different systems are used by different individual bilinguals, but argues that the subordinate system particularly applies to initial stages of bilingualism, in which only one language is mastered and the other language is being learnt. At the early stages of acquisition, he argues, the words in the second language can only be retrieved via their translation equivalents in the L1. Weinreich further assumes that the subordinate system gradually develops into a coordinate system with increasing proficiency. Many proposals have followed Weinreich's model that address one or more of the suggestions he advanced and that apply this view of the organisation of the bilingual lexicon to language processing. Most attention has been given to the distinction between coordinate and compound organisation, which can be attributed to the synchronic dimension of this problem. The distinction between subordinate organisation on the one hand and coordinate versus compound organisation on the other, relates to the diachronic aspect. These two aspects are discussed in separate sub-sections below.

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[36] I will use the broad definition of bilingualism, including all stages of second and foreign language learning, and even including the knowledge of more than two languages.

3.3.2.1 Processing in the bilingual lexicon

Recently, de Groot (1992, 1993) has argued that compound and coordinate organisation are not mutually exclusive and that both systems can coexist within the mental lexicon of the individual bilingual; an idea that was also put forward by Weinreich. In de Groot's view of a mixed representation, the storage of words in the bilingual lexicon is dependent on the word type: concrete words in the two languages are stored compoundly, while abstract words are language dependent and are stored coordinately. De Groot bases her argument on empirical evidence showing that in bilingual word association tasks more between-language responses were found for concrete words than for abstract words (Kolers, 1963; Taylor, 1976). These findings are confirmed by later research (Jin, 1990; De Groot, 1992), showing a stronger interlingual semantic priming effect for concrete words than for abstract words. Additional support for De Groot's position is found by the cognate status of translation equivalents: both between-language repetition priming effects and short-lag priming effects for a word (prime) and its translation (target) were stronger for cognates than for non-cognates (de Groot & Nas, 1991; de Groot, 1992). All these findings point to a differential storage of cognates (compoundly) and non-cognates (coordinately), and abstract (coordinately) and concrete (compoundly) words. Besides the factors determining the type of storage mentioned in the literature thus far, word frequency is another likely candidate to affect storage. Differential storage is compatible with the model of the mental lexicon advanced in the previous sections, as this model allows for semantic forms that may completely or partly overlap in terms of conceptual representations. The more semantic/pragmatic and syntactic properties are shared, the more a word in the lexicon can be considered "compound". In view of the empirical evidence discussed above, this would imply that concrete interlingual words pairs share more of their properties than abstract word pairs, and that cognates share more properties than non-cognates. In fact, this is also what De Groot suggests by pointing to the lack of external referents for abstract words.

The evidence thus far strongly points to a mixed system of lexicon organisation for bilinguals. However, when one language is spoken or comprehended, the general activation level of lexical items in that same language must be higher than the activation level of lexical items in the other language, because bilingual speakers and listeners are usually quite able to focus on one language only. Therefore, some supralexical monitor system will have to be assumed that provides the speaker with additional information about which language should be most strongly activated. A proposal along these lines is done by de Bot (1992), who combines the subset hypothesis (Paradis, 1981) with a proposal to distinguish three levels of language activation (Green, 1986). The subset hypothesis assumes a connectionist model of the bilingual lexicon, which is seen as a single storage system in which intralingual links are stronger than interlingual links. In this way, the lexical entries belonging to a particular language constitute a linguistic subset. De Bot combines this notion with Green's idea to distinguish three levels of activation: *selected*, *active* and *dormant*. The selected language primarily controls the speech output, the active language works parallel to the selected language, but has no access to the speech channel, and the dormant language is present in the lexicon, but does not play an active role in language processing. Any language in the bilingual lexicon can be dormant, active or selected. At least one language is “selected”, and in some situations (like in code-switching), more than one language may be selected. During speech (or comprehension), the words are selected from the linguistic subset of the selected language, if necessary from the active language, and if everything else fails, from the dormant language. De Bot et al. (De Bot, 1992; de Bot & Schreuder, 1993; de Bot et al, 1995) place this system in the context of Levelt’s (1989) model of speech production (see 2.5.4). They argue that the intended message is not language specific, but that the language is selected in the processing component (i.e. the conceptualiser at the level of micro-planning). De Bot & Schreuder (1993), for instance, argue that the chunking of the message originating from the Conceptualiser, which is taken care of by the Verbaliser, is dependent on the language selected. The result is that the pre-verbal message contains a language cue for a given message fragment, which will ensure the selection of a particular language subset in the lexicon. It should be noted that this does not exclude the possibility for lexical items from other (“active” or “dormant”) languages to be activated.

The notions of subset and activated language can also be applied to the model of the lexicon advanced in the previous section. First, it should be noted that this model focuses on the lexicon itself, rather than on the complete track of language production or comprehension. It assumes that the speaker/listener is provided with information about the language to be used by some supralexical monitor system (i.e. the conceptualiser). However, adjusting this model to suit the bilingual mental lexicon, it must be assumed that the activation metaphor applies twice: once at the level of language selection and once at the level of the lexical entries.

With regard to language selection, the relative activation of languages (Paradis) need not be limited to three levels. It is conceivable that language selection constitutes a continuum similar to the level of activation of lexical entries. In certain contexts, like in code-switching communities, the activation level of more than one language subset may be raised. Once the speaker/listener has been provided with information about the language subset to be “switched on”, some mechanism must be assumed to take care of the selection of the words from that subset. This subset information can be seen as part of the information linked to the lemma node to make up a complete lexical entry[37]. To account for the activation of a particular language subset, a language selector must be presumed that resides outside the lexicon, but that is linked to the node contained in the lemma that associates a particular lemma with a certain language. When a language is selected by the external selector, the properties in the lemma are activated that refer to the language subset concerned. The activation of the node containing the language selection information of a lemma spreads activation to other lemmas belonging to the same language subset.. In this way, the activation of one lemma of a particular language subset will enhance the activation of other lemmas of that subset.

The selection of a particular language subset does not exclude the possibility for lexical entries that do not belong to the selected language subset to be activated.

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[37] A similar proposal, though in a different framework, has been put forward by Poulisse & Bongaerts (1994); see also Poulisse (1996).

Words in the active (or maybe even dormant) language(s) that have a very high frequency may overrule activation of the language subset. This explains why bilinguals may use lexical items with a very high resting activation, but from a language other than the selected one. Every bilingual will be familiar with the experience of only being able to think of a word in the language that is not spoken at that moment. Besides these frequency effects, lexical entries from other language subsets may be co-activated through activation feedback from shared semantic information (see Figure 15). The more conceptual representations are shared, the stronger the interlingual co-activation will be. Figure 15 sketches the situation in which a Dutch-English bilingual is confronted with the English (=L2) form "carpet". Consequently, activation spreads from the lexeme (LX) to the lemma node (LN) and from there to the syntactic properties (SP) and the semantic form (SF). After matching for meaning with the conceptual representations, activation flows back towards the lexemes. Moreover, some activation flows from the shared conceptual representations to the lemma node of the L1 form "tapijt". In this figure, two features have been added: the language information attached to the lemma node (LG) and the supralexical language selector (LGS). Since the latter has to account for the an overall increase of activation of all lemmas belonging to a particular language, some link must be assumed between the language selector and the language information of the lemma. The assumption of interlingual activation feedback from the conceptual representations predicts the strongest interlingual co-activation for concrete nouns, as the differences between L1 and L2 semantic forms will be minimal for these entries. This is in line with the results of the various studies discussed above.

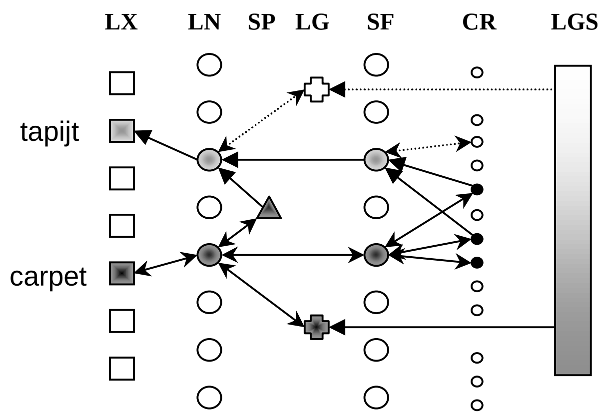

Figure 15. Example of interlingual activation feedback

Besides co-activation as a result of overlapping conceptual representations and syntactic properties, co-activation will also occur at the level of the lexemes. Via the intermediate comprehension representations, the form in the input will trigger a range of modality-neutral lexemes, mediated by spelling in the visual modality and by phonology in the auditory modality. Since lexemes are purely form-based, co-activation will always occur for lexemes that are similar in form. Therefore, the lexemes of cognates will always be mutually activated, which accounts for the cognate effect found by, among others, de Groot (1992, 1993). Co-activation, in turn, will speed up processing procedures. This means that for similar forms in L1 and L2 that do not share much conceptual information ("false friends") a priming effect can be expected. This is indeed what was found by Gerard & Scarborough (1989). But in spite of the expected priming effect, false friends will eventually lead to confusion, as additional (erroneous) conceptual information is matched to the semantic form of the lemma. In case the lexemes associated with the cognates also share some or more conceptual representations ("translation equivalence", see 3.4.3.3), this may lead to an additional increase of the activation level of the lexical entries concerned. By referring to form-based similarity, both the observed decrease of reaction times for cognates compared to non-cognates and the priming effect found for false friends can be accounted for.

Another fact of bilingual processing that is often reported in the literature is translation asymmetry (e.g. Kroll, 1993). Generally, a difference in reaction times and accuracy is found in translation tasks *from* versus *to* the native language. Kroll argues that translation asymmetry is evidence of two different routes to translation; translation from the first to second language is different from translation from the second to the first language. However, no such distinction is required for a model based on interlingual activation. If a bilingual is not fully balanced (and hardly any bilingual is), the lexical entries linked to the L1 language subset will be more fully developed and will have a higher resting activation. Therefore, production and comprehension of lexical entries that are linked to L1 can be expected to be faster and more accurate than those linked to L2. Translation from L2 to L1 involves the production L1 forms, which can therefore be expected to be faster and more accurate. This is indeed what is generally found in research involving translation tasks and cross-linguistic priming tasks. The role of activation is further confirmed by the observation (reported by Kroll, 1993: 76 and Snodgrass, 1993: 101) that high-frequency words are less likely to show translation asymmetry than low-frequency words; the resting activation of high-frequency entries will be relatively high, and thus leaves less room for the asymmetry to occur.

With regard to L2 production, we are again faced with the chunking problem (see 2.4.4 and 3.2.3). If the L2 lexicon of learner contains many incomplete lexical entries, it may be difficult to chunk the conceptual information in such a way that all aspects of the message can be verbalised. It is not unlikely that the chunking is done based on the learner's previous experience with the L1. As argued by Poulisse (1996), learners seem to have a reasonable idea of the items contained in their L2 lexicon and chunk the conceptual information accordingly. To account for this knowledge, a compromise to the rigid modularity of Levelt's model is a reasonable assumption. This compromise could take the form of a feedback mechanism from the Formulator to the Verbaliser that can be used when grammatical encoding fails.

3.3.2.2 Development of the bilingual lexicon

There is some evidence that subordinate and compound systems may represent the lexical organisation of learners at different levels of proficiency. Kroll & Curley

(1988) show that for bilinguals at early stages of L2 learning, translation is significantly faster than L2 picture naming, while no difference between these tasks was found for learners at later stages of L2 acquisition. This can be interpreted (as Kroll & Curley do) as a development from subordinate to compound organisation. The question, however, is whether this interpretation is justified. Among other things, the early bilinguals in their experiment were children, while the more advanced bilinguals were not. Children's responses to these tasks are quite different from those of adults: for beginning adult learners, translation is faster than picture naming, while for child beginners, picture naming is faster than translation (Cheng & Leung, 1989). This indicates that other factors may be at work that have not been taken into account in the experiments of Kroll & Curley. It has been suggested (Snodgrass, 1993) that the effect they found may be due to differences in the teaching method (involving lexical or conceptual presentation of new words). In addition, effects of word frequency are particularly relevant here, as the differences in the organisation of the bilingual lexicon can be expected to be much smaller for low-frequency words[38]. The opposite position, a development from a unified lexicon towards a system of two separate lexicons for the two languages has also been claimed. In a priming study including cognates and non-cognates that compared different levels of acquisition, Kerkman & de Bot (1989) found that at a very advances stage of L2 learning the mental representation of L1 is completely separated from the representation of L2. They argue that even for words that are identical in the two languages both in form and in meaning, the representation for very advanced learners is entirely separated for L1 and L2. For less advanced learners, however, such complete separation could not be assumed. The authors therefore hypothesise that in the development of L2 acquisition the L1 and the L2 lexical representations show the tendency of gradual separation.

This discussion shows that the developmental issue cannot be adequately solved by theories currently available, especially because external factors are not taken into account. However, the model of the bilingual lexicon as proposed here, referring to the activation metaphor, can account for all the facts mentioned thus far. In this interlingual activation model, the following developmental steps can be distinguished. Upon first hearing or reading a new word in a foreign language, the learner will have to set up a lemma node for the new word. The syntactic properties and the semantic form relating to the new lemma node will be arrived at by inferencing from the context or by relating the new lemma to an existing L1 lemma, by noticing an overlap in the conceptual representations. However, the L2 representation will always be given its own lemma node to allow for the specification of the language subset; the minimal difference between the L1 concept and the L2 concept consists of the property referring to the information about the language subset to which the word belongs (see, for instance, Figure 15). At initial stages of L2 acquisition, the learner will assume full overlap between the conceptual representations of the L1 lemma and the L2 lemma. Gradually, the differences between the L1 and the L2 lemma will

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[38] This holds for monomorphemic words only; the situation for morphologically complex words is discussed in the next section.

be acquired. This process can entirely be based on positive evidence and is guided by the same principle that is at work in L1 acquisition: contrast. If the learner encounters a new L2 word, this may lead to the partial restructuring of the semantic form of existing concepts by adding or deleting the match with some of the conceptual representations. This will usually be the case for words that are similar but not identical. An example of this is worked out in Figure 16. In this example of a Dutch L1 speaker learning English, the situation at t_1 represents the stage at which the learner's L2 lemma *last* has been over-generalised on the basis of its similarity to the L1 lemma; the L1 concept *laatste* has a broader meaning than *last*, and includes meanings that in English are represented by the forms *latest* and *latter*. At t_2 the learner has encountered the English word *latest*, for which a new lemma node has to be set up. The principle of contrast will ensure that the learner will not accept two lemmas to be fully identical, leading to the discovery of the semantic differences between *latest* and *last*. This will subsequently lead to restructuring of the semantic form of *last*. The ultimate result of the acquisition process can be a "balanced" bilingual lexicon in which all semantic forms of all lemmas have been fully specified. However, cases where this happens for all lexical entries in both languages will be highly exceptional, as most bilinguals will not be fully "balanced".

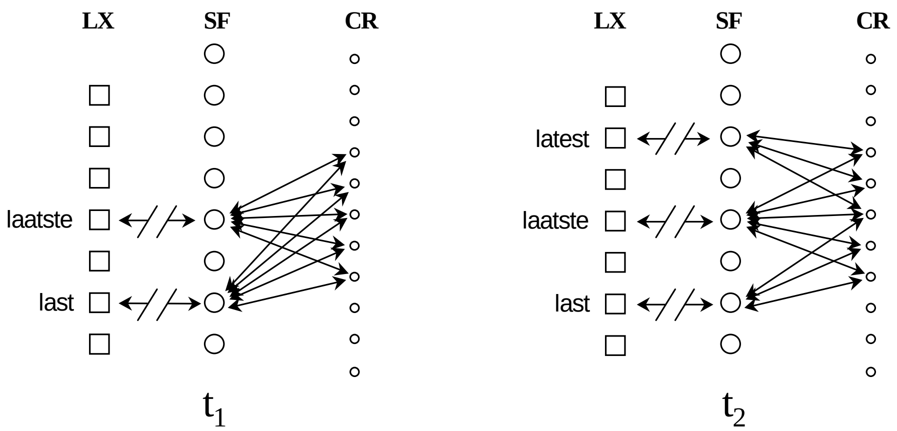

Figure 16. Simplified representation of two time slices in the process of acquiring the new L2 concept "latest". In this figure, the lemma nodes have been left out.

Not only the differences between languages will be gradually acquired, but also the similarities. Translation equivalents in the L1 and L2 lead to the co-activation of semantic forms. If translation equivalents are cognates, the equivalence will soon be noticed. However, if translation equivalents are non-cognates, it may take the learner some time to notice the equivalence. It can thus be expected that non-cognate translation equivalents have a stronger effect at higher levels of L2 acquisition. The developmental effect of morphological translation equivalence will be tested in Chapter 4.

3.3.3 Morphology in the bilingual mental lexicon

In the Chapter 2, morphemes were defined at the level of lexical representations similarly to other entries in the lexicon: consisting of a concept node (later labelled "lemma node") to which are attached a set of syntactic properties and a semantic form. It was argued that morphemes can have their own representations, provided they are sufficiently productive and are frequently used. For the bilingual mental lexicon, the definition will be no different. Morphologically complex words, monomorphemic words and affixes alike may be stored in the mental lexicon and may have their own lexical entry. In the case of affixation, the lexical representation may be called the "morphological type". In the bilingual mental lexicon, one of the properties associated with any lemma node is the language subset a lexical entry refers to. Although the syntactic properties and the conceptual representation associated with L1 and L2 morphological types may largely overlap, they will minimally be different by the language subset property. An example of this is worked out in Figure 17: the Dutch affix *-baar* and the English suffix *-able* largely share their syntactic and semantic information, but do not share the lexical property for the language subset. The double-headed arrows in this figure indicates the possibility of activation feedback, also for morphological types. This means that interlingual co-activation will occur for morphological types. This observation will be used in a study investigating the role of L2 morphology in the bilingual lexicon, which is reported on in Chapter 4. The role of transparency, simplicity and productivity of L2 morphological types and the interaction with similar types in the learner's L1 will be discussed in section 3.4 below.

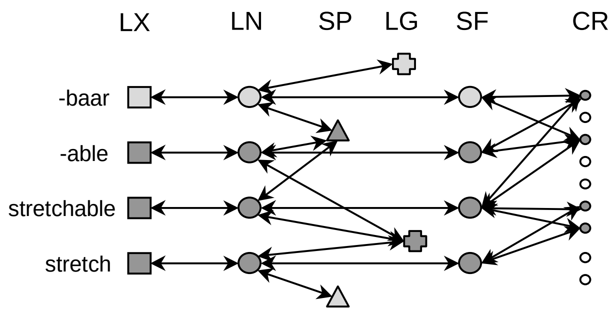

Figure 17. Example of the lexical connections for English -able *and Dutch* -baar. *These affixes share much syntactic and semantic information, but are different by their connection to different the language subsets.*

3.3.4 Conclusion

The interlingual activation model proposed here can account for all major findings of the bilingual mental lexicon. The additional language subset information at the level of the lexical entries allows for the selection of words from the appropriate language subset by assuming that words belonging to that subset receive extra activation from a supralexical monitor. In this respect, the selection of lexical entries on the basis of information about the language subset runs parallel to their selection on the basis of matching with a set of conceptual representations. The semantic/pragmatic and language cues for the selection of a lexical entry are triggered by a supralexical system (the “Verbaliser”). This mechanism leaves the possibility for lexical entries that do not belong to the selected subset to be strongly activated. The selection of a language subset is relevant for both production and comprehension in both the visual and the auditory modality, even though between the modalities the access procedures may strongly differ at the level of the intermediate access representations. The word-type effects described in the literature (for concreteness and cognate status) can be accounted for at different levels of the model. The differential organisation that has to be assumed for concrete versus abstract words can be explained in terms of the amount of overlap of L1 and L2 semantic forms: the more conceptual information is shared by the concepts, the more activation feedback will flow to the related lemma node. The facilitating effect found for cognates in priming experiments can be explained at the level of the lexemes, as words in the input that are similar in form will always lead to co-activation of lexemes. Translation asymmetry can simply be explained in terms of activation: the lexical entries related to the learner’s L1 will have a higher resting activation than the L2 entries and will be more complete. Therefore, translation to L1 is more adequate and is faster. The process of acquiring new words in the L2 can be explained in terms of restructuring of lexical entries, which is guided by the principle of contrast.

By referring to the activation metaphor, it is no longer necessary to distinguish between different ways of lexical organisation; the current model hypothesises that all individual lexical entries are stored identically, but that major differences between the entries can be expected based on their frequency, which is reflected and expressed in their relative level of activation. L1 entries are never directly linked to L2 entries, but information that are shared between the languages will result in activation feedback flowing to the lemma nodes concerned. In other words, L1 and L2 entries can never be lexically mediated, but are always conceptually mediated to a degree that is dependent on the relative activation of the conceptual representations, the lemma nodes and the lexemes.

The place of morphology in the bilingual mental lexicon is not different from its position in the monolingual lexicon. If the model of morphology in the mental lexicon as advanced in the previous chapter is applied to the bilingual lexicon, morphological types, like all other entries in the lexicon (monomorphemic or morphologically complex) are specifically associated with a particular language subset. All morphological types in the mental lexicon are thus marked for language.

3.4 Morphology and the mechanisms of L2 acquisition

3.4.1 Introduction

As a last source of information that can shed some light on the acquisition of interlanguage morphology, this section focuses on the work that has been done on morphology within the area of second language acquisition (SLA). In this area, little or no work has yet been dedicated to the role of morphology in the bilingual mental lexicon. Yet, by looking at the main principles of second language acquisition, it will be determined to what extent the findings from the previous sections can be applied to the acquisition of L2 morphology. This will be attempted by surveying the work done on morphology in second language acquisition, which will be put into the perspective of a general model of SLA. This model will be applied to the interlingual activation model proposed in the previous section.

A major difference between learning a first language and learning a second language is in most cases the learner's cognitive abilities. Only in cases of fully balanced bilingualism two languages may be learned simultaneously; in all other cases the L1 has largely been acquired when acquisition of L2 starts. One of the consequences of this difference is that the L2 learner has already built up L1 concepts and will already have acquired the concepts. The question is to what extent knowledge of L1 will interfere with or facilitate the acquisition of L2 morphology. Does cross-linguistic influence indeed occur? And, if so, can cross-linguistic influence be helpful in the acquisition of L2 word formation? In other words: is positive L1 transfer more important than (simultaneously occurring) L1 interference? Furthermore, in section 3.2.1 we have seen that the main principles that apply to the acquisition of morphology are transparency, contrast and conventionality. The question is whether the same principles hold for the acquisition of L2 morphology.

In this section, the representation and development of L2 morphological knowledge will be worked out for a general integrated framework of L2 acquisition. The SLA model that is adopted here distinguishes between knowledge and control. It will be argued that the affix discovery procedure described in section 3.2 with regard to L1 acquisition can be attributed to the analysis of implicit knowledge in L2. The representation and development of knowledge of L2 morphology is affected by the same principles and constraints that have been found for L1 acquisition: simplicity, productivity, frequency and transparency. The L2 learner's native language must be regarded in interaction with other variables affecting L2 acquisition, like the learner's stage of L2 acquisition, the language level and universal principles of acquisition. The most important impact of the learner's native language can be expected at the level of transparency: the learner's perceived transparency of morphologically complex L2 words, or "psychotransparency", is strongly affected by the learner's native language.

3.4.2 Representation and development of L2 morphological knowledge

Before turning to the representation and particularities of L2 morphological knowledge and the development of that knowledge, I will briefly present an overview of the model of second language acquisition that will be adopted here. In developing an integrated model of the acquisition of L2 morphology, the most suitable framework of SLA to adopt is a theory combining cognitive approaches and approaches taking linguistic universals as a starting point: while the latter can account for the distinguished nature of linguistic knowledge (as revealed by, for instance, fixed sequences of acquisition – see 3.4.2.2), cognitive learning theories provide a powerful explanation of the development of the learner's ability to use her L2 knowledge. Models of SLA advocating this combination have been proposed by, among others, Bialystok & Sharwood Smith (1985) and Ellis (1990). Following such a model of language learning, interlanguage development can be seen as the development along two distinct dimensions: *knowledge* and *control* (or "automaticity").

The development of control is the least controversial. It can be assumed that increasing proficiency in language acquisition develops with increasing automaticity: learning starts off with "controlled" processing and becomes gradually more automatic. (Bialystok, 1988; Sharwood Smith, 1981; McLaughlin, 1987). Applied to the acquisition of morphology, the control dimension expresses the automaticity with which type-familiar words are analysed and produced. In terms of activation, the control dimension is equivalent to the degree of activation: both item-familiar and type familiar morphologically complex words can have variable degrees of activation; a mechanism that can be compared to the degree of automaticity with which a word or morpheme is processed.

The development of knowledge itself, however, is controversial and opinions differ according to the universalist or cognitive stance taken. There are two constructs that are variably referred to in the literature: explicit vs. implicit knowledge and analysed vs. unanalysed knowledge. The distinction between explicit and analysed knowledge on the one hand and implicit and unanalysed knowledge on the other is not necessarily relevant from a purely cognitive point of view. Anderson (1985), for instance, claims that language learning, like all learning, begins with conscious attention resulting in declarative knowledge (analysed, explicit knowledge). The declarative knowledge is then automatised and will become unconscious knowledge. This is not in conflict with Berman (1987), who describes a step by step reorganisation of the system from unanalysed to analysed knowledge. From the point of view of universalist language learning theory, however, the assumption that implicit knowledge is directly affected by explicit knowledge is controversial: although explicit learning may facilitate the acquisition of implicit knowledge, explicit knowledge cannot be assumed to be converted into implicit knowledge. One piece of evidence for this is that grammar instruction is not able to affect the natural order of acquisition of developmental structures (Pienemann, 1989). From this point of view then, explicit knowledge cannot be conflated with analysed knowledge. Yet the analysis of knowledge (from formulaic speech to a creative rule system) provides a plausible explanation for the development of language acquisition (see, for instance, McLaughlin, 1990; Bialystok, 1991).

In a proposal incorporating linguistic theory into cognitive models of language acquisition advocated by Ellis (1990), this problem is solved by attributing the analysis component to implicit knowledge only, without excluding the possibility of an indirect influence of explicit knowledge (conscious concepts and metalinguistic knowledge) on the acquisition of implicit knowledge. In this way, explicit knowledge could, for instance, affect the rate of acquisition, but not the actual order of acquisition. In this model, explicit and implicit knowledge are represented separately, while variable degrees of automaticity can be assumed to both types of knowledge. The relation between explicit and implicit knowledge has not yet been fully resolved, but some general assumptions can be made. Firstly, interaction between the two types of knowledge is most likely to occur at the level of analysed implicit knowledge and explicit knowledge. This interaction is not fully congruent in both directions: Explicit knowledge can always be derived from implicit knowledge, but the nature of the influence of explicit knowledge on implicit knowledge is uncertain (see the discussion on negative evidence in 3.2.3.1). Secondly, the interaction between explicit and implicit knowledge is also linked to the control dimension: for highly automatised processes interaction between implicit and explicit knowledge is less likely than for rules and items that require controlled processing in performance. Although this model is not yet free of problems, it shows that linguistic theory and cognitive approaches to language acquisition are not necessarily incompatible.

Applied to the acquisition of morphology, unanalysed knowledge can be regarded as words that the learner approaches item-familiarly, while analysed knowledge is represented by type-familiarity. Morphological knowledge, like all linguistic knowledge, gradually develops from unanalysed, item-familiarity to analysed, type-familiar knowledge. The fact that type-familiar knowledge is not necessarily explicit is revealed by attributing the entire process of affix discovery to implicit knowledge. Explicit knowledge is the equivalent of what was is commonly called “awareness” in L1 studies (see section 3.2.2.2).

With regard to the order of acquisition of L2 morphology, it can be hypothesised that, similar to L1 acquisition, comprehension precedes production. This is confirmed by studies of L2 morphology by Derwing (1976), Derwing & Baker (1977 and 1979) and Freyd & Baron (1982), which indeed indicate that comprehension of derivational affixes is acquired before the ability to use these affixes productively. The development of implicit knowledge versus explicit knowledge or awareness, however, will depend on the learning context. In naturalistic contexts this can be expected to be similar to L1 acquisition, but in formal learning contexts often much attention is being paid to the explicit knowledge, so that it is not obvious that (implicit) knowledge precedes awareness in these contexts. It is conceivable that formal learners are well able to reflect on the application of a “rule” without being able to apply it correctly in spontaneous speech. The sequence of acquisition of individual morphemes can, again similar to L1 acquisition, be predicted by factors like frequency, transparency, simplicity and productivity using the activation metaphor. A large number of studies have investigated the sequence of acquisition of individual

L2 morphemes. One of the general tendencies found in these studies is that there is little evidence for the influence of the learner's native language. It will be argued here that although there seems to be a natural order of acquisition of morphemes, it is not correct to trivialise the influence of the learner's native language.

3.4.2.1 Factors affecting representation of knowledge

The question that will be addressed here is what principles underlie the acquisition of L2 morphology and to what extent these principles are different from the principles guiding morphological acquisition in L1 acquisition. Unlike children learning L1, L2 learners do not usually have to add new meanings to their repertoire. L2 learners, instead, will most of the time have to map new forms onto existing meanings. It has been argued above that the interlingual links in the mental lexicon are mediated by the conceptual representations. This means that although the conceptual characteristics of L1 and L2 lemmas may overlap, different lemma nodes must be hypothesised for the different languages. The mapping process for L2 acquisition will therefore be similar to L1 acquisition in that new lemma nodes will have to be established. In the case of L2 acquisition, however, new concepts will normally not have to be set up. Consequently, the kind of semantic over-generalisation that is common in L1 acquisition, like using "duck" for any kind of water bird, is not apparent in L2 acquisition. However, similar to L1 acquisition, the transparency principle plays an important role in the affix discovery procedure in L2 acquisition. Learners will be constantly looking for meaning and will attempt to match meaning with form. Morphologically complex words will initially be acquired as unanalysed wholes, and used item-familiarly. If the relative frequency of an affix is higher than the roots with which it occurs, the affix will receive more activation; the learner will start to recognise the affix, and will subsequently attempt to match meaning to the perceived constituents of the complex word. After a successful parse, separate representations may be set up for the constituent morphemes. Since L2 learners have already developed a more or less complete set of conceptual representations, the affix discovering procedure in L2 can be expected to proceed more rapidly and efficiently. Evidence for this can be found in the differences between adult and child L2 learners. Snow et al. (1980) for instance, show that English learners of Dutch below the age of 10 have difficulty in acquiring the correct application of the Dutch agentive affix *-er*, even though this affix is very similar to their L1, both in terms of form and in terms of function or meaning. The obvious explanation for this finding would be that these learners have not acquired all the properties of this affix in their own language either (as has been argued in section 3.2.2.2, the acquisition of [abstract] morphology will not be completed before puberty)[39]. Snow et al. also argue that

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[39] An alternative explanation would be that learners are reluctant to use L2 forms that are similar to L1 forms, and that the use *-er* suffix is avoided for this reason. However, this behaviour is mostly observed for non-prototypical meanings of a particular form (Kellerman, 1986) and between languages that are relatively "distant". This explanation is therefore not probable for agentives (which can be considered a prototypical meaning of the *-er* suffix) between Dutch and English (languages that are not generally considered "remote").

many of the learners in their test had acquired some of the “affixes”, but not the “rules”. In terms of the model proposed here, this would again mean that the lexical entry in the mental lexicon is present, but its semantic form is not yet fully developed; the learners have matched some, but not all of conceptual representations to the semantic form of the lemma.

In L1 acquisition, the acquisition process of a morphological type has been shown to be dependent on its semantic transparency, its simplicity and its productivity. These factors also play a role in L2 acquisition, though this role is not always identical to L1 acquisition.

The condition of transparency remains essential for L2 acquisition: words in the second language that are not transparent cannot be adequately analysed and will not lead to type-familiarity of the affix. It is at the level of transparency, however, that the learner’s knowledge of the L1 plays a predominant role. Due to L1 knowledge, the L1 learner is equipped with many tools to analyse morphologically complex words, which can facilitate the discovering of affixes. However, the knowledge of L1 may also tempt the learner to interpret opaque words in the L2 as transparent; for the L2 learner, morphologically complex words may then be “deceptively transparent”. The effect of transparency as a function of the learner’s L1 will be elaborated on in section 3.4.3 below.

Simplicity is another factor determining the establishment of a separate representation for an affix. Simplicity relates to the processing complexity of morphological types. This includes phonological and orthographic change, conceptual complexity, the presence of homonymous forms and the number of different properties to which a form has to be matched. Major differences can be expected between L1 acquisition and L2 acquisition in regard to simplicity. In some cases the simplicity of affixes will be very similar for L1 and L2 learners. For instance, the simplicity constraint would predict that morphological processes that require little computation are acquired earlier. Transparent compounding, which is a concatenation of two concepts, is relatively simple and in L1 acquisition this was found to be acquired early. This is also what was found in an L2 study by Broeder & Extra (1988) investigating lexical innovations by Turkish and Moroccan learners of Dutch involving spontaneous production. Similar to L1 acquisition, zero-derivation, which is a mechanism that requires the least change, can be expected to be acquired early in L2 acquisition. In other cases, however, major differences may occur between L1 acquisition and L2 acquisition in the actual perception of the simplicity of affix types. For instance, in L1 acquisition, morphological types like *-ity* are considered less simple because they involve stress shift; therefore these types are more difficult to acquire. However, a lower degree of simplicity in the L2 does not necessarily imply greater difficulty for the L2 learner: if a very similar affix type occurs in the L2 learner’s native language, no difficulty may be experienced in the acquisition and use of this type. In other words, phonological change is not necessarily a factor of difficulty for L2 learners. More differences between L1 acquisition and L2 acquisition can be expected at the level of conceptual complexity. The (adult) L2 learner usually does not have to acquire new conceptual information. Yet, morphology that requires higher levels of abstractness will be more difficult to acquire, as the conceptual representations associated with the morphological types are likely to have less overlap with similar types in L1 than is the case for morphological types referring to concrete concepts. Cross-linguistic similarity will affect the activation of the shared properties and indirectly, through activation feedback, co-activation of L1 and L2 lemmas will occur. The more different conceptual characteristics there are to be matched to the semantic form, the more computation will be needed and the more difficult it will become to acquire the related lemma or type. Regular plural formation, for instance, may seem to require little computation, as this process merely involves the agglutination of the plural affix. Even this seemingly simple process, however, may be rather complex for L1 learners who have not yet acquired some essential concepts. In early stages of L1 learning the learners not only have to learn morphological representations, but they also have to acquire a number of notions necessary for understanding differences involved. Snow et al. (1980: 540) list some of these notions with regard to the correct production of plural forms in English: (1)Recognition of the differences between 'one' and 'more than one'. (2)Recognition that this distinction must be marked linguistically. (3)Recognition that it is marked by using a suffix. (4)Acquisition of the plural allomorphs /s/, /z/ and /iz/, and the phonological rules governing their use. (5)Learning about the exceptional lexical items which take no or irregular plural endings. For L2 learners, plural formation is a relatively simple process, as they only have to cope with steps 4 and 5. Another example illustrating the differential role of simplicity between L1 learners and L2 learners is deverbal adjectivisation by means of *-able*. This requires complex computation involving inheritance of the argument structure of the verb (*-able* only applies to verbal roots that have an external argument). This difficulty holds for both L1 acquisition and L2 acquisition, but can be expected to be less strong in L2 acquisition, as L2 learners may already have complex word formation devices that are very similar. Native speakers of Dutch, for instance, will already have developed the concept of *-baar*, which is very similar to *-able*, both in terms of syntactic properties and in terms of the conceptual representations related to the semantic form. This overlap over syntactic and semantic information will facilitate the acquisition of the L2 type. In sum, simplicity is a factor that may affect the acquisition of L2 morphology, but the extent to which this occurs is largely dependent on the similarities between morphological types in L1 and L2.

Other differences between L1 and L2 acquisition may be expected at the level of productivity. The most essential difference here may be expected between different learning contexts. Productivity has been defined as the preferences of a speech community at a certain moment in time. The acquisition of productivity has been accounted for in terms of the frequency of forms in the learner's input. If the principle of contrast forces the learner to choose between two transparent formations, she will opt for the conventional alternative. L2 learners acquiring the language in a naturalistic context will basically be exposed to the same kind of input as L1 learners. However, the input of L2 learners learning the language in a classroom context may receive a different kind of input. The typical classroom context may lead to a high morphological awareness, but to less implicit morphological knowledge. In formal learning contexts, awareness may well precede implicit knowledge, which is a situation that is highly unlikely to occur in natural language acquisition. Probably, the explicit type of knowledge typical of classroom learning cannot be directly transformed into implicit knowledge. In the present context, it is important to realise that the acquisition of productivity is fully dependent on the frequency of forms in the input. Therefore, a difference can be expected with regard to the acquisition of productivity between formal and naturalistic learning contexts. A further influence on the acquisition of L2 productivity can be expected from the L2 learner's native language. L1 and L2 Morphological types that are similar in form may be assumed to be equally productive, which is not necessarily the case. The question is to what extent form-based similarity will tempt learners to draw conclusions about productivity. Singh and Martohardjono (1988), for instance, found evidence that L2 learners will only make errors with regard to morphology which are "possible" in the L2. The fact that learners are able to separate L1 and L2 lexical entries can be interpreted as further support for the separation of L1 and L2 lemma nodes: the words and affixes built up for the L2 will be marked as such in the lexicon. However, the precise nature of productivity in second language acquisition in relation to apparently equivalent L1 forms is an empirical question that will be investigated in Chapter 4.

3.4.2.2 Developmental sequence of L2 morphology

In the wake of a series of studies investigating the order of acquisition of grammatical morphemes in L1, conducted by Brown (1973) and De Villiers & De Villiers (1973), Dulay & Burt (1974) investigated the order of acquisition of grammatical morphemes in children learning a second language. In their study they found the same order of acquisition of grammatical morphemes for the Spanish and the Chinese learners of English[40]. Other studies, replicating Dulay & Burt's approach with adult second language learners (Bailey, Madden & Krashen, 1974; Larsen-Freeman, 1976) yield similar results. On the basis of these results a claim is made that there is a universal order of acquisition of morphemes that is independent of the learner's L1. This is claimed to be evidence of the "L2 = L1" position: the process of acquisition of L1 is identical to the acquisition of L2, implying that the process of L2 acquisition is not affected by the learner's L1. Dulay & Burt's study has provoked much criticism on all its aspects: the elicitation method (the Bilingual Syntax Measure, or BSM), the statistics (rank order correlation), the individual variation in the learner data, etc. Some points of criticism are especially worth closer consideration. First, Dulay & Burt used cross-sectional sampling; what they in fact determined is the order of accuracy of morphemes rather than the actual order of acquisition. Therefore, different terms have been used in other studies, like "order of difficulty" (Bailey et al., 1974). Moreover, scoring on the presence of a particular affix in the learner's performance in obligatory contexts (as elicited by the BSM) fails to say anything about the inappropriate use of that morpheme in non-obligatory contexts. Neither does this method account for developmental stages in which the morpheme may be used holistically. Accurate usage is not necessarily evidence of a morpheme

[40] The sequence of morphemes they found in their study is as follows: pronoun case; article (a, the); contractible copula ('s); progressive (-ing); plural (-s); contractible auxiliary ('s); past -reg. (-ed); past -irreg.; long plural ('s); 3rd person (-s).

being analysed and then mastered, but may be due to formulaic speech or U-shaped behaviour (similar to the child adding -y to all adjectives, reported in section 3.2.1). This weakness of the morpheme order studies becomes especially apparent when the results of these studies are compared to longitudinal studies investigating the same phenomenon. The individual orders found in longitudinal studies (Hakuta, 1974; Rosansky, 1976; Schmidt, 1983) do not match the order found by Dulay & Burt. Wode et al. (1978) compared the results of a developmental sequence study (longitudinal observations) to the morpheme order studies and conclude that no universal order can ever be found, since reliance on L1 is an integral part of L2 acquisition: within groups of the same L1 background, a similar order was found.

Nevertheless, in spite of the criticism, the similarity of the outcomes of the cross-sectional morpheme order studies cannot be denied. Especially when the individual morphemes are grouped into broader classes of morphemes, as proposed by Krashen (1977), the commonalities among the results are striking. The fixed order of acquisition is further supported by studies concentrating on the development of the acquisition of one particular morpheme. Several studies investigating the development of pronouns, for instance, have shown striking similarities among learners from different L1 backgrounds. Broeder, Extra & van Hout (1989), for example, report on the fixed order of acquisition of pronouns in adult learners of Dutch from a variety of L1 backgrounds: subject pronoun forms were acquired first, followed by object pronouns, then followed by possessive forms.

The morpheme order studies have been very influential in understanding the nature of developmental sequences, but do not *explain* the order. The explanation of the "universal" order of acquisition must be sought in the interaction of several factors. As argued above, some general principles of acquisition will be identical for L1 acquisition and L2 acquisition. It is these principles that should be considered in accounting for the universal order of acquisition of morphemes. One obvious factor is the productivity of the morphemes concerned, as expressed by the frequency of forms in the learner's input. Forms that are frequent in the input will have a higher resting activation. A condition for this to occur is that the forms are semantically transparent, so that they can lead to successful parsing. In a study comparing the data from the morpheme order studies to those of Brown (1973), Larsen-Freeman (1976) indeed shows that L2 accuracy orders of grammatical morphemes correlate with frequency orders of the same morphemes in parental speech to children. Long (1981) found a significant positive correlation between Krashen's average order of acquisition of grammatical morphemes and the frequency order of these same morphemes in the speech (by native speakers) addressed to elementary Japanese learners of English. Apparently, frequency of forms in the input is an important determiner of the order of morpheme accuracy. This makes perfect sense in terms of the activation model: types that are well represented in the input will have a higher activation. Grammatical morphemes are generally highly productive, so the morphological types in the input will show a variety of tokens, enabling activation of the morphological type.

The frequency effect can for a large part explain the accuracy orders found in the morpheme order studies. However, this explanation seems limited to acquisition that takes place in naturalistic contexts. Studies investigating correlations between teacher input and the accuracy order of morphemes in formal contexts have not yielded unambiguous results. Lightbrown (1983), for instance, investigated the accuracy order of *-s* morphemes in oral communication in connection with the frequency order of these morphemes in their teacher's speech, but found no significant correlation. This points to a difference with regard to the learning context. In terms of input, there is an obvious difference between classroom and naturalistic language learning. Naturalistic input is much more pervasive and the frequencies of forms are much higher. In the classroom, on the other hand, the learner may acquire more explicit knowledge, which is not necessarily transformed to implicit knowledge. The frequency of the input can be expected to be lower overall, and there may even be so little input that differences in frequency are not meaningful. An additional factor is that the teacher is not necessarily a native speaker, which may lead to a different order of frequency. This may confuse the learner, especially when she is exposed to the L2 outside the classroom as well, in which frequencies may be considerably different, while a consistent high input frequency is required to induce activation. This is also the conclusion of a longitudinal study by Snow et al. (1980) after they investigated the acquisition of morphemes marking plural, diminutive and agent by English learners of Dutch in a naturalistic context. The results suggest that frequency is an important determiner of the order of acquisition. The more frequent plural marker *-en* was acquired before less frequent *-s*, and the more frequent diminutive markers were learned before the less frequent ones. Here the relation between frequency and productivity re-emerges. Some of these affixes will be more productive than others, and the productive use of an affix can only be assumed if the type frequency of an affix is relatively high. To hypothesise a high type frequency, the affix has to occur with many different roots. It is conceivable that the required number of roots is not reached in classroom contexts.

In sum, there appear to be striking similarities in the order of acquisition of grammatical morphemes by learners from different L1 backgrounds. This order of acquisition can for a large part be accounted for by the difference in frequency and the productivity of these morphemes. The differential outcomes found in different learning contexts can also be accounted for in terms of the frequency of forms in the input. Different orders of acquisition found between L1 and L2 acquisition can be explained in terms of the conceptual complexity of the different morphemes: L1 learning is inhibited by the conceptual complexity of some morphemes, while L2 learning is not. Studies emphasising similar orders of acquisition of morphemes for learners from different L1 backgrounds tend to play down the role of the learner's native language. But the learner's native language will always play and important role in L2 acquisition. This role is not necessarily found in direct interference, but affects the acquisition process more subtly through interaction with many other factors affecting L2 acquisition. This is the subject of the next section.

3.4.3 The role of the learner's native language

The morpheme order studies have shown a fixed order of acquisition of morphemes in second language acquisition that is independent of the learner's native language. But in spite of what the morpheme order studies seem to suggest, the influence of the L2 learner's native language should not be underestimated. If cross-linguistic influence is considered as a factor in interaction with other factors affecting L2 acquisition, many findings can be accounted for that otherwise remain unexplained. In this section the role of cross-linguistic influence will be discussed with regard to the acquisition of L2 morphology in view of its interaction with the learner's level of L2 proficiency and cognitive development, the linguistic level, the language distance and the learning context. It will be argued that in the processing of morphology, cross-linguistic influence plays an important role. This role can be expressed in terms if the transparency of morphologically complex items as perceived by L2 learners.

3.4.3.1 Learner issues

There is some evidence (reported by Taylor, 1975) that cross-linguistic influence is strongest at early stages of second language acquisition. But it has also been argued (for instance by Wode, 1976) that for L1 transfer to take place, the learner must first have reached a certain level; the learner must have perceived that a particular L1 feature is transferable. However, it is as yet not clear which precise conditions have to be met for cross-linguistic influence to occur. Kellerman (1977) has argued that the actual occurrence of transfer is dependent on the learner's willingness to transfer L1 lexical properties to L2. This is related to the "distance" between the native and target language. Learners are generally reluctant to transfer items from their L1 to languages that have little in common with their L1. But learners from languages more closely related to the TL can use more transfer and will acquire the TL more rapidly. It may be more correct to speak of the "perceived" language distance between target and native language, which Kellerman has labelled "psychotypology": learners form "projections" of what can be transferred from L1 to L2 on the basis of the psychotypology of target language. The psychotypology, Kellerman argues, is subject to change due to increasing experience in the L2. It follows from this that cross-linguistic influence can be expected to increase with growing L2 development. In terms of the activation model, this effect can be explained in terms of productivity. It can be hypothesised that learners will only create an L2 lemma node for a new affix if there is evidence that the morphological type is productive in L2; the transferability of lexical properties is dependent on the perceived productivity of morphological types in the L2. This is in line with the finding (Singh & Martohardjono, 1988) that L2 learners only make L1 induced errors if they feel a particular word formation device is similar in L1 and L2. The learner will only transfer a particular word formation type if she has assumed a pattern in the target language to licence it. It should be noted, though, that the learner's perception of productivity is not necessarily identical to that of the native speaker.

Another learner factor affecting cross-linguistic influence is the learner's development of L1 knowledge. As has become apparent in the discussion on the development of L1 morphology, the level of acquisition of the first language is likely to affect the acquisition of morphology. The learner's command of L1 morphology can also be expected to interact with cross-linguistic influence, especially in regard to less productive and therefore more controlled language processing, as is the case for the use of less productive morphological types. After all, knowledge (especially if it is explicit) of morphology can only be transferred to the second language if it has been acquired in the first language.

3.4.3.2 Language level

The language level is also commonly regarded as an interacting factor determining the amount of cross-linguistic influence. It is a well attested fact that different language levels are variably sensitive to cross-linguistic influence. Phonology is usually mentioned as the area where cross-linguistic influence is most obvious. But even at that level cross-linguistic influence cannot be appropriately predicted by the differences between L1 and L2. The obvious reason is that differences do not necessarily lead to difficulty, as discussed above, and cross-linguistic influence is not the only candidate to affect acquisition and performance. Universal principles, like markedness, have also been shown to affect acquisition. The language level in which cross-linguistic influence is the least obvious is syntax; probably, linguistic universals are prevalent at the level of syntax. It has been argued that the influence of cross-linguistic influence is related to the amount of metalinguistic awareness that is at the learner's disposal. Odlin (1990), for instance, has convincingly demonstrated that metalinguistic awareness inhibits cross-linguistic influence in the case of word order. This is corroborated by the observation that cross-linguistic influence is strongest at the level of phonology: this is also the level at which the learner can be expected to have little metalinguistic awareness. With regard to lexis and morphology, it can be assumed that morphological markers that are, in traditional terms, "most closely linked to syntax" will show the least cross-linguistic influence, while affixes that are more purely lexical show more cross-linguistic influence. This explains why little effect of L1 was found in the morpheme order studies: these studies have almost exclusively included grammatical morphemes. In terms of the model of morphology advocated here, it can be hypothesised that for very productive and frequent morphological types segmentation and composition has reached a high degree of automaticity. A high degree of automaticity implies that there is less control over the process. For most productive morphological types (like plural marking) therefore, little metalinguistic awareness can be expected, which in turn diminishes the role of the learner's native language. At the level of lexis in the mental lexicon, on the other hand, cross-linguistic influence has commonly been observed (see Kellerman, 1987 and the discussion about the bilingual mental lexicon above).

3.4.3.3 Psychotransparency

The morpheme order studies, advocating the L2=L1 position, can be seen as a reaction to earlier approaches of second language acquisition in which the influence of the learner's L1 was regarded as the major factor affecting second language acquisition. The erroneous assumption that was used as the starting point of these approaches, like the Contrastive Analysis Hypothesis, was that difficulty in L2 could be predicted by the typological differences between L1 and L2. But "more different" does not automatically imply "more difficult". In the acquisition of phonetic features, for instance, it has been demonstrated (Flege, 1990) that L2 features which are similar but not equal to corresponding L2 features were acquired later than features which are entirely different, because the difference of the features was not recognised by the learners (due to what Flege labelled "equivalence classification"). There is no reason to assume that phenomena like equivalence classification are limited to phonology, and similar effects may be expected in the area of morphology. It is, for instance, not unlikely that L1 and L2 affixes that are similar in form, but functionally or semantically different, are the ones that are most difficult to acquire. The similarity of L1 and L2 morphological types contributes to the L2 learner's perceived transparency of morphologically complex words.

The transparency of morphologically complex words has thus far been defined as the compositionality of these words. In terms of acquisition, however, it is not only the inherent transparency of morphologically complex words that is important, but also the learner's perception of transparency. For the learner, these two notions of transparency are interdependent: if the conditions for word internal transparency have not been met, even the most proficient word-analyser cannot derive meaning on the basis of the form of a morphologically complex word that is not transparent: it is not possible or helpful to try and analyse *seldom, random*, or *condom* as analogous to *kingdom*; or *comment* and *element* as analogous to *payment*. The reverse is true as well: although a structure may be quite transparent, the individual may not recognise the transparency: room number 2717, indicating second floor, wing 7, room 17, may be hard to find for someone who is not familiar with these conventions. To distinguish between the potential semantic transparency of morphologically complex words and the individual's perception of transparency, the latter type will be referred to as "psychotransparency". In second language acquisition, the learner's native language plays a predominant role through the psychotransparency of morphologically complex words in L2 in two ways: by form-based similarity between L1 and L2 affix types and by syntactic and semantic similarity: the overlap of the syntactic properties and the semantic characteristics of L1 and L2 affix types.

Form-based similarity between affix types in L1 and L2 is defined as the orthographic or phonological overlap of the actual realisation of the affix. Applied to the affix types of English and Dutch, for instance, the suffix *-er* is similar in form, because it is orthographically identical in both languages. Also the Dutch affix *-iteit* and English *-ity* and are considered similar in form due to their orthographic similarity (in spite of the difference in stress placement). The overlap in the conceptual characteristics of morphological types in L1 and L2 is labelled "translation equivalence" in this study. This is not a binary concept, but a continuum; the larger the number of overlapping features, the higher the degree of translation equivalence.

Translation equivalence does not necessarily coincide with form-based similarity, but both can be expected to facilitate the acquisition and use of morphological types in L2. It can be hypothesised that the strongest facilitating effect is to be expected from a combination of a high degree of translation equivalence and a high degree of form-based similarity. L2 Morphological types that are similar in form to L1 morphological types and that have many overlapping syntactic and semantic properties can be expected to be relatively easy for L2 learners to acquire and subsequently use. A facilitating effect can also be expected from types in L2 that share the syntactic specifications and many conceptual representations with an L1 type, but which are not similar in form. In that case, the familiar combination of conceptual representations (occurring in co-activation) can "simply" be mapped onto the newly encountered lemma. However, negative transfer can be expected for types that are similar in form, but that are essentially different in terms of semantic properties. The latter case is sometimes referred to as "deceptive transparency" (Laufer, 1989). Several studies concerning the acquisition of L2 morphology (for instance Storch, 1979) have indeed shown that learners have most difficulty learning words that seem transparent, but are not.

Based on a typological comparison of L1 and L2, predictions can be made about the translation equivalence of L1 and L2 affixes. With reference to the morphological translation equivalents, some areas of potential difficulty can be predicted in terms of psychotransparency. Firstly, there may be L2 types that do not have an L1 form and, vice versa, there may be L1 types for which there is no corresponding L2 form. An example is the Dutch affix *-sel* as in *zaagsel* ("saw dust"). The most important syntactic properties of this type can be represented in a subcategorisation frame as follows:

(2) [[V_{dyn}]____] [N, -abstract] (with a link to the semantic form: 'that what remains after Ving').

There is no equivalent English affix form representing this type. What Dutch learners of English will do with this problem is an empirical question that will be addressed in Chapter 4. But since the language information related tot this affix links it to English, and since the learner cannot have perceived the productivity of this type licensing its use in English, the model will predict that no direct transfer of the Dutch affix to English roots will take place. Secondly, there may be L2 forms that are similar to L1 forms, but that do not represent an equivalent type in terms of semantic form. In that case, a high degree of form-based similarity between the affixes is combined with a low degree of translation equivalence. For Dutch and English this situation is exemplified by the suffix *-ster*: in English this refers to an agent, male or female ("person of a certain type or of a certain trade or interest"[41]), while in Dutch it refers to female agents only. Since the English affix refers to a broader semantic category than the Dutch affix, equivalence classification of the two affixes may lead a Dutch learner of English to assume that English agents ending in *-ster* are female. Only the encountering of a male agent of the *-ster* type will induce restructuring of the semantic form related to the English type. Finally, the problem of morphological asymmetry, mentioned in 2.5.2 is multiplied for L2 learners. Morphological asymmetry occurs when there seems to be no one-to-one relation between a morphological type and form. It has been argued in Chapter 2 that a one-to-one relation can be maintained if minor conceptual differences between morphological types are taken into consideration. For all learners, it may be very difficult to acquire the minor differences between the types, but for L2 learners this difficulty may be increased by low degrees of translation equivalence for L1-L2 affix pairs relating to these types. Consider, for instance, the case of the two minimally different types in (3) and (4).

[41] This meaning refers to the transparent interpretation of this suffix. There are some (lexicalised) examples in which *-ster* does not refer to a person (e.g. *roadster*).

(3) [[N] ____] [A]] (‘having the tendency to cause N’) (e.g. peaceful, helpful, doubtful)
(4) [[N] ____] [A]] (‘containing much of N) (e.g. colourful, meaningful, powerful).

The acquisition of the minor differences between these two homonymous affix types will be further complicated by the large number of different translation equivalents for the English affix *-ful*, all linked to, again, minor semantic and pragmatic differences. The affix *-ful* can be translated by the Dutch affixes *-ig* (“kribbig”), *-lijk* (“hatelijk”), *-vol* (“hoopvol”) *-achtig* (“twijfelachtig”), *-baar* (“dankbaar”) and *-zaam* (“bedachtzaam”). It may be obvious that this range of possible translations does not facilitate the transparency of this English morphological type for Dutch learners. Hence, the extent to which an affix type is consistently represented by the same form in the two languages, is an important determiner of the transparency of that affix type. This consistency is related to the conceptual overlap of the morphological types in L1 and L2. The more conceptual overlap there is between an L1 and an L2 lexical item (i.e. the higher the degree of “translation equivalence” is), the more consistently the form of this item will be represented in two languages. It should be noted that the consistency with which a form represents a morphological type is independent of the form-based similarity of the L1 and L2 lemmas.

3.4.3.4 Summing up cross-linguitic influence

The learner’s native language is certainly not the only factor that plays a role in the acquisition of L2 morphology, and a contrastive analysis on the basis of the typological differences between two languages alone can never accurately predict the difficulties for L2 learners. On the other hand, it is not realistic either to assume a minimalist position, in which language acquisition is not at all affected by the learner’s native language. A closer analysis of the role of the native language reveals that it is especially in the interaction with other factors that cross-linguistic influence can be explained. With regard to the acquisition of L2 morphology an important constraint on transferability is the learner’s perceived productivity of a word formation type in a particular language. As morphological types are marked for language in the mental lexicon, the productivity of an L1 type will not automatically be transferred to a L2 type. As a result, an L2 learner will not be prepared to transfer L1 affixes directly to L2. However, interlingual co-activation of a particular set of conceptual representation may cause some activation feedback to flow to the lemma nodes of another language. Cross-linguistic influence may variably affect different linguistic levels. Strongly automatic implicit L2 processing is less likely to be affected by the L1 than is controlled processing. This means that very frequent productive affixes for which computation is relatively simple are less likely to be affected by L1 morphology than less productive or less simple types. The most important effect of cross-linguistic influence can be expected in terms of the psychotransparency of morphologically complex words. It is at this level that the relation between typological differences of languages and predicted areas of difficulty for L2 learners are strongest. Both form-based similarity and a high degree of translation equivalence due to overlapping semantic forms of L1 and L2 lemmas may facilitate the acquisition and use of these lemmas for L2 learners. It should be noted, though, that the conceptual representations linked to an L2 lemma may considerably deviate from the same lemma in native speakers of the target language as a result of the perceived semantic transparency due to cross-linguistic influence.

3.4.4 Individual differences

The acquisition and use of a second language is affected by individual differences between learners. I will not discuss the separate effect on morphology of the wide range of individual variables that affect second language acquisition. The way age, sex, aptitude, intelligence, personality, L1 proficiency, motivation, etc. affect the acquisition of morphology may be interesting, but this falls outside the scope of the current study. Two individual differences are particularly relevant for the acquisition and use of morphology: the learner's style and the learning strategies that the learner adopts. Individual differences in cognitive style affect the acquisition and use of morphology. The differences between learners will especially become apparent in investigations involving awareness of morphology. It is to be expected that learners applying an analytic cognitive style are better at these tasks than learners applying a concrete learning style. In addition, the learning strategies employed by learners will affect the acquisition of morphology, since some individuals are better at finding transparency in words than others.

The role of individual differences in the acquisition of L2 morphology was investigated by Freyd & Baron (1982), who compared two groups of learners (5th graders and 8th graders) that were matched for vocabulary knowledge. Both groups of learners were given two types of tests: a vocabulary test and a test in which the subject had to learn a series of nonsense words (half derivationally related and half unrelated). The 5th graders, who were apparently superior learners of vocabulary, scored particularly higher at derived words in the vocabulary test in analysis, but not in production. Both groups of subjects had equal difficulty in using suffixes (i.e. assessing meaning) once the analysis had been performed. In the learning test, the 5th graders were correct more often in morphologically related word pairs than in unrelated pairs; the 8th graders showed no difference. Apparently, the 5th graders used the derivational relations in learning. The authors' general conclusion is that those learners who do analyse the words are better learners of vocabulary. The asymmetry between the analysis task and the production task can be accounted for in terms of the activation model: apparently the segmentation stage was passed successfully, but the semantic form had not been sufficiently developed to allow successful matching of meaning onto form. The differences between the two groups in this study can probably not be explained by the difference in age, as the younger learners were superior. The superiority of the younger learners are more likely to be sought in the learning style they employ.

Of all language levels, morphology is often claimed to be most sensitive to differences in cognitive style and learning strategy. Singh & Martohardjono (1988), for instance, argue that morphology is strongly dependent on the speaker's ability to apply "problem solving cognitive strategies" rather than "language specific cognitive strategies". This effect is obviously related to the level of explicit knowledge and the degree of automaticity. In the previous section it has been argued that less productive morphology is likely to be subject to controlled processing and may therefore benefit from explicit knowledge more than strongly automatic processes. Nevertheless, the strongest effect of the learner's cognitive style may be expected regarding the psychotransparency of morphologically complex words; i.e. at deriving analysed implicit knowledge based on the input. The study of cognitive styles and learning strategies is still relatively undeveloped, and there is little agreement about which cognitive styles should be distinguished and what constitutes a learning strategy. Therefore, no specific predictions can yet be made with regard to the acquisition of L2 morphology. However, the learner's individual ability to apply problem solving cognitive strategies can certainly be expected to affect the acquisition and use of L2 (derivational) morphology.

3.4.5 Summary

The integrated model of second language acquisition adopted here distinguishes between implicit and explicit knowledge (awareness) on the one hand and control on the other. The gradual analysis of language is attributed to implicit knowledge. Analysed implicit knowledge can be transferred to explicit knowledge, but the status of the transition from explicit knowledge to implicit knowledge is yet unclear. Activation of words and affixes in the lexicon will affect the automaticity of lexical processing. L2 lexical processing is further affected by the same principles and constraints as L1 processing. Whether or not a separate representation for an L2 form is established depends on the simplicity, the productivity and the transparency of the related concept. The "simplicity" of a morphological type is determined by the degree of phonological change it involves and by the conceptual complexity of the type. Especially at the level of conceptual complexity differences between L1 acquisition and L2 acquisition may be expected, as the L2 learner will usually have acquired fully developed lexical representations in her L1 and will thus have established the most essential conceptual representations, while L1 learners will simultaneously develop syntactic properties, lemmas and concepts.

Differences in the acquisition of L2 productivity have predominantly been observed in formal learning contexts. This can be ascribed to the differences in the nature of the input between naturalistic and formal learning contexts: the frequency of forms in classroom input may be insufficient to bring about the establishment of separate representations.

Similar to L1 acquisition, transparency is a condition for the analysis of morphologically complex words and for the establishment of separate representations. In L2 acquisition, however, (psycho)transparency is strongly dependent on the learner's L1.

The developmental sequence of mastering the application of morphological types seems to follow a fixed order, independent of the learner's L1. For naturalistic language acquisition, this order can be explained by the frequency of the morphemes concerned.

The acquisition process is further affected by the learner's native language. The native language does not equally affect second language acquisition at all linguistic levels and under all circumstances. Cross-linguistic influence should rather be seen as a factor that affects the L2 acquisition process through an interaction with other factors. For the acquisition of morphological types, the role of the first language is particularly relevant in affecting the psychotransparency of morphologically complex words. The psychotransparency of morphologically complex words in the L2 is determined by the inherent (L2) transparency of the word, the form-based similarity between L1 and L2 affix types and the degree of overlap of syntactic properties and semantic forms, expressed in the degree of translation equivalence of L1-L2 affix pairs.

Finally, the acquisition and use of L2 morphology is likely to be affected by individual differences like the learner's cognitive style and learning strategies; an analytic learning style is particularly beneficial for the acquisition of less productive, controlled morphology, like what has traditionally been considered derivational morphology in English. The acquisition and use of these morphological types in L2 (and in L1, for that matter) will be affected by differences regarding the learner's cognitive development.

3.5 Morphology in the bilingual mental lexicon: the overall picture

In this section I will summarise the processing of lexical information in L2 as this has been proposed in Chapter 2 and modified in Chapter 3. This model of morphological processing has been derived from Schreuder & Baayen's (1995) Meta Model, which was modified to account for production data and refined to include morphological processing and acquisition in L2 learning.

Processing lexical information may strongly depend on factors like the learner's stage of L2 acquisition and the language distance. Except for section 3.5.3, the discussion in this summary will concentrate on the situation in which the speaker/listener is fully bilingual and has acquired native-like lexical entries in the L2.

This section is organised as follows. First, an brief sketch of the model is provided (3.5.1) that focuses on the comprehension of morphologically complex words in the bilingual mental lexicon. This part is described from the learner's input to the eventual matching of conceptual information to the semantic forms of the lemmas. In 3.5.2 production is described, starting from the Verbaliser (which is the input on the production side) to the modular-specific production interface. 3.5.3 follows with a summary of what has been said about the way the model deals with acquisition and development.

3.5.1 A sketch of the model

After a brief summary of the basic elements of the model, the discussion in this section will proceed from input to output for comprehension. The overview will concentrate on the representation of L2 morphology, and elaborate on the function of the modular interfaces that constitute the entry to the comprehension side of the model. Next, the central position of transparency and simplicity is emphasised for language processing, followed by an important consequence of applying the activation metaphor to the bilingual mental lexicon: interlingual co-actviation.

3.5.1.1 The main ingredients

The core of a lexical entry is the lemma node. Attached to the lemma nodes are lexemes, which are modality neutral and are used for both comprehension and production. The lexemes are not fully specified for form, but contain information (similar to parameters) about the orthographic and phonological representations of a lemma. Also attached to the lemma node are the nodes determining the syntactic characteristics of the lexical entry, including its argument structure. Finally, the lemma node is linked to a node determining the semantic form of the lexical entry. The meaning of a lexical entry is established by mapping a set of extra-linguistic conceptual primitives to the semantic form. Besides semantic information, these primitives contain semantic and pragmatic information like the choice of register. A particular combination of syntactic and semantic/pragmatic information makes each lexical entry unique. In this framework, pure synonyms do not exist: two lemmas will always differ with at least one lexical or conceptual property.

Processing in the lexicon is driven by frequency-induced activation; all elements in the lexicon can attain variable degrees of activation, which increases each time a node is used, and decreases over time. Activated nodes spread activation to nodes with which they are connected. This implies that activation spreading takes place in two directions; from the lexemes to the lemma nodes and from the lemma nodes to the lexemes. By the application of the activation metaphor semantic priming effects can, for instance be accounted for.

Comprehension starts with the decoding and segmentation of the spoken or written message into intermediate comprehension representations. This is taken care of by separate modular interfaces for spoken and written language. The modular interfaces trigger a range of intermediate comprehension representations, which result in the selection of a limited number of lexemes. The main factor determining the selection of a lexeme is its level of activation. The selected lexemes will subsequently activate the lemma nodes to which they are linked. The lemma nodes will then activate the syntactic and semantic properties associated with the lemma nodes.

In the bilingual lexicon, one of the properties linked to the lemma node comprises information about the language subset to which the concept belongs. The activation of a particular language subset property will spread activation to other concepts belonging to that subset. Through activation feedback, each subsequent activation of the language subset will result in a higher degree of activation of all the concepts related to that particular subset. This mechanism sets and reinforces the supralexical selection of a particular language subset (see 3.3.2.1).

3.5.1.2 Representation of L2 morphology

In this model, morphology is not represented by rules, but by the independent lexical operation of morphological constituents. Morphological constituents represented in the lexicon are called "morphological types". These types can be used to create and interpret (morphologically complex) words that are not readily available in the mental lexicon. The main criterion for a morphological type to attain its own lexical entry is the degree of activation it receives. In other words, the establishment of a separate lexical entry for a morphological type is dependent on the productivity of the morphological type, which is determined by its relative type frequency. Once a separate lexical entry has been set up for a particular morphological type, morphologically complex words containing that morpheme can be processed type-familiarly. But the establishment of a morphological type in the lexicon is not permanent: the activation of morphological types will decay over time. The lemma node representing a morphological type refers to the abstract notion of a morphological operation, characterised by the interaction of the subcategorisation frame or argument structures that are part of the syntactic properties connected to selected lemma nodes. In the example below, the conceptual representations matched to the semantic form are sketched for the affix *-ness*:

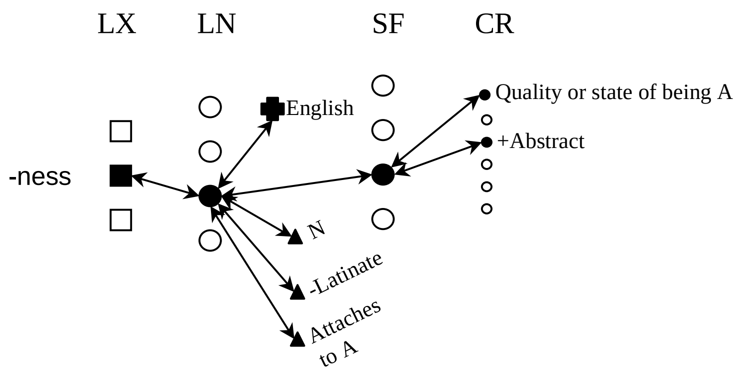


Figure 18. Lexical entry of the morphological type -ness, comprising*: Lexeme (LX), lemma node (LN) plus syntactic properties and language subset information, semantic form (SF) and its associated conceptual representations (CR).*

The information represented in the syntactic properties linked to the lemma node of a morphological type will allow or inhibit its combination with other lemmas, driven by the argument structure it contains; a process that is referred to as "licensing". The meaning of a licensed combination is computed on the basis of the semantic properties of its constituent elements. A licensed combination results in the establishment of a temporary lemma node and a lexeme associated with that lemma node. Activation feedback will not only flow to the lemma nodes and the associated lexemes of the successful combinations, but also to the constituent elements of the combination. If a combination cannot be licensed or if the meaning cannot be computed on the basis of the constituents, all activation will flow back to the lemma node and the lexeme of the whole word. If a combination is licensed and the meaning of the combination can be computed, activation flows back to its constituent elements. This means that the level of activation of the lemma nodes of the morphological type varies as a function of the number of semantically transparent formations that are successfully formed on the basis of that morphological type and on the frequency of those formations. Combinations that are fully transparent and, therefore, require little computation (like regular plural formation) will induce strongly activated lexical entries of the morphological types and weakly activated representations of the combinations. Due to this mechanism of activation feedback, temporarily established lemma nodes that are the result of licensed word formation types will soon decay, while newly formed combinations that are not transparent have higher chances of becoming permanent. Considering the definition of productivity used here (see 2.5.1), this means that the occurrence of separate lexical entries for morphological types is dependent on the productivity of that type.

An example of a licensed combination in the comprehension of a newly encountered word is presented in Figure 19. The lemma nodes for *open* and *-ness* are two of the lexical entries that have been activated by the intermediate comprehension representations. Had there been a lexical entry for the whole word, *openness*, this would also have been activated. To map the forms encountered onto meaning, activation is spread through the lemma nodes, via the semantic form to the conceptual representations. Upon co-activation of conceptual representations, an attempt will be made to compute the meaning of the combination. But before computation can occur, the combination has to be licensed on syntactic grounds. In the current example, the argument structure of the elements license their combination, resulting in the establishment of a temporary lemma node for the combination, *openness*, which is copied to the short term memory. As little computation was required to arrive at the meaning of the combination, the new lemma node and its associated lexeme will receive little activation feedback, while more activation flows back to lemma nodes and the lexemes of its constituents, *open* and *-ness*. The more often the morphological type *-ness* results in a successful combination, the higher the level of activation of this types will become, and the higher the chances are that words containing this affix are interpreted type-familiarly.

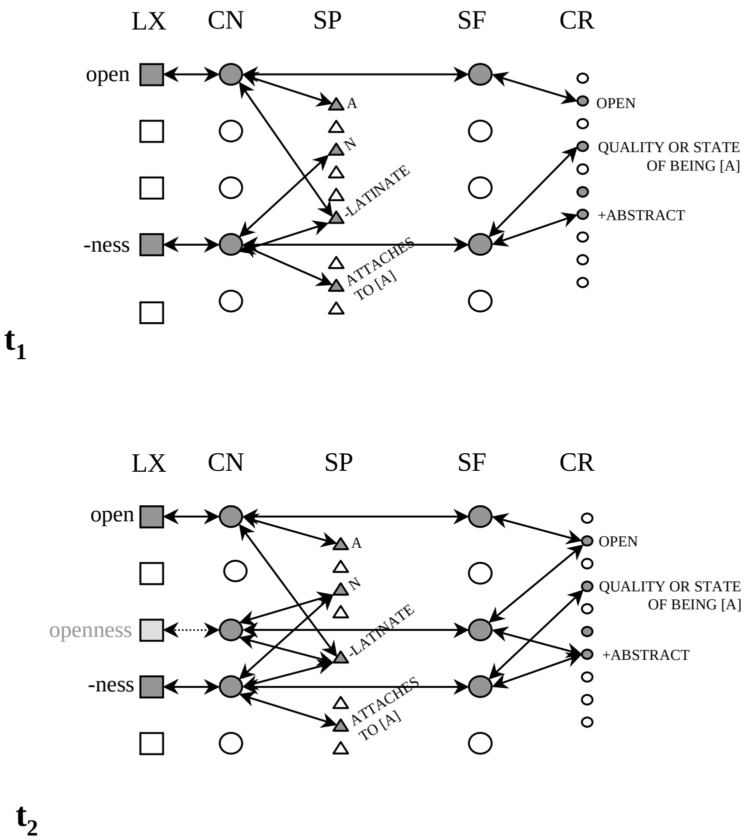


Figure 19. Example of a licensed combination. t_1 and t_2 represent subsequent time steps in the process of licensing and combining the word openness*, for which no lexical representation was available. The degrees of shading represent the level of activation. (Freely adapted from Schreuder & Baayen, 1995). This example has been simplified by omitting the language nodes.*

3.5.1.3 Modular interfaces

The function of the modular interfaces is to identify segments in a sentence and to map these onto modality neutral lexemes that are attached to lemma nodes. This process is mediated by intermediate access representations for comprehension. In visual recognition this mechanism may be rather straightforward, because the words can easily be identified. Spelling rules will have to be applied to come to neutralised lexemes. For instance, the spelling interface will have to account for the deletion of *e* in *serenity* to lead to the neutral representation for *serene*, and for the recognition of the segments *clap* and *-ed* in *clapped*. More complex processes will have to be assumed for the segmentation of speech. The phonological interface, which, in conjunction with some acoustic-phonetic processor is responsible for speech recognition, is considered a black box in the current model, but it can safely be assumed that cohort-like mechanisms and spreading activation as well as rhythm (see, for instance, Cutler, 1994) play a role in this. The recognition process, however, does not stop at the recognition of words, but is followed by segmentation into morphemes to identify morphological types. Segmentation may be different between the two modalities, but it simultaneously activates a set of intermediate comprehension representations regardless of the modality that initiated the process. These intermediate access representations set off the actual process of word recognition by triggering the lexemes with the highest level of activation. This level of activation, as was argued above, is determined by the frequency of occurrence and can be enhanced by activation feedback.

3.5.1.4 Transparency

A major condition for the comprehension mechanism sketched above is semantic transparency. Morphologically complex words that are not transparent cannot trigger the activation of separate representations, which will disable the type familiar conception of morphological types; opaque words will always have to be processed item-familiarly. Moreover, it is not possible to correctly compute the meaning of morphologically complex words that are not fully transparent. As we have seen, a failure to compute meaning of a licensed combination will result in activation feedback flowing to the lemma node (and subsequently to the lexeme) of the whole word. The transparency condition is particularly pertinent for (second) language acquisition, as the learner is dependent on transparency for the acquisition of morphological types. For language acquisition it is more appropriate to speak of the "psychotransparency" of morphologically complex words (see 3.4.3.3). Psychotransparency is individually determined and includes all of the learner's linguistic knowledge. Through psychotransparency, the L2 learner's native language may strongly affect the processing of words in L2. For instance, a problem for the accurate recognition and processing of morphologically complex words in L2 is caused by "deceptive transparency": L2 words that seem transparent due to similarity to L1 forms, but are opaque really. In cases where the L1 and L2 morphological types are similar but not identical, deceptive transparency may lead to L2 lemmas containing semantic forms that are deviant from those of native speakers of the L2. This may occur especially in cases of homonymous L2 affixes. For instance, consider the English prefix *un-*. This prefix is linked to two different morphological types that are very similar, except for their syntactic subcategorisation characteristics, which are:

(5) *un-*: [_____[A]] [A]

and

(6) *un-*: [_____[V]] [V]

respectively. This means that words like *undoable* are ambiguous. Taking into account the subcategorisation frame *-able*, which is *-able*: [[V]____] [A], *undoable* could be bracketed $[\text{un}[[\text{do}]_V[\text{able}]_A]_A]_A$ or $[[\text{un}[\text{do}]_V]_V\text{able}]_A$. The form of the Dutch affix type *on-* is very similar to *un-* and the Dutch and the English prefix share many conceptual characteristics. However, *on-* is not productive with verbal stems. A Dutch learner of English may therefore easily acquire the first type of *-un*, but fail to acquire the second type. The second interpretation of *undoable* may be missed by Dutch learners of English. This example goes to show that the perceived semantic transparency of L2 words is a crucial issue in the discussion on the acquisition of L2 morphology, as it is at this level that cross-linguistic influence plays a predominant role.

An important concept in this discussion is the “translation equivalence” of word pairs or affix pairs between languages. In section 3.4.3.3, translation equivalence was defined as the amount of conceptual overlap of a lemma in the L1 and a lemma in the L2. A higher degree of translation equivalence between words and morphological types in L1 and L2 will increase the psychotransparency of morphologically complex words in the L2 and will facilitate the (type-familiar) comprehension of these words. A low degree of translation equivalence, on the other hand, may hamper the comprehension of morphologically complex L2 words.

3.5.1.5 Simplicity

The success of the parsed access procedure for morphologically complex words is also dependent on the processing complexity, or “simplicity” of a morphological type. Simplicity is constituted by several factors at different stages of lexical processing, like phonological complexity and conceptual complexity. Phonological and spelling complexity play an important role in the segmentation stage; if segmentation is complex, the lexeme of the whole word is activated faster, leading to an increased chance of item-familiar access of that word. The affix *-ity*, as in the word *serenity*, is an example of a morphological type that involves relatively complex segmentation compared to, for example *-ness*, due to stress shift and vowel deletion. Ultimately, this observation can account for the higher productivity of *-ness* over *-ity*. Phonological and spelling procedures are subject to automaticity. Very frequent procedures, like consonant doubling, take place with a high degree of automaticity and will not strongly affect the processing of morphological types. Simplicity at the level of licensing and combination is determined by syntactic and conceptual complexity: the more complex the argument structure is, the more complex the licensing procedure is. The more conceptual representations are associated with the semantic form of a lemma, the more complex the computation of meaning will be. Conceptual complexity also affects the processing procedure: eventually, complex processing results in lexicalisation of morphologically complex words. Conversely, the application of morphological types that require very simple computation, like union in the case of regular English plurals, will induce type-familiar access and prevent lexicalisation of morphologically complex words formed on the basis of those affix types. Applied to language acquisition, simplicity at both levels may affect the acquisition of morphological types (see 3.2.2). However, processing complexity need not run parallel between L1 learners and L2 learners. Procedures that complex for L1 learners are not necessarily equally complex for L2 learners if similar processes occur in the L2 learner’s L1 (see 3.4.2).

3.5.1.6 Interlingual co-activation

As has been argued above, the bilingual mental lexicon is not different from the monolingual lexicon except for one additional bit of information linked to the lemma node: information about the language to which a particular lemma (including morphological types) belongs. L1 and L2 lemmas can considerably overlap in terms of shared syntactic and semantic information, but will be different with regard to at least one characteristic: the language information. Due to overlap of lexical and conceptual properties between L1 and L2 lemmas, activation of an L1 lemma can spread activation to an L2 lemma and vice versa ("interlingual co-activation", see 3.3.2). A particular language is selected by the initial activation of a lemma associated with that language. Activation of this lemma spreads activation to a supralexical language selector that subsequently enhances the level of activation of all lemmas containing the same language selection information (see 3.3.2.1).

Based on interlingual co-activation it can be hypothesised that successful type-familiar processing of a word in L1 can affect the activation of a similar L2 type, very similar to the same phenomenon for monomorphemic words (exemplified in 3.3). Figure 20 illustrates the mechanism of interlingual co-activation. The activation of the lexical entry of the English affix *-er* induces, through activation of the conceptual representations, co-activation of the syntactic and conceptual properties associated with that lexical entry. Due to the overlap of many conceptual representations, it is hypothesised that some activation feedback will flow to the equivalent Dutch affix. It should be noted that this figure represents only part of the process, as activation feedback only occurs after successful parsing.

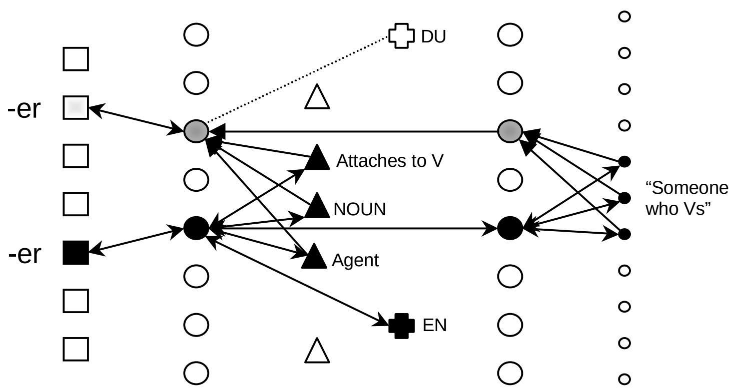


Figure 20. Simplified example of cross-linguistic co-activation of similar concepts in L1 and L2.The degree of shading reflects the level of activation. The dotted line represents a link that is marginally activated.

3.5.2 Production

For production, the mechanisms described above roughly apply in reversed order. The production process starts at the conceptualiser, where a "preverbal message" is generated that is passed on to the lexicon through the formulator. At the level of the conceptualiser, also a language subset is selected that enhances the activation level of all entries belonging to that subset, while other language subsets may be active or dormant. The extra-linguistic language selector must be assumed to operate at the level of the conceptualiser and must be assumed to have direct links to the language selection information linked to the lemma nodes (see Figure 15 on page 98).

For the selection of a particular word, the formulator triggers the activation of a set of conceptual properties. The co-activation of a particular set of conceptual representations (containing semantic and pragmatic information) activates a lexical entry by matching the conceptual primitives to the semantic form of a lemma. The activated semantic form spreads activation to the lemma node, which activates the syntactic properties associated with the lemma node. The lemma node, including its syntactic (subcategorisation) information enters the formulator, where the selected lemmas are combined through grammatical encoding, generating a surface structure that generates phonologically encoded frames. Subsequently, these frames are filled with the lexemes that are again retrieved by association with the selected lemmas. (see section 2.5.4 in Chapter 2). Although this is an simplified representation of the processes that play a role in production, it does provide a framework in which the same lexicon can serve for comprehension and production.

3.5.2.1 Selection of lemmas

Language production starts with the conceptualiser, which generates a preverbal message. The information in the output of the conceptualiser is purely conceptual and at this level the system does not know for which elements in this information a lexical representation exists. Therefore an additional interface is assumed, the Verbaliser, which does have some knowledge of the elements present in the lexicon. Using this information, the Verbaliser creates chunks of verbalisable information that are matched to the semantic forms of the lemmas in the lexicon (see 2.5.4). The precise nature of the chunking mechanism is not yet fully clear, but for the current purpose it suffices to conclude that decomposed conceptual information originates from some extra-lexical device and that this conceptual information is matched to the entries in the lexicon. This information refers to both the semantic and the pragmatic aspects of the message. For the bilingual lexicon, it must further be assumed that the chunked elements reaching the lexicon, the "conceptual representations" includes information about the language subset that is selected.

The process of matching the conceptual representations to the semantic forms of the lexical entries includes the selection of morphological types. The selection of the types depends on the level of resting activation of the morphological type relative to the activation level of the whole word. If no entry exists for a concept to be verbalised, the morphological type will always be selected.

Once matching is completed and the lemmas selected, activation spreads to the lemma node and from there to the syntactic properties of the lemma. The syntactic and semantic information of all lemmas selected this way is combined by the formulator in a process has been labelled “grammatical encoding”. It is at this level that combinations of morphological types and other lemmas have to be licensed on the basis of the syntactic information in the selected elements. This implies that in the system there is no need for the separate application of morphological rules. If no lemma node exists for a concept that the speaker wishes to express, a temporary lemma node is set up as a result of a (licensed) combination of lemmas that are present. Obviously, the speaker can only make use of morphological types that have been recognised and stored as such, and in this way, production is dependent on comprehension.

For example, consider the formation of the word *daftness*. The speaker wishes to express the “the quality of being” in combination with the adjective *daft*. This results in the co-activation of a set of conceptual representations related to this semantic content. In addition, the conceptual representation also contains information about the language subset, and some pragmatic implications of this combination. During the matching operation, it will appear that no lexical entry exists representing this semantic content. This situation, by the way, may be different if the speaker had just heard this word and the combined form is still resident with a sufficient level of activation, but let’s assume this is not the case. Consequently, the lemma nodes of both the affix type *-ness* and the lemma node of *daft* are activated. In the grammatical encoding procedure, the combination of these two elements is licensed and the combination inherits the argument structure of the affix type.

Relatively little is known about the exact nature of the chunking procedure, but it must be assumed that the Verbaliser has some information about the items the lexicon contains. If this is indeed the case, some feedback mechanism must be assumed that provides the Verbaliser with lexical information. The feedback mechanism will also apply if no valid message can be generated based on the lemma nodes selected. This will be the case if the combination of an affix type and another lexical element cannot be licensed on the basis of their argument structures. If this is the case a new matching attempt must be started, in which a different affix type is selected. It should be noted that in most cases the selection of the most productive morphological type will lead to a licensed in combination. For morphologically complex lexical items based on less productive affix types a whole-word entry covering the concept is more likely to be present with a level of activation that is high relative to that of the affix type.

For both morphologically complex neologisms and monomorphemic words, the stages beyond the selection of the lemma node are identical. The selection processes are driven by activation. Once a lemma node has received sufficient activation, it will trigger the selection of a lexeme. Lexical entries are neutral between production and comprehension.

3.5.2.2 Phonological encoding

Phonological encoding itself is a complex process, and in the current model it is regarded as an interface outside the lexicon. Therefore, the following brief summary of the main observations on this issue will suffice for the purpose of this model: the phonological frame (or "phonological word") must be considered separate from its segmental content. In the time course of speech production, first the metrical frames are generated. Then the segmental content, provided by the lexemes, fills the empty metrical skeletons. The result of this process is a series of syllable specifications that are transferred to an articulatory device.

3.5.3 Acquisition and development

The acquisition of L2 morphological types partly runs parallel with the acquisition of L1 morphological types, but is different in several respects. Both in L1 acquisition and in L2 acquisition the principle of transparency, the learner's constant urge to discover meaningful elements in language, accounts for the establishment of new lexical entries matched with newly discovered meanings. In the current model the establishment of new lemmas for monomorphemic words, morphologically complex words and morphological types was explained in terms of spreading activation. Only those lexical entries (words and types alike) that regularly receive a sufficient amount of activation will establish a lasting representation in the lexicon. The activation level of morphological types varies as a function of the number of successful and licensed combinations based on that type. Considering the definition of productivity used for this model (see 2.4.1), this implies that only productive morphological types can attain their own representation in the lexicon. The perceived productivity of a morphological type must be seen as a variable that is subject to change. This change is due to the relative activation of the whole word and the morpheme constituents it contains, which varies as a function of the type frequency and the item frequency: high type frequency will lead to high activation of the morpheme; high item frequency will lead to high activation of the whole word. In other words, the establishment of separate representations for morphemes is determined by the forms in the L2 learner's input.

Development in both L1 and L2 is further affected by the principle of contrast. The basic assumption underlying this principle is that no two entries in the mental lexicon are identical in all respects. This principle accounts for the restructuring of semantic forms and when a new feature is discovered (see the example of the acquisition of "last" and "latest" by Dutch learners of English in Figure 16 on page 101).

A major difference between L1 acquisition and L2 acquisition is that in the first situation the learner simultaneously builds up concepts and lemmas, while in the latter situation she will have acquired the conceptual representations and "only" has to match these to L2 lemmas to be established. Therefore, a crucial factor for the L2 learner is the extent to which L1 and L2 lemmas consistently overlap. This consistency, labelled "translation equivalence" is particularly of importance regarding morphological types. A consistent overlap of morphological types will facilitate the acquisition and use of a morphological type. However, as was argued in 3.3.2.2, translation equivalence that does not coincide with form-based similarity may take time to be "discovered" by learners. For the acquisition of translation equivalence not only the consistency of the equivalence is important, but also the frequency with which it occurs.

The most essential underlying condition for the acquisition and use of morphological types is semantic transparency. If a morphologically complex word is not semantically transparent, no segmentation can take place, no “affix discovering” can be expected, and hence no representations for morphological types can be established in the lexicon. An important concept introduced in this chapter is psychotransparency: the learner’s perceived transparency of morphologically complex L2 words (see 3.4.3.3). It is at the level of psychotransparency that the learner’s L1 plays a crucial role: similarity between an L1 and an L2 morphological type will increase the psychotransparency of that type, which creates the fundamental condition for that type to be acquired and used.

3.6 Conclusion

The discussion in this chapter has demonstrated that evidence from three different areas of research, the acquisition of morphology in a first language, the structure and development of the bilingual lexicon and the theory of second language acquisition, are compatible with an integrated model of the role of morphology in the bilingual mental lexicon. It has become clear that essentially the same principles can account for both L1 acquisition and L2 acquisition. The first principle is transparency, the desire to map meaning onto form. In second language acquisition transparency is dependent on psychotransparency, which is related to the learner’s native language and which is individually determined. The second principle is contrast: the learner, both in L1 and L2, will reject pure synonyms, which are defined as lemmas that overlap in all conceptual characteristics. This principle, in combination with the principle of conventionality, offers a solution to the learnability problem: if the learner encounters a conventional form that overlaps with the learner’s own lexical coinage, the coinage will be dropped in favour of the conventional form. For second language learning, this implies that concepts for different languages can never fully overlap. It is therefore hypothesised that the language to which a lexical representation belongs is included in the links to the lemma node of a lexical entry. A language is selected at a supralexical level by the conceptualiser, provoking additional activation of all lexical entries associated with that language. The actual acquisition and use of type-familiarity in both L1 and L2 acquisition is determined by an interaction of transparency, productivity (as defined in the previous chapter and related to frequency) and simplicity. Transparency, which in L2 acquisition is, besides inherent L2 transparency, also dependent on the learner’s native language, and is therefore a necessary condition for the analysis of morphologically complex words. Once analysed, the constituents of the words may be given separate representations and represented in the lexicon type-familiarly. This depends on the type frequency of the constituent morphemes and on the simplicity of the type; simplicity determines the processing complexity of a combination of morphemes and is affected by the degree of phonological and orthographic change and the number of different properties linked to a lemma node (the “conceptual complexity”), which may complicate computation.

The activation model proposed here is compatible with an integrated model of second language acquisition that distinguishes between knowledge and control, by attributing the activation level to the control dimension. Knowledge, in turn, can be subdivided into implicit knowledge (or “intuition”) and explicit knowledge (or awareness). These subdivisions are required to account for general observations of second language acquisition. The procedure of the discovery of morphemes, the development from item-familiarity to type-familiarity, takes place inside the implicit knowledge component. Analysed knowledge enables the learner to derive explicit knowledge. Explicit knowledge provided in a formal language learning context in L2 learning or as explicit (negative) evidence in L1 acquisition may enhance facilitation of the acquisition process, but is not likely to affect the order of acquisition.

It is hypothesised that only one lexicon exists for comprehension and production in all modalities. This does not exclude the possibility to assume differential representations for production and comprehension, as these can be postulated at the level of specific interfaces. Production and comprehension are triggered at different ends of the model. Comprehension is form-based and is triggered by the input, while production is triggered by a supralexical “conceptualiser”. Furthermore, different interfaces can be hypothesised for lexical access in the visual and auditory modalities, mediated by spelling and phonology respectively. An important implication of this approach is that it must be possible for lexical representations to be incomplete at certain stages of development. Since comprehension precedes production in the sequence of acquisition, concepts may have been sufficiently developed for comprehension, but not yet for production. In second language acquisition, L2 lemmas may be linked to a set of conceptual characteristics that deviates from the concepts of adult native speakers. In the course of the acquisition process, concepts are restructured and completed by adding and deleting links to conceptual representation, induced by the learner’s observations on the input.

Finally, the overall picture of the model demonstrates its applicability to both comprehension and production. The overview emphasises the role of transparency, simplicity and productivity for the comprehension, production and acquisition of L2 morphological types.

This model raises many questions that merit empirical investigation. In the next chapter, three major questions will be addressed, both of which are related to the role of the first language in the acquisition and use of L2 morphology. The first question concerns the similarity of L1 and L2 morphological types and the extent to which this similarity affect the acquisition and use of L2 morphological types. This question is related to the discussion about psychotransparency in section 3.4.3.3. The second question concerns the link between the L1 types and L2 types in the mental lexicon. In the current chapter it has been hypothesised that L1 and L2 lemmas and types have independent lexical entries that may conceptually overlap in varying degrees. It has been argued that conceptual overlap induces activation feedback. Applied to the bilingual lexicon, it was argued that L1 and L2 types that largely overlap conceptually will affect each other’s level of activation through interlingual activation feedback (see 3.3.2.1 and Figure 15 on page 98). The occurrence of this type of activation feedback can be empirically investigated. Closely related to this issue is the third question, which concerns the relative importance of L1-induced translation equivalence versus L2-induced productivity at different levels of L2 acquisition. It has been hypothesised that translation equivalence, defined as the consistent relation between L1 and L2 affix types due to an overlap of conceptual representations, will have a facilitating effect on the acquisition and use of L2 morphological types. This facilitating effect can also be empirically tested.

Chapter 4

An empirical investigation

4.1 Introduction

This chapter investigates some of the predictions made on the basis of the theoretical observations in the previous chapters. Not all aspects of the model are equally suitable to be empirically tested or can be tested within the scope of the current study. Therefore, some aspects have been selected for investigation, all focused on determining the factors that affect the psychotransparency of morphologically complex words in a second language. First, an exploratory study is reported on (4.2) that compares the impact of form-based similarity of L1 affix types and L2 affix types to the impact of semantic similarity between these types. Starting from the results of this exploration, two experiments were conducted that investigate to what extent syntactic and semantic overlap of L1-L2 affix pairs affect psychotransparency. In one of these studies, it was attempted to test the effect of interlingual activation in a priming experiment involving reaction time measurement (4.3). The other studies contain two steps. First, the degree of translation equivalence between L1 and L2 affix types was determined in a corpus study. Second, the outcomes of the corpus study were tested in an experimental setting involving the effect of different levels of translation equivalence and productivity in an L2 production task (4.4). The overall conclusion of these studies is provided in 4.5. The languages of investigation in all studies described here are L1 Dutch and L2 English.

4.2 An exploratory study of L2 morphology

4.2.1 Introduction

In Chapter 3 it was claimed that psychotransparency (including word-internal and individual factors) is an essential condition for the analysis from item to type. This claim is supported by studies into L1 acquisition, as described in 3.2. One of the conclusions drawn by Clark (1993), for instance, was that of the strategies children use in creating new words, transparency takes precedence over productivity and frequency, and that transparency is one of the main factors determining the acquisition of lexical items.

In 3.4.3 it has been argued that the main difference between L1 learning and L2 learning is that L1 learners will gradually acquire the conceptual characteristics associated with the semantic form of word formation types as well as their corresponding lexemes. L2 learners, on the other hand, have already acquired the concepts, and will "only" have to relate these to the correct types and corresponding L2 lemmas. As was argued there, this means that there are three areas of problems the L2 learner has to cope with. Firstly, learners may have problems with L2 types for which no equivalent L1 form exists and, vice versa, with L1 types for which no corresponding L2 form is available. An example is the Dutch affix *-sel* as in *zaagsel* (sawdust):

(7) [[V_{dyn}]____] [N, -abstract] ('that what remains after Ving').

No equivalent English affix form represents this type. Secondly, the problem of polysemy and synonymy is multiplied for L2 learners: there may be L2 forms that are similar to L1 forms, but that do not represent the same type, and different types may be represented by similar forms. For Dutch and English this was exemplified by the affix *-ster*: in English, this form refers to an agent, male or female ('person of a certain type or of a certain trade or interest'), while in Dutch it refers to female agents only. Finally, it will be very hard for L2 learners to acquire the subtle differences that distinguish certain (similar, but not identical) L2 types. The example given in 3.4.3 was the difference between the two types represented by *-ful*: the acquisition of the subtle differences between the types in L2 is further complicated by the lack of a consistent translation equivalent for these types. Moreover, several studies concerning the acquisition of L2 morphology have shown that learners have most difficulty in dealing with "deceptive transparency": words that seem transparent, but are opaque in fact.

Taking psychotransparency as a starting point, four categories of affix types can be distinguished for L2 learners:

A. Semantically equivalent types that are represented by identical or very similar forms in L1 and L2. Words based on these types can be expected to be transparent for L2 learners, independent of the learners' knowledge of L2 morphology, since the types fully overlap in terms of form and semantic content. An example for Dutch learners of English is agentive *-er* (lezer - reader).

B. Semantically equivalent types that take a different shape in L1 and L2. The transparency of words based on these affix types is dependent on the learner's familiarity with the L2 form. Once the learner has made a link between the two types, the semantic overlap between the L1 and L2 types will facilitate the use of forms based on these types, especially if there is a consistent translation equivalent for in the affix in L1. Example: Dutch *-heid* - English *-ness* (open*heid*, open*ness*).

C. Similar forms in L1 and L2, which are based on semantically different types. These forms can be labelled "deceptively transparent": they seem to be identical, but are not. An example for Dutch learners of English is the affix *-ster*, which in Dutch always denotes a female agent, but can be either male or female in English: Dutch *omroepster* -a female announcer-, vs. English *speedster* -male or female-. Other affix types that fall within this category are L2 types that lack a consistent translation equivalent in the L1 and for which a similar Dutch affix leads to deceptive transparency. An example is the English affix *-ful*, which in some words is the translation equivalent of the similar Dutch form *-vol*, but in many other words is represented by different affixes in Dutch.

D. L1 types for which no equivalent L2 forms exists or vice versa. The transparency of words in this category is completely dependent on the learner's familiarity with the L2 type and form. An example of this type would be Dutch *-sel*, worked out in (1) above.

The acquisition of affixes of the first three types was investigated in an exploratory study of L2 morphology[42], consisting of three experiments. The main purpose of this study was to serve as a pilot study on which further research could be built. After a brief outline of the method of investigation (4.2.2), the results will be represented of each of the three sub-tests of this pilot study, followed by a brief discussion of each of the sub-tests (4.2.3 to 4.2.5). Then the results of all three sub-tests will be reflected upon in a more elaborate global discussion of all the results (4.2.6), followed by a general conclusion of this study (4.2.7).

4.2.2 Method

From each of the categories above, three suffixes were selected (see Table 4) and presented to 34 Dutch secondary school pupils from two different levels of L2 acquisition (third form and fifth form of the "VWO", pre-university education), aged approximately 14 and 16 respectively (see details in 4.2.2.1). Three sub-tests were administered. Instructions and excerpts from all tests have been included in Appendix 1.

The first test was a two-part translation test in which learners were asked to provide English equivalents for morphologically complex Dutch words (e.g. doofheid -), and Dutch equivalents for morphologically complex English words (e.g. deafness -). To minimise effects of item-familiarity, the translation of the stem was given (e.g.: doof = deaf). 36 items were divided over the two tasks, eight representing category A, eleven for B, sixteen for C. Eleven morphologically complex decoys were added to the scoring forms, which consisted of transparent prefixed words and opaque suffixed words; these decoys were not included in the analysis.

The second test was a judgement task, in which learners had to decide whether the items in the test were valid English words. In the instructions, the subjects were told that the words in the list had to be marked "possible" or "not possible". Furthermore, it was emphasised that we were not after "existing" words, but after (morphologically) "possible" words. This was illustrated with some examples. This test consisted of 26 items; nine from category A, six from B and nine from C. Six decoys were added to the scoring forms, which were not included in the analyses. Half of

[42] Category D was not included in the experiment, because two problems for the analysis were anticipated. First, this category would have to depend on a very limited number of affixes. Second, the interpretation of the scores would be problematic, as it is not clear what should be regarded as a "correct" score.

the items consisted of “possible” words, the other half of “impossible” words. All “impossible” words were pseudo-words that were illegal due to the incorrect or awkward affixation. For instance, affixes were attached to stems belonging to syntactic categories or subcategories that were not in agreement with the subcategorisation restrictions of the affix type (e.g. *softity*). The words in Category C were subject to deceptive transparency based on the learners’ L1 (e.g. *learnsome*). To enable controlling for individual variation, a Dutch control test was included, in which learners had to decide on the possibility of a set of morphologically complex Dutch words and pseudo words. The Dutch sub-test was administered before the English sub-test.

The third test was an analysis test in which learners had to select the best possible meaning for a given pseudo-word in a multiple choice test (“frickless = looking like a frick/without frick/something that can be fricked”). Besides, the learners were asked to select a syntactic category of the each pseudo-word. This test contained four affixes from categories A to C. The focus of attention was rather obviously on the meaning, function and syntactic category of the affix types. One of the alternatives in the semantic multiple-choice answers related to all items was “not possible in English”. The syntactic categories the learner could choose from were Verb, Noun and Adjective. These word class labels were provided in Dutch. Similar to Experiment 2, this experiment consisted of an English sub-test and a Dutch sub-test to enable controlling for individual differences. The Dutch sub-test was administered before the English sub-test.

Instructions for all tests only concerned the way in which the forms had to be filled in and no additional information was provided about the actual issue of investigation. The order in which these test were presented ranged from little attention to morphological complexity in the translation test to abstract, very explicit questions about the morphological structure of words and the functions and meanings of morphemes in the final test (see discussion in 3.2.2).

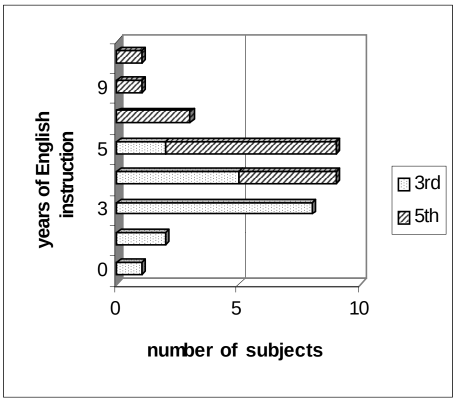
Table 4. Affixes selected for each category in the test.

CAT A		CAT B		CAT C	
Dutch	*English*	*Dutch*	*English*	*Dutch*	*English*
-er	-er	-baar	-able	-dom	-dom
-iteit	-ity	-heid	-ness	-ster	-ster
-loos	-less	-(acht)ig	-ish	-ful	-vol

4.2.2.1 Subject groups

The two subgroups in this experiment are assumed to represent different stages in the acquisition of L2 English. The learners from the fifth form can be expected to have reached a higher level of English proficiency than the learners from the third form, as they will have had more years of English instruction and have been exposed to English more. However, these learners do not only differ in level of L2 proficiency, but also in age. To determine the relative effect of these factors, a questionnaire was administered in which enquiries were made about the subjects’ age and years of English instruction. The subject groups differed significantly on age

(χ^2=28.9; *df*=5; p=0.00002) and on years of English Instruction (χ^2=18.8; *df*=7; p=0.009). The distribution of these variables over the groups is graphically represented in Figure 21. Interviews with the English teachers of these groups revealed that during classes hardly any attention had been paid to morphological generalisations.



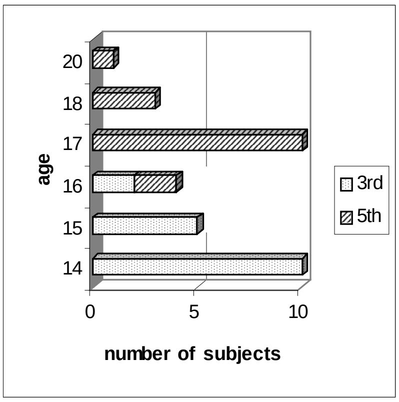


Figure 21. The distribution of two between-subject variables over the two subjects groups in these experiments.

An additional between-subject variable in these experiments was Exposure to English. This was determined by a set of questions about experience in English outside school, like English relatives, holidays in English speaking countries and the approximate exposure to English spoken media. The distribution of this variable across the subject groups is represented in Figure 22. The two subgroups did not differ significantly with regard to the exposure index (χ^2 =6.6, *df*=5; p=0.26).

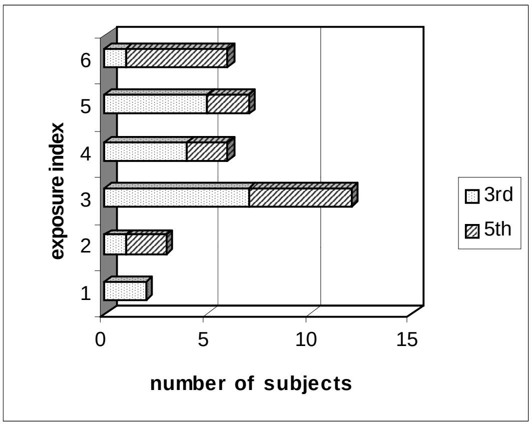


Figure 22. The distribution of the six levels of exposure index over the two subgroups.

4.2.3 Experiment 1

4.2.3.1 Introduction

The translation experiment was analysed on three variables: the differences between the two subject groups, the categories (A to C) and the direction of the translation (Dutch to English and English to Dutch). From an L2 perspective, the direction of translation can be seen as a production task and a comprehension task respectively, and are referred to as such in this section. In addition to these analyses, the interaction was investigated between the categories and the subgroups. A motivation for these analyses is given in the sections concerned.

The model outlined in the previous chapters would predict that the sequence of acquisition of morphological types is affected by the inherent transparency of the morphological types, the psychotransparency as perceived by the learner, productivity, frequency and simplicity. An increase of exposure to English implies a greater chance of being familiar with morphological types. The same will apply to a difference in years of instruction in English: the more instruction in English, the greater the chance of being familiar with morphological type, even though no explicit attention had been paid to morphological generalisations in instruction. Therefore, the general knowledge of morphological types can be expected to be more extensive for the learners in the fifth form. The age factor included in this experiment would imply a difference in L1 maturation, which can be expected to increase the possibility of transferring morphological generalisations (see 3.4.4).

In this experiment, the learner's native language will particularly play a role at the level of the psychotransparency of morphological types: the affix types that display a greater form-based similarity to a type in the learner's L1 can be expected to be more transparent. In terms of the model outlined in the previous chapter, form-based similarity will lead to co-activation at the level of lexemes (see 3.3.2), which yields a facilitating effect if it coincides with semantic overlap. Therefore, the affix types in Category A were expected to be acquired and applied more easily than the ones in Category B. The deceptively transparent types in Category C were expected to be most difficult to apply. Due to the form-based similarity combined with the lack of consistent translation equivalents for these types, the error rate in category C can be expected to be relatively high.

The difference between the two tasks in this test (comprehension vs. production) can be expected to yield a difference in scores. In the previous chapters (see 2.5.4 and 3.2.3.2), it has been argued that, for production, fully specified lexical entries are required, while comprehension can occur based on incomplete lexical entries. Applied to the current experiment, it can be expected that a learner is able to recognise a particular L2 word, but is not (yet) able to produce it due to under-specified lemma nodes. Therefore, the overall score for comprehension is expected to exceed the overall score for production.

An interaction may be expected between the amount of exposure to English and the interpretation and production of morphologically complex words, as comprehension can be expected to precede production. At higher levels of exposure, the difference between comprehension and production can be expected to be smaller than at lower levels of exposure. Furthermore, an interaction can be expected between the amount of exposure to English and the affix categories in this test, as facilitation due to L1 similarity will affect the order of acquisition of the affix types in the categories (A before B before C). Consequently, the difference between the categories will increase with increasing exposure.

4.2.3.2 Scoring

To all of the subjects' scores in Experiment 1 a response-code was assigned, comprising the following information:

- Correctness of the affix used, based on the Random House Webster's Unabridged Electronic Dictionary.
  Example: *fathership* (for Dutch "vaderschap") was regarded as incorrect; *fatherhood* as correct. Non-morphologically complex forms not regarded as "correct" responses, as they did not comply with the assignment.
- Correctness of the syntactic category of the affix type.
  Example: the syntactic category of *reachsome* for *bereikbaar* ("reachable") was considered correct; that of *reachment* was not.

For incorrect responses the following information was added:

- The origin of the error (L1 or L2).
  Example: *valueful* was considered as based on L1 (Dutch "waardevol"), *besiegance* (for *besiegement*) was considered as based on L2, as Dutch only has *omsingeling*.
- Meaning-based or form-based error.
  Example: *girly* for *meisjesachtig* ("girlish") was considered meaning-based as the affix bears no form-based similarity to -*achtig* or *ish*; *valueful* was considered to be form-based, due to its obvious orthographic and phonological similarity to the Dutch affix -*vol*.

4.2.3.3 Results

Two analyses were used to investigate the data scored as described above. Firstly, a MANOVA test was run to determine the relative effect of the variables involved on the percentage of correct scores. In this analysis, Category (A-C) and Task (Production-Comprehension) were used as within-subject factors. The mean scores for each group is represented graphically in Figure 23. Secondly, several χ^2 analyses were run to test the differences between the frequencies of correct, incorrect and blank scores for the different variables involved.

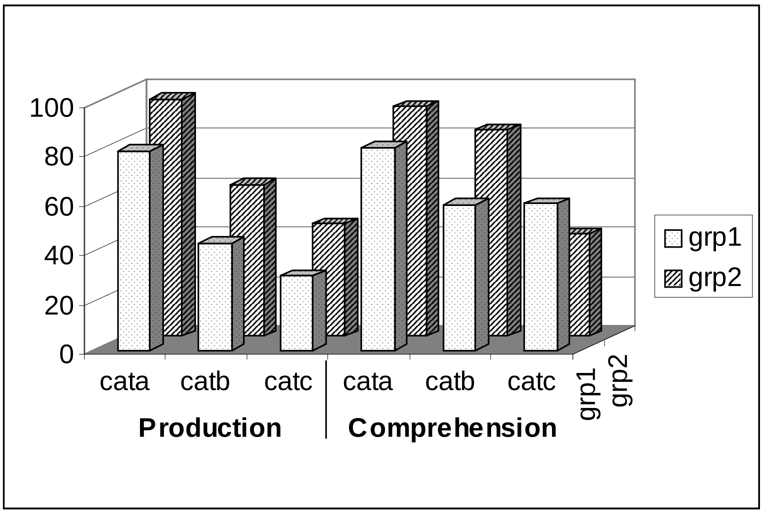


Figure 23. Representation of the mean percentage of correct scores in Experiment 1. The scores for each category are separately represented for the two tasks: production and comprehension.

4.2.3.3.1 Between-subject effects

The overall difference between the subject groups turned out to be significant at $p<0.01$ ($F[1,32] = 11.32$; $p=0.002$). Further analyses were applied including the number of years of instruction in English ($F[6,26]=1.98$; $p=.106$), and age ($F[5,27]=7.28$; $p=.011$). Finally, a design was run testing the exposure index (as defined by the factors mentioned above, which turned out not to be significant at $p<0.05$ ($F[3,30]=1.35$; $p=.277$). The difference between the subgroups in the type of answer (correct, incorrect and blank) is shown in Table 5. In this table, no additional subdivision was made for meaning-based and form-based errors; errors based on L1 were mostly form-based; errors based on L2 were mostly meaning-based. Answers that avoid the target word by description are clustered together under "non-morphologically complex" at the bottom of this table. The differences turned out to be significant at $p<0.01$ ($\chi^2=88.9$; $df=12$).

Table 5. Frequency table of the differences between groups. In parentheses is the percentage of all scores for each sub-group (column percentages).

	3rd form (n=629)	**5th form (n=576)**
Blanks	108(17.6)	16 (2.9)
Correct response	321(52.5)	389(69.5)
Incorr, correct syncat.	134(21.9)	126(22.5)
Of which L1 based	107(17.5)	101(18.0)
Of which L2 based	27 (4.4)	25 (4.5)
Incorr, incorr syncat	15 (2.5)	16 (2.9)
Of which L1 based	7 (1.1)	4 (0.7)
Of which L2 based	4 (0.7)	8 (1.4)
Of which ambiguous	3 (0.5)	3 (0.5)
Non-morph complex	34 (5.6)	13 (2.3)

4.2.3.3.2 Categories

The main issue of investigation in this pilot was the difference between the affix categories (see 4.2.1) A to C as within-subjects factor. The difference between the categories (see Figure 23) was significant at $p<0.01$ ($F[2,64]=114.67$; $p=0.000$). The differences between the subgroups in terms of correct, blank and incorrect scores, summarised in Figure 24, Figure 25 and Figure 26, were found to be significant in all categories (χ^2 = 9.6, 28.7 and 41.4 for Category A, B and C respectively; $p<0.01$ in all cases).

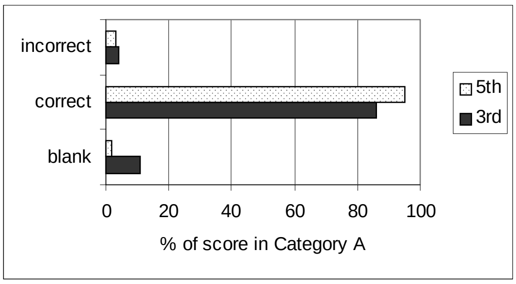


Figure 24. Percentage of incorrect, correct and blank scores in Category A across tasks.

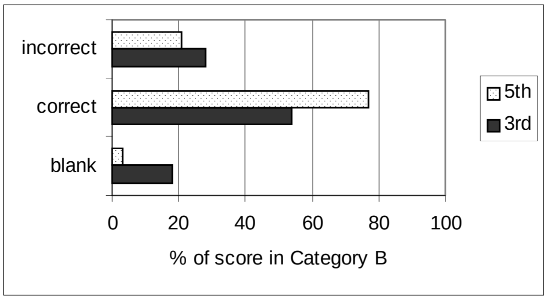


Figure 25. Percentage of incorrect, correct and blank scores in category B across tasks.

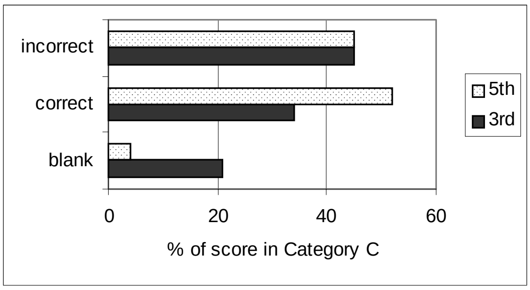


Figure 26. Percentage of incorrect, correct and blank scores in category C across tasks.

4.2.3.3.3 Task (production/comprehension)

The difference between production and comprehension was analysed to investigate a possible asymmetry between these tasks. The overall difference between the sub-tests, as shown in Figure 23, turned out to be significant at $p<0.01$ ($F[1,32]=12.41$; $p=0.001$). The difference between the subgroups in terms of blank, incorrect and correct scores was significant in both tasks $\chi^2 = 39.1$ and 40.6 for production and comprehension respectively; $p<0.01$ in both cases. These data are represented in Figure 27 and Figure 28.

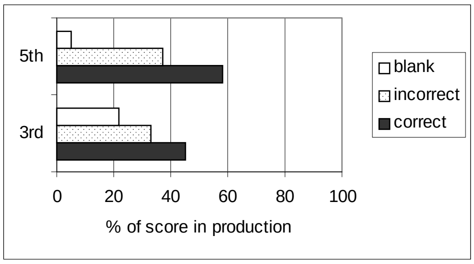


Figure 27. Percentage of blank, incorrect and correct scores in production task across categories.

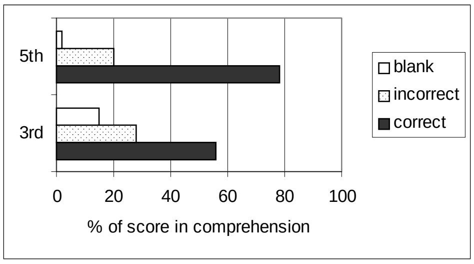


Figure 28. Percentage of blank, incorrect and correct scores in comprehension task across categories.

4.2.3.3.4 Interactions

A significant interaction was found for Task x Category (F[2,64]=4.94; p=0.01), where the difference between scores on production and comprehension was largest in Category C. No significant interactions were found for any of the between-subject variables included in this experiment.

4.2.3.4 Discussion

The difference between the two subject groups, representing different levels of L2 acquisition, turned out to be significant. An interesting question, however, is what determines the difference between these two naturally occurring groups. An explanation might be found in some of the between-subject factors included in the design. Since the subgroups differed significantly in terms of age and years of English instruction (see 4.2.2.1), the explanation was to be found in a difference regarding these variables. The factor age turned out to be significant; older learners obtained higher scores. Since the amount of formal instruction in English did not turn out to be a significant factor, another age-related factor must be involved. This seems to imply that command of L1 morphology is a more important factor in the acquisition and use of L2 morphological types than either instruction in the foreign language or exposure to the foreign language. In the χ^2 analysis, the largest differences observed between subjects were a generally larger number of correct responses at the higher levels of acquisition and the larger number of blanks at the lower level of acquisition. Furthermore, the subjects from the third form used more descriptions than did the subjects from the fifth form. These observations can be explained in terms of the development of morphological knowledge in L1; learners with a greater command of L1 morphology have acquired more morphological types and analyse and more often produce morphologically complex words type-familiarly. Learners at the lower level use different strategies to make up for their lack of type-familiar knowledge: they leave out the item altogether (blanks) or they provide descriptions ("non-morphologically complex"). Surprisingly, exposure to English, operationalised as the Exposure Index, did not turn out to be an accurate predictor of L2 morphological performance.

The difference between the categories turned out to be very clear. There were hardly any incorrect responses in category A (about two per cent), there were significantly more errors in category B, while category C showed the largest number of incorrect responses. The fact that the largest number of blank scores was observed for the affix types in Category C confirms the idea that learners experience the types in this category as the most difficult. These observations are in line with the expectations mentioned in section 4.2.3.1.

Contrary to what had been expected, the interaction between the exposure and the percentage correct scores between the categories and between the tasks was not significant. Apparently, the difference in exposure to English between these subgroups was not sufficiently large for this effect to show.

The fact that the total number of correct responses for comprehension was larger than the number of correct responses for the production sub-test confirms the expectations on this variable. More interesting, however, is to look at the difference between the subgroups at this variable. If comprehension preceded production, and if the acquisition of the morphological types concerned were acquired in the time span investigated in this experiment (between the third and the fifth form), an interaction between the tasks could have been expected. In that case, there should be little difference between the subgroups with regard to comprehension and a larger difference with regard to production. The data presented above, however, reveal that this interaction was not found (see, e.g., Figure 23). Apparently, the distance in level of acquisition between these subgroups is not big enough to show the difference. An alternative explanation for the lack of interaction might be that the difference is lost in a stronger facilitating effect of the comprehension task. Yet, no conclusive answer can be given to this question.

4.2.4 Experiment 2

4.2.4.1 Introduction

The scores in Experiment 2 were encoded for correctness. This experiment consisted of a Dutch part and an English part. The Dutch part was included to investigate the ability of the individual subjects to interpret morphologically complex words in their mother tongue type-familiarly. As the affix categories were based on the expected difference in psychotransparency due to L1/L2 similarity, no categories could be distinguished in the L1 test. In the English part, the categories as described in Table 4 were distinguished. Analyses were carried out to determine the effect of the sub-groups in the two sub-tests. Further factors entered in the analysis were the categories of affix types (A to C), the interaction of the between-subject variables (exposure index, age, years of instruction in English and group) and the categories, and the interaction between the Dutch and the English sub-tests. Similar to Experiment 1, it was to be expected that the scores would differ between the two subgroups in this experiment. For the same reasons as mentioned in the description of Experiment 1, the largest proportion of correct answers in the English sub-test were expected to occur in Category A, followed by B, followed by C. Furthermore, within the categories the largest difference between the subgroups was to be expected within categories B and C, as the developmental aspect is most obvious for these categories. Finally, it was expected that the subjects would score better on the Dutch sub-test than on the English sub-test, as all subjects will have fully acquired most of the morphological types in this experiment in their native language, but not necessarily in their L2.

4.2.4.2 Results

An overview of the results is represented graphically in Figure 29.

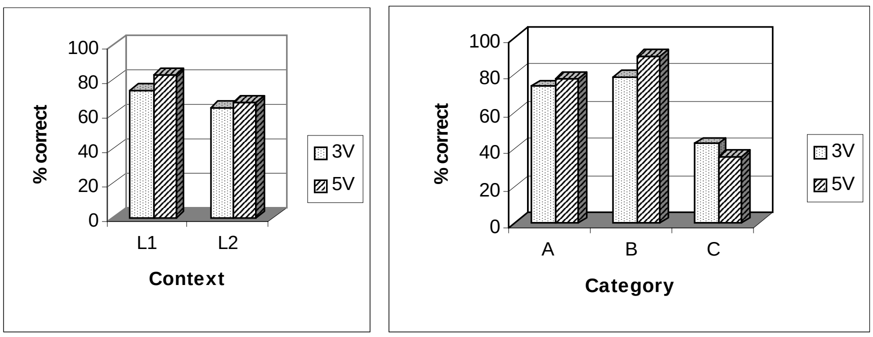


Figure 29 Graphic representation of the mean percentage of correct scores in Experiment 2. The figure on the left-hand side indicates the difference between the subjects' scores in the two sub-tests. The figure on the right-hand side represents the difference between the three categories distinguished in the L2 context.

4.2.4.2.1 Between-subject effects

The difference between the two subgroups turned out not to be significant, neither between the sub-tests (F[1,31]=3.43; p=0.073) nor between the categories (F[1,231]=0.68; p=.42). Of the other between-subject factors, neither the exposure index nor the age was found significant in this experiment. However, a significant effect was found for the years of English instruction between L1 and L2 (F[6,25]=3.12; p=0.020.

4.2.4.2.2 Categories

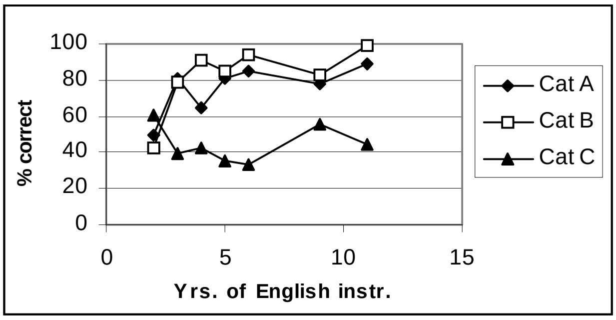


Figure 30. Percentage of correct scores as a function of the years of instruction in English.

The difference between the categories (in the English sub-test) turned out to be significant (F[2,62]=52.93; p<0.001). Moreover, a significant interaction was found for years of English instruction and Category (F[12,50]=2.14; p=0.031), where the effect of years of instruction in English was strongest for the items in Category B, followed by A and C respectively (see Figure 30).

4.2.4.2.3 Dutch and English sub-test

The difference between the English and the Dutch sub-test turned out to be significant (F[1,31]=46.77; p<001). The correlation between the subjects' scores on the L1 part of the test and the L2 part of the test was significant at p<0.01 (r_{xy}=.48).

4.2.4.3 *Discussion*

No overall effect was found for the sub-groups within the English sub-test, nor between the two sub-tests. However, the years of English instruction was a significant factor in the MANOVA involving the scores on the two sub-tests. In itself, this makes sense, as it can be expected that the amount of instruction has an effect on L2 morphological performance. But the fact that no interaction was found between the English and the Dutch sub-test on the one hand and years of instruction on the other implies that performance on Dutch morphology also increases with years of instruction of English. This effect cannot be attributed to a difference in age or exposure to English. From this it may be tentatively concluded that learning a second language affects the skill to apply word formation types in L1, possibly due to raised awareness leading to an increased psychotransparency of L1 words[43].

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[43] The influence of L2 learning on L1 awareness has been suggested earlier by, for instance, Vygotsky, who cites Goethe in: "he who knows no foreign language does not truly know his own." (1962:110)

The findings about the difference between the categories were roughly in line with what had been expected: most errors were encountered in Category C, while significantly fewer errors were found in Categories A and B. In this experiment, however, the difference between A and B was minimal. This suggests that the form-based similarity between L1 affix type and the L2 affix type is not relevant in this type of experiment. The interaction between the years of English instruction and the percentage of correct scores on the different categories points out that the development of L2 morphology predominantly takes place for category B and (to a lesser extent) category A rather than category C. This observation is in agreement with the expectations formulated in 4.2.4.1.

Finally, some observations were made about the subjects' performance in English and Dutch morphology. Both subject groups scored better at the Dutch sub-test, which confirms the expectations. Obviously, learners are better at applying morphological types in their L1 than in the L2. The fact that a significant and relatively strong positive correlation was found between the subjects' scores in both tests, indicates that individual differences in the application of morphological types did play a role in this experiment.

4.2.5 Experiment 3

4.2.5.1 Introduction

The variables included in the morphological assessment experiment were, again, the categories of affix types, the Dutch and the English sub-test and the between-subject variables group, age, years of instruction in English and exposure. An additional dependent variable that had been explicitly included in this experiment is the score on syntactic categories.

More than the other experiments, this experiment investigates the learners' metalinguistic awareness of morphology and their ability to reflect on this rather than actual "linguistic" knowledge (see the instructions and the excerpts in Appendix 1). Due to the high level of abstractness of this experiment, it was expected that the difference between the two subject groups would be larger than in the other experiments discussed so far. After all, the subject groups do not only represent the level of L2 learning, but also a difference in age. For the native language, it has been argued in Chapter 3 that "knowledge precedes awareness" (see 3.2.2.2). Therefore, older learners are more likely to have acquired morphological awareness (in L2 and in L1).

The difference between the categories was expected to be similar to the outcome in the previous experiments. The largest proportion of correct scores were expected to occur in Category A, followed by B and C respectively. Between the subgroups, the least difference was expected to occur in category A, as words in this category would be equally transparent for both subgroups.

Differences were expected between the Dutch and the English sub-test, as learners are more likely to have acquired all conceptual implications of the morphological types in their native language than in a foreign language. However, a complicating factor is that this experiment concerns metalinguistic awareness. Learners may have acquired morphological awareness through internal analysis, but also through formal instruction. As the learners in this experiment had not been given specific training in the analysis and production of morphologically complex words in English, this could not be seen as an advantage over the discovery of Dutch morphological types. The amount of instruction being equal, the learners in this experiment can be expected to have a greater morphological awareness in their native language than in English.

Finally, differences could be expected between the scores on the semantic and the syntactic parts of this experiment. The attribution of syntactic categories to morphologically complex pseudo-words not only requires metalinguistic awareness of the morphological type concerned, but also of the linguistic terminology and the application of that terminology. Therefore, the proportion of correct scores on the syntactic categories can be expected to be generally lower than the number of correct semantic interpretations of the words in the experiment. Moreover, the learners from the fifth form can be expected to be more familiar with the terminology than the learners from the third form, as they will have received more instruction in syntax. In addition, the learners in the fifth form can be expected to be more able to deal with the high level of abstractness for the syntactic part of the experiment.

4.2.5.2 Results

A graphic representation of the mean percentage of correct scores is represented in Figure 31 (semantic scores) and Figure 32 (scores on syntactic categories).

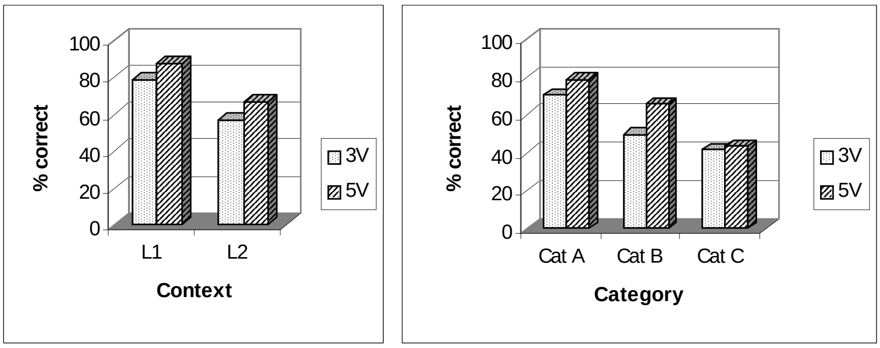


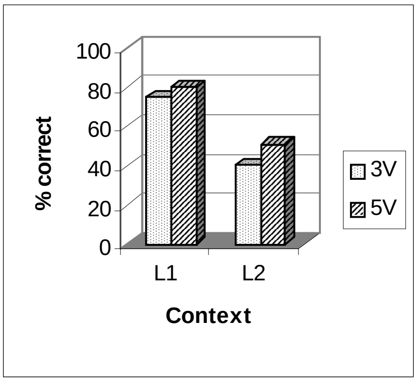
Figure 31. Percentage correct scores on the questions about the meaning of the affixes in pseudo-words for both subgroups with regard to the different sub-tests (on the left-hand side) and the affix categories in the L2 context (on the right-hand side).

4.2.5.2.1 Subject groups

The overall difference between the subgroups was not significant, neither in the test involving the language context ($F[1,32]=3.1$; $p=0.088$), nor in the test involving differences between the affix categories ($F[1,32]=2.1$; $p=0.157$). None of the between-subject variables included in this experiment turned out to be significant at $p<0.05$.

4.2.5.2.2 Categories

The differences between the categories turned out to be significant (F[2,64]=49.08; p<0.001).



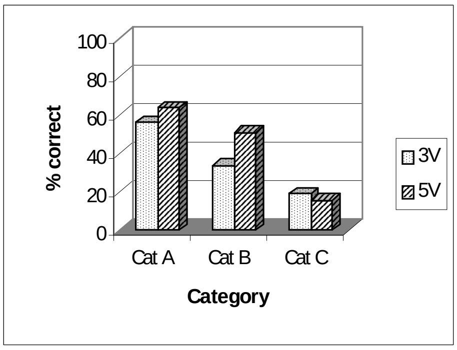


Figure 32. Percentage correct scores on the questions about the syntactic category of the affixes in pseudo-words for both subgroups with regard to the different sub-tests (on the left-hand side) and the affix categories in the L2 context (on the right-hand side).

4.2.5.2.3 Dutch and English sub-test

The scores on the Dutch sub-test were significantly higher than the scores on the English sub-test (F[1,32]=84.19; p<0.001). Furthermore, a significant correlation was found between a subject's score in the L1 test and the L2 test for both the semantic (r_{xy}=.64) and the syntactic (r_{xy}=.34) part of the test.

4.2.5.2.4 Syntax and meaning

The additional variable that had explicitly been included in this experiment was the subjects' score on the attribution of the syntactic category of the pseudo-words. Table 6 reflects the co-occurrence of correct, incorrect and blank scores on these variables. This table shows that a larger proportion of correct scores was found for the semantic characteristics than for the syntactic characteristics of the pseudo-words. This difference was significant at p<0.01 (χ^2 =404.2; *df* = 4). In both MANOVAs run for the analysis of this experiment (one involving language context and one involving the difference between the affix categories), the difference between scores on syntax and on the meaning of the affix types turned out to be significant (F[1,32]=14.35; p=0.001 and F[1,32=28.32; p<0.001 respectively). Furthermore, the correlation between the scores on the syntactic category and the scores on affix meaning was significant at p<0.05 in both the English (r_{xy}=.40) and the Dutch sub-test (r_{xy}=.53).

Table 6. Co-occurrence of scores on the semantic and syntactic section of Experiment 3. The figures in this table represent actual frequencies, not percentages.

		Score syntax		
		Blank	**Correct**	**incorrect**
Score sem	**Blank**	17	8	25
	Correct		477	213
	Incorrect		97	149

4.2.5.2.5 Interactions

A significant interaction was found between the semantic-syntactic variable and the language context (F[1,32]=7.85; p=0.009. The difference between the syntactic and semantic score was larger in the L2 context than in the L1 context (see Figure 33). None of the other interactions were found significant at $p<0.05$.

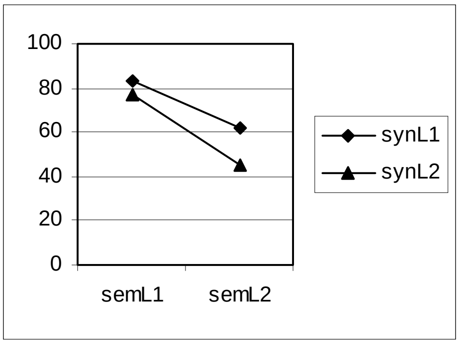


Figure 33. The interaction between the syntactic/ semantic score and language context in Experiment 3.

4.2.5.3 Discussion

Contrary to what had been expected, the difference between the two subgroups was not significant in this experiment. This was not so much due to a small difference in means between the groups (which is obvious from the figures above), as to the high standard deviations associated with these means. For instance, the mean for the semantic score on Category B in group 3V was 50.1 (see Figure 31) with SD=22.2. Apparently, these figures are strongly affected by individual differences. This, together with the significant correlation between the subjects' scores on the L1 test and the L2 test, seems to indicate that the scores in this experiment are affected by individual differences related to the skill to use morphological types. These differences could not be attributed to age and stage of L2 learning, since these two factors did not significantly affect the scores.

A significant effect was found in this experiment for the categories of the affixes. The largest percentage of correct scores (for the semantic part of the experiment) was found in Category A, followed by B and C respectively. This is perfectly in line with what had been expected. Furthermore, a major proportion of the "semantic" scores in Category C was left unanswered (50% blanks). A difference with the other two experiments is that the percentage of blanks occurred for both sub-groups (53 per cent for the third form learners; 47 per cent for the fifth form learners). Closer inspection of the data revealed that the number of blanks in Category C can largely be attributed to one pseudo-word, *lenksome*, which was massively skipped (97 per cent blanks).

Similar to the previous experiments, the difference between the categories emerged in this experiment, both for the scores on the syntactic categories of the affixes and for the score on the meaning of affix types. Clearly, Dutch learners find it most difficult to interpret morphologically complex L2 pseudo-words based on affix types that do not have a consistent translation equivalent in their L1 (Category C). Moreover, learners make the fewest errors with regard to types that are similar in L1 and L2 in terms of form and in terms of meaning (Category A). The expected interaction of the affix category and the between-subject variables did not occur: the expectation that the largest between-subject difference would occur at Category B scores could not be confirmed.

The differences found between the Dutch and the English sub-test are not very surprising. Obviously, learners are more able to interpret and produce morphologically complex words type-familiarly in their native language than in their second language, due to more fully developed semantic representations of their L1 types. This finding is in line with the expectations expressed in section 4.2.5 above.

The difference between the scores on the syntactic part and the semantic part evidently makes clear that learners from both subgroups have more problems referring to the correct syntactic category of a pseudo-word than referring to the meaning of that word. This, again, is in line with what had been expected. The interaction found between the syntactic and the semantic scores on the one hand and the language context on the other makes clear that this difference is largest in the L2 context. Apparently, learners find it more difficult to reflect on the syntactic category of pseudo-words in the L2 than in the L1. This difficulty is strongest for the affix types in Category C. Again, this is in line with what had been expected.

4.2.6 General discussion

This section summarises the findings for the main variables across the experiments, the subgroups, the categories and the sub-tests, and attempts to account for these findings in terms of the model proposed in the previous chapter.

4.2.6.1 Between-subject variables

An important issue in the model presented in this book is the role of type-form relations as a function of transparency in the development of L2 morphology. In this cross-sectional study, the difference between the subject groups represents the development of morphological acquisition over time. Extra between-subject variables included were the learners' age, the years of formal instruction in English and the amount of exposure to English.

Only in the translation experiment was the overall difference between the subjects found to be significant. This difference, it appeared, was particularly due to a difference in age. This finding was surprising, as the largest between-group difference was expected to occur in more abstract tasks (like in Experiment 3). An explanation for this finding could be that the two subgroups were not very far apart in terms of L2 development. Larger differences may have been found if the distance between subgroups had been larger. A closer inspection of the data, however, does reveal some relevant differences between the subgroups in the other subgroups as well. Firstly, there were significantly more blanks in the scores of the less advanced learners, which indicates that more advanced are more tended to create new words on the basis of morphological types when they are not familiar with a certain type; they have developed the idea of productivity. Secondly, in the comprehension test (the lexical decision task, Experiment 2), there were significantly fewer L1-induced errors in the fifth form than in the third form. Apparently, third-form students more often fail to recognise the morphological type based on the form provided, and more often tend to interpret L2 forms in terms of similar L1 types.

Surprisingly, the effect of the between-subject variables included varied between the experiments. The age factor was only significant in Experiment 1, while the effect of years of formal instruction was only significant in Experiment 2. It had been expected that these factors (and the Exposure Index) would affect the percentage of correct scores in all tests. An explanation for this difference is not obvious; it may either be due to the difference in tasks between the experiments, or to the relatively small samples. Since the individual differences between the subjects appeared to play a major role in these experiments, the latter possibility is most likely.

4.2.6.2 Categories

In all experiments, the largest proportion of correct responses was found in category A, followed by B and C respectively. This clearly indicates that both form-based and meaning-based similarity of L1 and L2 affix types play an important role in the production and comprehension of morphologically complex words in the second language. The more the forms (at the level of lexemes) and the meanings overlap, the more likely learners are to match type and form. This finding is confirmed by the interaction between years of instruction and Category, found in Experiment 2. Development of L2 morphology in terms of the acquisition of morphological types only occurs in Categories A and B, as the types in Category C are not sufficiently consistent between L1 and L2 to allow the acquisition of type-familiarity. Since this effect did not occur in the other experiments, the validity of this observation has to be determined in further research.

Looking at the type of errors made (distinguished in Experiment 1), the data show that very few errors were made in the syntactic category of the affixes in both comprehension and production. This confirms the idea that the types are mostly recognised, but that the real problem lies in matching the English type to the appropriate conceptual representations. Another interesting finding is that most L1-induced errors were found within category C. This makes perfect sense, since interference is most likely to occur in the category where the least consistent and sometimes even confusing relations between form, type and concepts are found.

4.2.6.3 Sub-tests

It is not very surprising that the subjects did generally better in the comprehension than in the production test in Experiment 1. This difference, which can be seen as similar to what Kroll (1993) labelled "translation asymmetry", can simply be accounted for by assuming that learners will have more fully developed semantic forms of their L1 lemmas than of their L2 lemmas. The fact that this effect was not found for the Category A words can be explained by the form-based and semantic similarity of L2 and L1 types in this category that facilitates acquisition and use of these types, leading to more fully developed semantic forms

The overall difference between the number of correct scores in the English and Dutch sub-tests (in Experiments 2 and 3) was evident and was not surprising: subjects can be expected to score better in their native language, as the amount of exposure to the native language is many times larger than the exposure to the second language, leading to more fully developed semantic forms of the morphological types. However, a relatively strong correlation was found between the subjects' scores in the Dutch and the English test. This seems to indicate that it is not only the knowledge of L2 morphology that plays a role, but also the ability to apply type-familiarity in general: subjects that scored well in the Dutch test also scored well in the English test (in Experiment 3, for instance, r_{xy}=0.71). Apparently, the use of language-independent cognitive strategies is an important variable in Experiments testing the performance of L2 morphology.

An interesting effect found in Experiment 2 was that L2 instruction seems to affect L1 performance on the application of morphological types. It may well be that the study of a second language leads to an increased awareness of morphological complexity, regardless of particular affix types and even regardless of the language in which these types occur. In the model outlined in the previous chapter, interlingual co-activation is indeed expected to be bi-directional.

4.2.6.4 Syntax and meaning

In Experiment 1, 50-70 per cent of all scores were correct, implying that the subjects provided the morphologically complex target word intended. 90 per cent of all incorrect scores were morphologically complex words to which an affix had been attached of the same syntactic category as the target word. This implies that for 97 per cent of all answers provided in this experiment the correct syntactic category had been activated. Differences between the subgroups were marginal in this respect. Apparently, the subjects experience no great difficulty in determining and selecting a morphological type with the appropriate syntactic category. The difficulty is obviously to select the particular affix type that matches the set of conceptual representations specifying the meaning intended.

Experiment 3, which includes scores of the syntactic category, provides a different picture. In this experiment, the scores on the syntactic category are significantly lower than the scores on the semantic category. However, the syntactic scores in Experiment 1 can hardly be compared to those in Experiment 3, as the latter refers to the ability to reflect on the syntactic category of morphologically complex (pseudo) words, which is a different task altogether. Similar to the semantic scores, the category in which the largest proportion of errors occurred was Category C. This, however, cannot be adequately explained in terms of deceptive transparency and similarity to L1 affixes: all of the deceptively equivalent L2 affixes included in this experiment (*-dom*, *ster* -and *-ful*) are of the same syntactic category as their L1 "equivalents". Apparently, a factor that had not been included in this experiment, the subjects' familiarity with the affix types, played a role in this experiment.

4.2.7 Conclusion

The overall picture provided by this exploratory study is that the use of morphological types is clearly affected by the learner's native language. It has been determined that the largest proportion of correct scores can be found for L2 affix types that show most overlap with L1 affix types in meaning, syntactic category and orthographic form. Moreover, even if affix types are dissimilar in terms of form (as in Category B), the overlap of conceptual representations facilitates the use of type-familiarity in production and comprehension tasks. This is further supported by the observation that very few errors were made in the syntactic category of the items in the experiments: morphological types are selected that do have the correct syntactic properties, but problems may occur in determining the semantic specification of the types. L2 forms that can be considered deceptively transparent from an L1 point of view (i.e. in terms of psychotransparency) yielded the largest proportion of incorrect scores. Clearly, psychotransparency is an important condition for the establishment of lexical entries for affix types in the bilingual mental lexicon.

With regard to the development of L2 morphological acquisition, no definite conclusions can be drawn based on this study. There is some evidence that the skill to use morphological types is more strongly dependent on L1 experience and formal instruction than on the exposure to the target language. In addition, the more advanced learners show a greater confidence in the use of morphological types, which makes perfect sense: the more L2 forms have been matched with their types, the more risk the learner is willing to take in guessing/producing new forms. However, these findings did not consistently appear in all experiments. In these experiments, no evidence was found for a developmental distance between comprehension and production. Although generally a larger proportion of correct scores was found in the comprehension task, no effect of any of the between-subjects variables was found on the difference between comprehension and production. It should be noted that this cross-linguistic study only included two subgroups, which were not very wide apart in the developmental process.

In sum, the findings of this exploratory study support the assumption that the use and acquisition of L2 morphology is strongly dependent on the form-based and semantic similarity to L1 morphological types. However, a few remarks are in place to put these experiments into perspective. First, the number of affixes in each category was variable and generally rather limited. In addition, the division of affixes in categories is rather imprecise. Especially Category C represents two distinct sorts of difficulty: L2 affix types that do have a consistent translation equivalent L1, but that are confusing due to cross-linguistic homonymy (like *-ster* / *-ster*), and type-form relations that sometimes lead to correct assumptions about transparency, but are often misleading (low degree of translation equivalence). An example of the latter is the English affix type *–ful*: this affix type had been attributed to Category C, as *–ful* is not always translated by the phonologically similar Dutch form *–vol* and therefore considered "deceptively transparent" (English *painful*, for instance should be translated by Dutch *pijn**lijk*** and not *pijn**vol***). Sometimes, however, the affix types in this category do appear with similar forms in L1 and L2 (English *respectful* can be translated by Dutch *respectvol*). The division into categories does not separately take into account the degree of translation equivalence of the various affix types in Dutch and English. Second, the number of subjects per group was small, and the stages of development represented by the subgroups were not very far apart. Third, the experiments reported here did not take into account some other relevant variables, like productivity and frequency. Consequently, the conclusions drawn here can only be tentative and further research is needed to confirm these findings.

Further studies were devised to investigate the factors that determine the (psycho-) transparency of L2 morphological types. These studies concentrate on the effect of different degrees of translation equivalence consistency in combination with different degrees of productivity. Two methods of investigation were used: a psycholinguistic priming experiment (involving reaction time measurement), reported in 4.3, followed by a written production task of morphologically complex words in L2, reported in 4.4.

4.3 Testing the links between L1 and L2

4.3.1 Introduction

In the previous chapter it has been argued that morphological surface forms are realisations of lexemes, which represent more abstract lemmas consisting of a lemma node that is linked to entities containing semantic (including pragmatic) information, syntactic information and information associating the lemma with a particular language. Based on this assumption, it can be postulated that lexical entries of L2 morphological types share syntactic and semantic information with their equivalent L1 types to the extent that the L1 and the L2 entries overlap in semantic and syntactic characteristics. Furthermore, it has been argued that lexical processes in both production and comprehension are driven by activation spreading. Nodes with a high degree of activation will spread activation to adjacent nodes. In comprehension, activation spreading takes place from the lexeme to the conceptual representations and in the reverse direction (“activation feedback”). The ultimate consequence of this assumption would be that a high degree of activation of an L1 lemma node would spread activation to the L2 morphological form (through co-activation and activation feedback, see 3.6). This type of co-activation is the subject of the current experiment.

To investigate the occurrence of interlingual co-activation and activation feedback, a priming experiment was conducted[44] in which morphologically complex words in one language were primed by a transparent morphologically complex word in the other language. This situation is graphically represented in Figure 34. The representation in this figure is simplified in that the lemma nodes have been left out; only the overlap of the semantic forms is indicated. It was ensured that the L1 and L2 morphological types that were selected for this experiment overlapped in terms of conceptual representations, but did not overlap in terms of form (i.e. in terms of orthography and/or phonology).

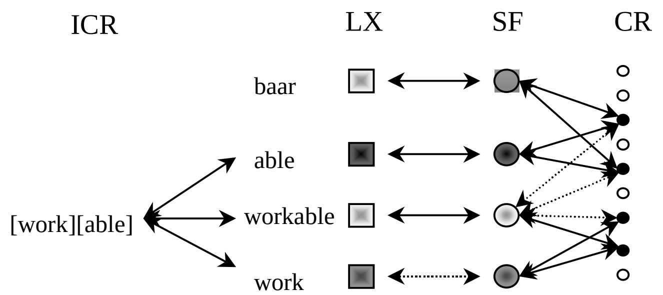


Figure 34 Co-activation of the English affix type -able *after priming of Dutch* -baar.

The experiment was set up in two stages: a pilot study and a follow up experiment. The major objective of the pilot study was to determine which morphological types would be most suitable to be included in this experiment. Secondly the pilot was carried out to determine some technical details, like the maximum response times, some details about the presentation of the target items and priming items and the maximum number of items that the subjects could be confronted with before they started to lose concentration. The pilot will not be reported on separately, but will be referred to in the relevant sections if necessary.

[44] For this experiment, I am greatly indebted to one of my students, Sible Andringa, who carried out the major part of the actual testing and was a great help in devising and analysing the experiment. Of course, any errors in the data presented here remain my own responsibility.

4.3.2 Method

4.3.2.1 Materials

In the pilot experiment, four conditions were used, representing Dutch and English morphological types with (1) similar forms, (2) similar meanings, (3) both similar forms and similar meanings, and (4) neither similar forms nor similar meanings. To avoid priming effects induced by orthographic or phonological similarity it was decided to restrict the affix types in the actual experiment to (3), viz. L1 and L2 morphological types that largely overlap in terms of their conceptual representations, but that bear no form-based similarity (cf. "Category 2" in 4.2.1).

For this category of L1/L2 affix pairs, four different item sets were compiled representing two conditions: a priming condition and a control condition. In the priming condition, a morphologically complex L2 target word was primed by a semantically related transparent L1 prime. For instance, the target word *brightness* would be primed by the L1 type -*heid*. In the control condition, the same target word would be primed by a non-affixed word that was not in any way related to the target item, neither semantically nor orthographically or phonologically. To avoid a practice effect, a split-group design was used. Each group was given half of the items from the control condition and half of the items from the experimental condition, thereby ascertaining that the same target word would be presented to the individual respondent only once. Two affix types were used in each condition: English -*able*, primed by Dutch -*baar*, and English -*ness* primed by Dutch -*heid*. Both affix types are productive in English and in Dutch, although -*ness* is more productive than -*able* (see 4.4.1). The degree of translation equivalence of both pairs turned out to be high, though the translation equivalence of -*baar*/-*able* (93%) is higher than -*heid*/-*ness* (52%; also see 4.4.1). Finally, it was ensured that the focus of attention was on the meaning and category of the affix type by avoiding additional semantic priming between the stems of the primes and the targets. For instance, the English word *thinkable* was primed by Dutch *regelbaar*, thereby focusing on the possible co-activation of the affix types (-*able* and -*baar*) and avoiding cross-linguistic semantic priming of the stems (*think* and *regel*).

The priming conditions and the control conditions for both pairs of affix types were divided over the two subgroups as represented in Table 7.

Table 7. Experimental conditions in the Priming experiment

Subgroup	Prime		Control	
A	-*able* target set 1	-*ness* target set 3	-*able* target set 2	-*ness* target set 4
B	-*able* target set 2	-*ness* target set 4	-*able* target set 1	-*ness* target set 3

4.3.2.2 Items and controls

Each target set consisted of ten items that were controlled for frequency; only low-frequency items were selected to avoid effects of item-familiar word recognition. A t-test was administered on the COBUILD frequency of all item sets to verify this. To control the number of syllables and word length between the experimental and control conditions, the same stem was used for corresponding pairs in the two conditions. For instance the prime-target pair *regelbaar – thinkable* (*-able*, target set 1) was given the corresponding control pair *regelneef – thinkable*. Some examples of the items and the controls are given in Figure 35. This figure also shows the division of the targets over the groups and the item sets. The full target sets have been included in Appendix 2.

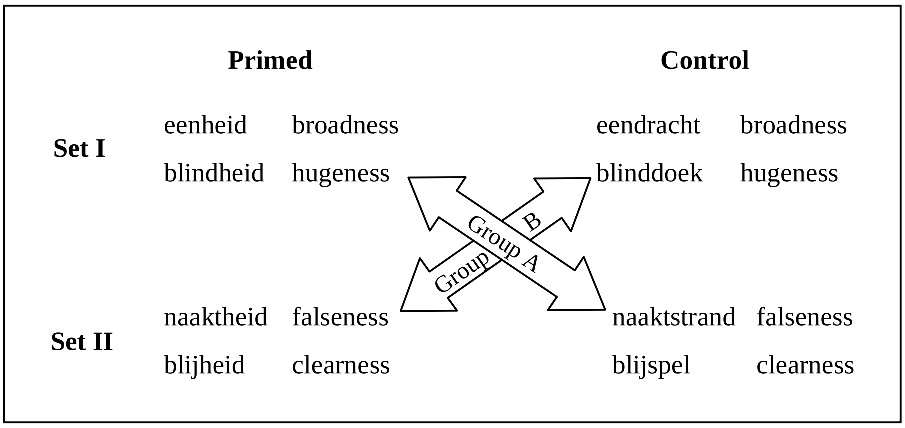


Figure 35. An overview of the design: some examples of items representing the primed condition and the control condition for the -ness *affix types in this experiment.*

4.3.2.3 Fillers

The total number of items in each subgroup was 240, including the practise items. The total number of words was the same as the number of pseudo-words in each group (120). The four conditions were represented by 40 items; 200 fillers were added to each test. 40 fillers were added that were pseudo-words representing the same affix types as included in the conditions. Half of the remaining 160 fillers (80 words and 80 pseudo-words) were morphologically complex, the other half was monomorphemic. All items, however, were polysyllabic.

4.3.2.4 Subjects

The subjects were advanced learners of English in their last phase of their study of English, 43 from the University of Groningen and 17 from the University of Amsterdam. The high level of L2 learning was chosen to ensure that all subjects had acquired the morphological types used in this test. The subjects were randomly assigned to one of the subgroups. None of the students participating was involved in any way in this experiment or any of the previous experiments, and they were not informed about the objective of the experiment. To encourage students to participate in the experiment, four book tokens for 25 guilders each were made available for a lottery in which all subjects participated.

Three subjects had to be excluded due to very slow response rates (>2000 ms) or extremely high error rates (50 per cent in one of the conditions).

4.3.2.5 Procedure
The item files for both groups were scrambled using the "block size" parameter of Dmastr Display System[45]. This resulted in blocks (size 10) containing an equal number of items from all conditions. The program then randomly ordered the items within each block and then finally randomly ordered the blocks themselves. This procedure guarantees an even distribution of conditions across the experiment: in this way it is impossible that most of the items in one condition occur in one half of the experiment and most items of another condition in the other half.

The experiments were conducted in quiet rooms at the University of Amsterdam and the University of Groningen. In both rooms the same computers were used (HP 386sx) with an SVGA colour screen. The subjects were randomly attributed to Group A or Group B. These groups were equally divided over the two computers that were used. The subjects received some instructions on the screen and orally by one of the experimenters. The experimenters were given specific instructions for this purpose (see Appendix 2). After going through a series of twenty trial items the experimenter asked the subject whether everything was clear. If this was not the case, the subject was given the same set of trial items again.

Before the prime was shown on the computer screen, a fixation point (asterisk) was placed at the centre of the screen during approximately 750ms[46] and subsequently replaced by the prime (750ms) and the target (750ms). To accomplish strong activation of the affix, the affix was previewed for 60ms before the start of the timer (SOA prime). The cut-off points were set to 300ms and 2000ms for the fastest and slowest reaction times. Subjects with an error rate larger than 50 per cent in one of the conditions were rejected.

The subject's preferred hand was always associated with the YES response button, the other hand with the NO response button. The experiment was self-paced; the subjects were not able to stop the program or to change the pace. No feedback concerning reaction times or correctness of responses was given during the experiment. After completion of the task (which took approximately twenty minutes), the resulting data file was saved for later analysis.

4.3.2.6 Analysis
A 3-way MANOVA was run, with the test condition (primed and control) and the affix type (*-ness* and *–able*) as within subject factors, and group (A and B) as a non-repeated factor. The effect of the item sets (I and II) could not be included in this

[45] The Dmastr Display System ("laboratory software for mental chronometry") v2.0 was used for all stages of the experiment, from compiling the item files to the statistical analysis. This software was made available by the University of Arizona, Tucson, Arizona. I am grateful to the writer of this software, Kenneth Forster, for his useful e-mail assistance to using this program.

[46] The timing in the Dmastr program is based on the refresh rate of the screen. The parameters in the program refer to ticks of the video clock. One clock tick resembles 16.67ms for the type of screen that was used in this experiment.

analysis, because the item sets I and II represent different items for each affix type. To test the possible effect of the item set, a separate ANOVA was run.

4.3.3 Results

The results of the MANOVA with the group as a non-repeated factor are represented in Table 8. A summary of reaction times per word and the matrices of all factors in the experiment have been included in Appendix 2. The overall analysis showed significant effects of the affix pairs and an interaction of group and condition. The main effect, primed vs. controlled condition, was not significant.

Table 8. MANOVA table of the priming experiment with Group as the non-repeated factor. The factors included are the condition (A), the affix (B) and the group (C).

SV	DF	F	P
C	1	3.43	0.0807
S	18		
A	1	0.44	0.517
AC	1	5.43	0.0316
S*A	18		
B	1	43.55	.340E-05
BC	1	0.01	0.916
S*B	18		
AB	1	0.30	0.591
ABC	1	1.39	0.253
S*AB	18		

Condition
The overall difference in scores of the priming condition and the control condition (Figure 36) turned out not to be significant at $p<0.05$.

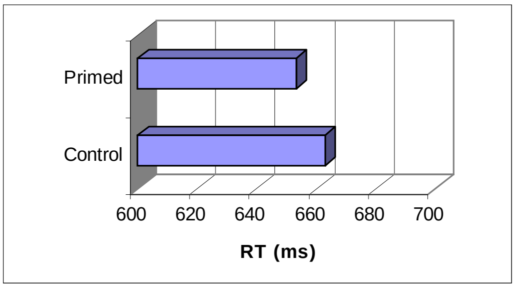


Figure 36. Overall differences between primed and control condition (not significant at p<0.05)

Affix

The overall difference between the reaction time on the *-able* words and the *-ness* words was significant at p<0.05. The reaction times on *-able* were faster than the reaction times on *-ness* (see Figure 37). However, this difference did not affect the priming effect, as the interaction between the condition and the affix type was not significant.

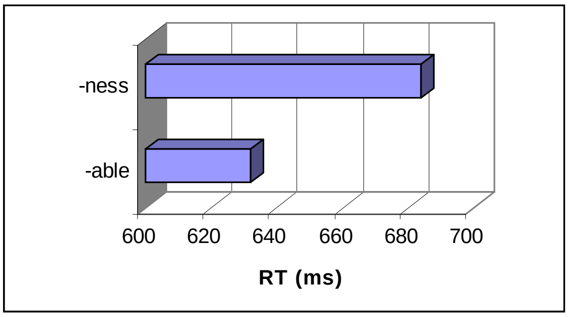


Figure 37. The overall difference in reaction times between the scores on -ness *and* -able*.*

Group

The overall effect of the group was not significant. However, the interaction between the group and the condition turned out to be significant (see Figure 38). Since each group had been given a different item set, further analyses were done on the differences between the groups and on the differences between the item sets. Of all subjects personal data had been recorded on their main specialisation within English (linguistics, literature or historical language and literature), their age (19-66; mean=24.1), the number of years of studying English at university (3-7; mean=3.9) and their sex. Firstly, none of these variables significantly affected the priming effect. Secondly, the two groups did not differ with regard to any of these variables (Levene test for homogeneity of variance yielded no significant results at p<0.05 for the subgroups for any of these variables). Finally, Q-Q plots revealed that both groups showed the normal distribution.

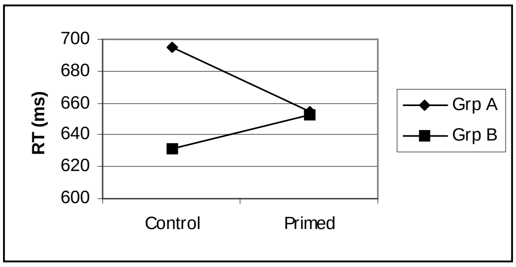


Figure 38. Interaction between the condition and the group (data set).

Item set

The item sets were numbered I to IV: I and II for the different item sets in the *-able* sub-test, and III and IV for the different item sets in the *-ness* sub-test. These sets were entered in an ANOVA with reaction times. The overall difference between the item sets was significant (F[3,79]=6.99; p=0.0003). A Scheffé post hoc analysis, however, revealed that the difference was due to a difference between the affix types: homogeneous subsets were found for Set I, II, III and III and IV. No differences were found between the item sets with regard to the string length of the prime, the string length of the target, the lemma frequency of the prime[47] and the lemma frequency of the target.

Error rates

For the error rates, the same pattern was found as for the reaction times. Again, no significant difference was found between the primed and the control condition (F[1,18]=0.51; p=0.486), as is apparent from Figure 39. The only significant main effect was found for the differences between the affixes *-able* and *-ness* (F[1,18]=17.08; p=0.001); most errors were found for the *-ness* words (see Figure 40). This time, no significant interaction was found with group (F[1,18]=0.166).

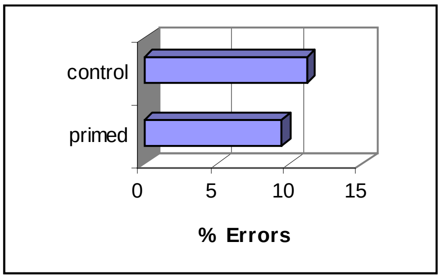


Figure 39. The overall difference in error rates between the primed and the control condition (not significant).

[47] For these data, the 36-mln-word INL corpus was used, available from Leiden University. The subcorpora selected for this purpose were “Varied” and “Newspaper” (25,189,682 tokens together), leaving out “Legal”.

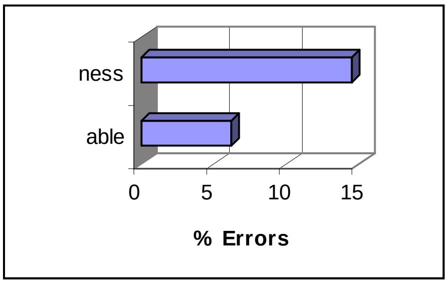


Figure 40. The different overall error rates for the -ness *words and the* -able *words (significant).*

4.3.4 Discussion

The main effect that had been expected, the difference between the primed condition and the control condition, did not occur in terms of reaction times, nor in terms of the percentage of incorrect responses. This implies that the occurrence of interlingual co-activation, postulated in the model, could not be demonstrated by this experiment. The reason why this effect did not show is a matter of speculation: perhaps the groups were not sufficiently large, the level of L2 proficiency of the subjects not high enough or the effect not strong enough to come out in a Lexical Decision Task. An external factor may have interfered (see below).

The difference found between the two affixes, both in terms of reaction times and in terms of errors had not been expected. It was particularly striking that the fastest reaction times and the fewest errors were found for *-able*, while the affix type *-ness* is much more productive than *-able*. Probably, this is related to the difference in an L1 effect (translation equivalence) that had not been included in this experiment (see section 4.4).

The most puzzling effect found, however, was the strong interaction between the item sets and the condition. In one group, the priming effect is rather strong (40ms), but in the group, a reversed effect (22ms) partly neutralises the eventual priming effect found. Clearly, some experimental flaw must have affected the experiment, and it seems of the utmost importance to determine the cause. Since each group had been given a different item set (to ensure each subject had to respond to each target item only once), there are two possible causes for this effect: a difference between the groups and a difference between the item sets. The analyses carried out to investigate possibly interfering effects clearly showed that the difference cannot be attributed to any of the between-subject effect that could be traced, like the subjects' age, sex, years of studying English or their main specialisation. Neither could any difference be found in terms of the length of the items or the frequencies of the primes or the targets between the group scores or between the item sets. Both the groups and the item sets appeared to be perfectly heterogeneous, and in regard to the way the subjects were randomly attributed to the groups, a between-group difference would indeed be very unlikely. To date, no satisfactory explanation of this awkward result has been found.

4.3.5 Conclusion

In this experiment, the hypothesised effect between the primed condition and the control condition was not confirmed. Since the hypothesised effect was expected to be rather small, an explanation for the non-occurrence of the effect might be found in the fact that interlingual activation feedback is too weak to be demonstrated in a lexical decision task like this. In further research, different methods of investigation should be attempted.

An effect that clearly showed was a difference in reaction time between the two affix types included: the responses to the *-able* words were considerably faster than the responses to the *-ness* words, while fewer errors were made in the responses to the *-able* words. The difference between these two affix types has been further investigated in another experiment (see 4.4).

A significant interaction was found between the two groups and the difference between the primed condition and the control condition. As yet, no satisfactory explanation has been found for this result. It might be worthwhile to conduct a replication study to further investigate the nature and cause of this phenomenon. In Chapter 5, some suggestions to this effect will be made.

4.4 Morphological translation equivalence as a factor affecting the acquisition of L2 morphology

The exploratory study described in 4.2 gave rise to some more detailed questions with regard to the acquisition of L2 morphological types. One of the most pertinent questions concerns the role of the perceived transparency (psychotransparency) of morphologically complex items in the L2 in conjunction with the productivity of L2 morphological types. What are the factors that contribute to the learner’s conception of the productivity of morphological types in L2? This is the issue of investigation in this section. Based on a typological comparison of the major morphological types in L1 and L2 (4.4.1), predictions will be made about the degree of translation equivalence of Dutch-English affix pairs, leading to differences with regard to difficulty of learning. These predictions do not assume that more different is necessarily more difficult, but are based on the chance that morphological type in L1 can be translated to a similar morphological type in L2, which is a reflection of the amount of conceptual overlap between these types (see 3.4.3). The second element of the typological comparison concerns L2 productivity. In section 4.4.2 the relative importance of L1-based translation equivalence and L2-based productivity is investigated in a production experiment involving Dutch learners of English from three different levels of L2 proficiency.

4.4.1 A typological comparison of Dutch and English suffixation

In Chapter 3 it has been argued that the consistency of the possibility to translate an L2 affix type by a particular L1 affix type, labelled "morphological translation equivalence", is an important predictor of the psychotransparency of morphologically complex words in L2 (see 3.4.3.3). Morphological translation equivalence is determined by the overlap of semantic and syntactic characteristics of an L1 type and an L2 type. Translation equivalence is not a binary construct, but a continuum: the more syntactic and semantic characteristics are shared by an L1 type and an L2 type, the higher the degree of translation equivalence will be. Since it is not possible to compute the amount of overlap of conceptual representations, translation equivalence is here defined as the chance that a particular morphological type in L1 can be successfully translated into an equivalent morphological type in L2. In this section, a corpus-based approach is described that was used to compute this notion of morphological translation equivalence.

The procedure that was used is very simple: from a representative corpus of English and Dutch random samples were taken of a fixed number of tokens for a range of morphological types. For each morphological type, the number of equivalent translations was counted. For example, consider the seemingly comparable morphological types for nominalisation, the Dutch affix *-heid* and the English affix *-ness*. To determine the extent to which *-ness* is an appropriate translation equivalent of *-heid*, the number of instances were counted where *-ness* could be used to form a morphologically complex English word with the same meaning or function as the Dutch *-heid* word. In the case of this example, it turned out 51 per cent of the Dutch words in *-heid* can be translated by an English word in *-ness*.

4.4.1.1 Corpora

For this typological comparison[48] the lexical databases were used from the Dutch Centre for Lexical Information in Nijmegen (CELEX). The English CELEX database (v. 2.5) is based on the Cobuild corpus, the result of the Cobuild Project of the University of Birmingham. In this corpus, spoken (25%) and written (75%) language has been recorded, from several categories: "broadly general, rather than technical, language; current usage, from 1960, and preferably very recent; naturally occurring" text, not drama; prose, including fiction and excluding poetry; adult language, 16 years or over; "standard English", no regional dialects; predominantly British English, with some American and other varieties" (Renouf, 1987: 2). The English CELEX database contains about 18,000,000 word forms, and provides information about phonology, morphology and frequency. The Dutch CELEX database (v. 3.1) contains 40,000,000 word forms and is based on the corpus from the "Institute for Dutch Lexicography" (INL). Both databases were accessed through an on-line UNIX Telnet connection with CELEX at the Max Planck Institute in Nijme-

[48] For this work I am greatly indebted to one of my students, Esther Bakker, who carried out large parts of this investigation, reported in her MA thesis (see bibliography). Of course, I take full responsibility for the data reported here.

gen. The standard FLEX interface was used to extract data from the database. There are several advantages of using the CELEX lexical database compared to other media. The database reflects current language use and provides frequencies for both spoken and written language, which is more than any dictionary can do. Moreover the database is superior to printed frequency lists currently available (like, e.g. the list by Kucera & Francis, 1967) in accessibility, size and recency. Most importantly, however, the CELEX corpus provides the opportunity of searching for text strings in combination with a wide range of features of orthography, phonology, morphology and syntax by means of complex queries. For English morphology alone more than thirty different features ("columns") are available for each word form, and information is available for word forms and lemmas. It has been calculated that if all columns from the CELEX database were printed for all word forms, a piece of paper would be needed of approximately 5.5m wide and 2.4km long, "so you could probably walk round it in just under an hour" (CELEX manual 1-3). In comparison, the 315,000 entry Random House Unabridged Dictionary of English would need not much more than a strip of 5.5 metres wide and 30 metres long.

For the current study, the following data on morphology were extracted from the database for a set of Dutch and English affixes (see 4.4.1.2). In parentheses are the standard CELEX abbreviations:

Headword (Head)
Headword, reversed (HeadRev)
Spelling number (OrthoNum)
Morphological status (MorphStatus)
Complete segmentation (flat) stems & affixes (Flat)
Complete segmentation (flat) class labels (FlatClass)
Complete segmentation (flat) stem / affix labels (FlatSA)
Immediate segmentation Opacity (ImmOpac)
Noun-verb-affix compound (NVAfffComp)
Derivation method (Der)
Compound method (Comp)
Derivational compound method (DerComp)
Cobuild frequency 17.9m (Cob)
Cobuild 95% confidence deviation 17.9m (CobDev)
Cobuild written frequency 16.6m (CobW)
Cobuild spoken frequency 1.3m (CobS)

Not all of these columns were needed for the selection of all the affixes in the experiment, but these are the columns that were used for both the Dutch and the English database.

The Headword gives the full orthographic form of the resulting lemmas. This column was selected for feedback only: in this column the orthographic form of all lemmas is listed.

The Reversed Headword was selected to enable sorting from right to left. As the focus of this study was to investigate suffixes, all similar words could easily be clustered in this way. For instance, words like, *dogcatcher*, *cowcatcher* and *fly-*

catcher will appear next to each other in a reversed alphabetical list (*rehctacgod*, *rehctacwoc*, *rehctacylf*, respectively). This was necessary for some manipulations that had to be done on the resulting list of lemmas.

The spelling number was included to exclude double occurrences of spelling variants in the lexicons. The output was restricted to spelling nr. 1. Without this restriction, all English lemmas containing the *-ise* morpheme (not only in the *-ise* lexicon itself, but also in cases like *-iser* in the *-er* lexicon) would occur twice. This way, all British and American English spelling variants would be merged and represented only once.

The morphological status provides information about the morphological complexity of the words in the database ("C" for morphologically complex lemmas). For all affixes, this was restricted to "C" only.

The "complete segmentation stems and affixes" renders the surface form plus its flat segmentation (un+like+ly+ness). This column was used for the actual selection of the affixes. The affixes were selected by defining a particular matching string, which would be applied to the "complete segmentation" feature to filter the database output. For the affix *-ness*, for instance, the matching string *%+ness* would ensure that only the lemmas ending in *-ness* were selected that contain the *-ness* affix (*witness*, *baroness*, *harness*). In the string *%+ness*, *%* stands for any number of preceding characters.

"Complete segmentation class labels and stem / affix labels" was selected to check and limit the selection of lemmas. The stem-affix labels provide the number of stems and affixes in the word form (for instance "ASAA" for *unlikeliness*). If this is confined to SA, only those lemmas are selected that consisted of precisely one stem and one affix. The class labels could be used to further confine the lemmas selected. For the selection of *-able* lemmas, for instance, the class labels were restricted to Vx, thereby limiting the resulting lemmas to those that have a verbal stem only.

"Immediate Segmentation Opacity" was included to provide information about the semantic transparency of the lemmas concerned. However, this feature was not used as a limitation, as translation equivalents should be defined as the percentage of successful translations out of all possible morphologically complex lemmas, regardless of their semantic transparency.

The methods of analysis ("Noun-verb-affix compound" "Compound", "Derivational compound" and "Derivation") were selected to avoid occurrence of compounds that would double the presence of particular lemmas. This was particularly necessary for Dutch lemmas, as unlike most English compounds, Dutch compounds are spelled as one string of letters without any spaces. Due to this, a considerable number of morphologically complex forms would occur more than once in the resulting lexicons. For instance, the morphological complex target word *drinker* would re-occur in forms like: *bierdrinker*, *theedrinker*, *koffiedrinker*, *gelegenheidsdrinker*, *kwartaaldrinker*, *sprirusdrinker* and *probleemdrinker*. An English example was found for *catcher*: *flycatcher*, *dogcatcher*, *cowcatcher* and *oystercatcher*. The Dutch lemma *werker* even re-occurred 77 times, some of which recursively: *werker*; *bankwerker*; *machinebankwerker*. The same problem occurred in English for prefixed words; many morphologically complex lemmas containing the prefix *un-*, for instance, recur elsewhere in the database without that prefix. However, a simple restriction to FlatSA column, limiting the selected lemmas to one stem and one affix would imply a loss of data. For instance, the Dutch corpus contains many phrasal verbs that are spelled as one letter strings. In the corpus the prepositions in these strings are tagged as "S" (for example: *indringer* is tagged as SSA: *in+dring+er*). Omitting all SSA lemmas would lead to the loss of all morphologically complex lemmas that have a phrasal verb as their base. The information about the possibility of different analyses in CELEX, however, creates an opportunity to solve this problem. The first type of compound analysis that is included in CELEX is the noun-verb-affix compound. This category contains all compounds that can be analysed as a nominal stem plus a verbal stem plus an affix. The analysis of many words of this type is ambiguous, and all analyses have been included in CELEX. For some compounds, more than three analyses are added to the database. The selection of this type depends on further analysis of compounds. Pure compounds should not be selected, as these will always lead to combinations of stems that will have been selected anyway, like *mapreader*, which overlaps with *reader*. Therefore, "Comp" was restricted to "N". Derivational compounds, on the other hand should be selected as these can only be formed in combination with a (derivational) affix. For instance, the word *cliffhanger* cannot simply be analysed similar to *coathanger* ([coat][hanger]) as a right-headed compound of the "isa" type ([cliff][hanger]). The analyses of these words in CELEX are [[coat],[[hang],[er]]] and [[cliff],[hang],[er]] respectively. This shows that words like *cliffhanger*, as opposed to *coathanger* should be included, as there is no obvious overlap between *cliffhanger* and *hanger*[49]. A third type of analysis that was included concerned those compounds that do not comply with any of the previous analyses, but that must be seen as derivations. An example of this type is *proofreader*, which has been tagged in CELEX as a compound verb (*to proofread*) plus an affix. Setting "Der" to "Y" (Yes) covered this inclusion of this type".

Finally, frequency data were included for all affixes selected. For the English affixes, the frequencies were added from the 17.9 million Cobuild corpus (spoken plus written frequency) and for the spoken and the written corpora separately. In addition, the column CobDev was added enable checking of the reliability of the frequencies. This is the deviation figure for the lemma frequencies that were estimated based on word form frequencies[50]. Similar columns were added to the lexicons containing the Dutch affixes. This time, the frequencies are based upon the 40,000,000 Dutch INL corpus. The Dutch corpus, however, does not contain frequencies of spoken language. Both the Dutch and the English databases contain many lemmas

[49] It might be argued (see, for instance, Lieber, 1980) that for these words an underlying verb *to cliffhang* must be assumed, which does not occur as a surface form.

[50] For strings with a frequency > 100, disambiguation these strings into lemmas was not done by hand. In those cases, as estimation of the distribution of lemmas for that particular string was made on the basis of the manual analysis of 100 strings. For these entries the deviation figure provides essential information about the reliability of the frequencies. See the CELEX manual for further details.

that have been given frequency 0. These words were listed in the dictionaries that had been used in compiling the database, but were not actually found in the corpora. Since the purpose of this investigation was to investigate the actual use of words in a language, rather than what is in a dictionary, a selection restriction was added to the queries that limited the output to lemmas with frequency greater than 0.

Table 9. Example of database selection from CELEX. In this example the following columns were selected: Headword lowercase alphabetic (Headlow); Morphological status (M); Immediate flat segmentation into Stem and Affix labels (FlatSA); Complete Flat segmentation stems and affixes (Flat); Overall Cobuild frequency (Cob); Written frequency (CobW); Spoken frequency (CobS); Immediate Opacity (I).

```
 -------------------------------------------------------------------+
|                                SHOW                                |
|                                                                    |
|HeadLow     M FlatSA Flat          FlatClass Cob    CobW   CobS  I  |
|acceptable  C SA     accept+able   Vx        518    472    46    N  |
|accountable C SA     account+able  Vx         82     80     2    N  |
|achievable  C SA     achieve+able  Vx          9      9     0    N  |
|actionable  C SAA    act+ion+able  Vx          6      5     1    N  |
|adaptable   C SA     adapt+able    Vx         49     47     2    N  |
|adjustable  C SA     adjust+able   Vx         28     27     1    N  |
|admirable   C SA     admire+able   Vx        190    176    14    N  |
|adorable    C SA     adore+able    Vx         31     31     0    N  |
|advisable   C SA     advise+able   Vx         76     73     3    N  |
|agreeable   C SA     agree+able    Vx        197    195     2    N  |
|                                                                V  |
|                                                                   |
| START     GOTO    ZOOM    HIDE     COUNT    PRINT    SAVE   QUERY  |
|                                                                   |
|  Page: 1 (2)    Columns:  9 (9)    Tempo: 10  Count: 465        ^ |
+-------------------------------------------------------------------+
```

4.4.1.2 Selection of affixes

The main aim of this study was to determine the translation equivalence to be tested in an empirical study. To test the impact of translation equivalence on the acquisition of L2 morphological types, affix pairs had to be selected that represent a range of the variables involved. For reasons of feasibility, the selection was restricted to affix types that are traditionally called “derivational”, even though the model presented in Chapter 3 does not make a principled distinction between derivational and inflectional morphology. The following affix types were included in this investigation: *-able*, *-dom*, *-ee*, *-er*, *-ful*, *-hood*, *-ing*, *-ish*, *-ity*, *-less*, *-like*, *-ment*, *-ness*, *-ship*, *-some* and *-ster* from the English corpus, and *-achtig*, *-baar*, *-dom*, *-ement*, *-er*, *-heid*, *-ing*, *-iteit*, *-lijk*, *-loos*, *-schap*, *-sel*, *-ster*, *-vol* and *-zaam* from the Dutch corpus. This selection is representative in degrees of productivity, form-based similarity and dissimilarity between equivalent Dutch and English types, and includes some affixes that can be expected to lead to formations that are "deceptively transparent" from a cross-linguistic perspective. This was determined by looking at the data of an earlier study, comparing form-based and semantic similarities of Dutch and English types (Lowie, 1991). The expectations with regard to the productivity of the English types were based on the typological descriptions by Bauer (1983) and Marchand (1969). At a later stage, this initial selection was narrowed for various reasons. These reasons are discussed below, in 4.4.1.4, where also the final selection of affixes is presented.

4.4.1.3 Procedure

Some lemmas in the resulting CELEX database queries (labelled "lexicons" within CELEX) occurred more than once, due to distinctions other than the ones selected. The selected corpora in CELEX were exported to an external file, using the "distinct" feature, thereby ensuring that "identical" forms were exported only once. These export files were transferred from CELEX using the ftp facility and were converted and retrieved into a spreadsheet application (Microsoft Excel 7.0) for further processing.

From the English and the Dutch databases, a random selection was made of all the resulting lemmas for each of the affixes. Of each affix type, thirty lemmas were randomly selected. This was done by having the spreadsheet attribute a random number to each row and then sorting the list by this column. The first thirty items were taken from the resulting random list. Although a set of thirty random items could thus be compiled for most affix types, for some affix types less than thirty lemmas were found to meet all selection criteria. This was the case for Dutch *-ement*, both Dutch and English *-dom* and English *-hood*, *-like*, and *-some*. In these cases, no further selection was made, but all the resulting lemmas were used, although there were less than thirty cases. Next, all the lemmas in these thirty-line corpora were translated to the other language. For all affixes in both languages, a morphologically complex translation was chosen if this was possible, even when this was not the most frequent translation. The only restriction to this was that the translation had to be one of the alternatives given in the van Dale dictionaries Dutch-English and English-Dutch (Martin & Tops, 1984), i.e., for those lemmas that were included in that dictionary. For lemmas that were not in these dictionaries, the target word was checked with either the Random House Unabridged Dictionary of English or the Van Dale Woordenboek der Nederlandse Taal. Furthermore, if possible, a word consisting of the same stem as that of the morphologically complex word in the source language was chosen, and, if possible, a preference was given to translations containing "an affix similar in form to the affix in the source language" (Bakker, 1996: 39). If a word in the source language could be translated by a morphologically complex word in the target language, this would be considered as a morphological translation equivalent. For each of the different affix types that yielded a translation equivalent for a particular form in the source language the number was listed and percentages were calculated. From the thirty-word corpus representing the Dutch affix type *-achtig*, for instance, ten times an English translation was possible of the form *-like*. It was thus stated that the translation equivalence of the cross-linguistic affix pair *-achtig*/*like* was 33 per cent. The translation equivalence (TEq) of the reverse pair, with English as the source language and Dutch as the target language (*-like*/*-achtig*) yielded a score of 24 per cent. The translation equivalents that are the result of this selection procedure must be regarded as the maximum translation equivalence of a particular affix pair. As the procedure and the criteria were identical for all affix pairs in the test, the lenient selection procedure could not in any way affect the outcome.

The resulting lists of affix pairs were ordered by the source language affix. For each source affix a list was compiled of possible translation equivalents, ordered from strong to weak degrees of translation equivalence. Phonological and orthographic varieties of the same affix (like, for instance, *-able*, *-ble* and *-ible)* were considered as representing the same morphological type and were taken together.

The productivity of each affix was calculated by dividing the number of hapaxes by the total number of tokens representing the same affix. The affix *-ness*, for instance, is represented by 1353 types, which have an average frequency of 14.9. The total number of lemmas in the corpus ending in *-ness* and complying with the other selection criteria is 20,179. The number of hapaxes is 209. Therefore, it can be stated that the productivity of this suffix based on hapaxes is $n_1/N= 0,010357$. See 2.5.1 for a discussion of productivity. [51]

4.4.1.4 Some problems and choices

The first problem that occurred during the selection of the databases from CELEX was that the Dutch and the English corpus turned out not to be fully compatible. The data in the Dutch corpus, for instance, had not been tagged for opacity and did not contain the spoken frequency information. Therefore, the information on spoken corpus frequency and opacity were not included in the analyses. A more serious problem in this respect was that the encoding procedures that were used for the Dutch and the English databases turned out not to be identical. Whereas for English lemmas of the type SA, like *twister*, the Compound analysis was given the value "N", similar lemmas in the Dutch database had been given "Y" for this same feature (*zaaier*). Hence the selection restriction "Comp=N" turned out not to work for the Dutch lemmas. Moreover, the Dutch corpus contained many doubtful or awkward tags. The headword *wijnproever* (wine taster), for instance, was labelled "NNx" in the FlatClass column, which would indicate that this word does not contain a verbal stem. This problem was solved by adding some specific restrictions for some of the affixes in the Dutch database[52] and by manually checking the output file on overlapping occurrences. For this purpose, the file was sorted by the HeadRev feature.

[51] The corpus use of "type" should not be confused with what has been defined as a "morphological type" in this study: a corpus type is one particular word form that may occur a number of times in the corpus. Each individual occurrence of a corpus type is conventionally labelled a "token".

[52] For example, the selection criteria for Dutch *-er* were as follows: OrthoNum=1 AND Flat=%+er AND Cob>0 AND (FlatClass=Vx OR FlatClass=AVx OR FlatClass=BVx OR FlatClass=PVx OR FlatClass= VVx OR FlatClass=xAx OR FlatClass=xVx). Some examples of the results are Vx: denker; Avx: dwarsligger; BVx: aangever; PVx: opschepper; VVx: zweefvlieger; xAx: versneller; xVx: behanger.

A problem which occurred as a result of the selection procedure was that homonymous morphological types could not be distinguished. An example of this is the different types underlying the words *mouthful* and *doubtful*. The first type expresses a quantity, whereas the latter expresses quality or a state. It is obvious that, although these two types may have many overlapping lexical and conceptual characteristics, they should be considered as different types. In this particular case, the same occurs with Dutch *-vol*. Other, more subtle differences can be found in the *-er* affix in both languages, which represents both agents (*reader*) and instruments (*tranquilliser*). The distinction of these types can be hard to make and for the current study making these subtle distinctions was not considered feasible. One reason is that no extensive description of all morphological types is available for Dutch and English.

4.4.1.5 Results

In the table below, the results of this investigation are represented for translation equivalents that reached a value greater than or equal to 20 per cent.

Table 10. English translation equivalents of Dutch affix types, % ≥ 20.

Dutch suffix	**English Translation Equivalent**	**% of types**	**Example**
-achtig	-like	33	lenteachtig-springlike
-achtig	-ous	20	monsterachtig-monstrous
-achtig	-y	20	regenachtig-rainy
-baar	-able/-ible	93	bereikbaar-approachable
-dom	-ity	24	adeldom-nobility
-ement	-ment	44	amusement-amusement
-ement	-ion	22	isolement-isolation
-er	-er	77	krasser-scraper
-heid	-ness	51	klamheid-dampness
-ing	-ion	47	beperking-restriction
-iteit	-ity	93	formaliteit-formality
-lijk	-able	27	draaglijk-bearable
-lijk	-al	27	natuurlijk-natural
-loos	-less	83	stemloos-voiceless
-schap	-ship	43	leiderschap-leadership
-vol	-ful	30	betekenisvol-meaningful
-zaam	-able	23	vreedzaam-peaceable
-zaam	-ive	23	werkzaam-effective

Table 11. Dutch translation equivalents of English affix types, % ≥ 20.

English suffix	Dutch Translation Equivalent	% of types	Example
-able	-baar	57	readable-leesbaar
-able	-lijk	23	presumable=vermoedelijk
-dom	-heid	29	wisdom-wijsheid
-dom	-dom	21	dukedom-hertogdom
-ee	ge-de	31	addressee-geadresseerde
-ee	-er	28	lessee-huurder
-er	-er	70	abstainer-onthouder
-ful	-ig	30	powerful-machtig
-ful	-lijk	20	baleful-verderfelijk
-ful	-vol	20	hopeful-hoopvol
-hood	-heid	35	adulthood-volwassenheid
-hood	-schap	35	brotherhood-broederschap
-ing	past part. -d	20	enterprising-ondernemend
-ish	-s	43	slavish-slaafs
-ish	-achtig	20	blueish-blauwachtig
-ity	-heid	70	security-zekerheid
-ity	-iteit	23	passivity-passiviteit
-less	-loos	60	bottomless-bodemloos
-less	on-	23	baseless-ongegrond
-like	-lijk	41	businesslike-zakelijk
-like	-achtig	24	hornlike-hoornachtig
-ment	-ing	83	assessment-beoordeling
-ness	-heid	90	briskness-vlugheid
-ship	-schap	60	friendship-vriendschap
-some	past part -d	27	lightsome-lichtgevend
-some	-lijk	21	troublesome-zorgelijk
-ster	-er/-eur	67	trickster-oplichter

4.4.1.6 Discussion

The approach taken here is not without problems. For instance, it was sometimes difficult to decide on the translation of the source words. Especially in the case of productive affix types, it was sometimes difficult to choose between equivalent alternatives without any context. An example of this is the Dutch word *wasachtig*, which can be translated by either *waxlike* or *waxy*.

It clearly appeared in these results that the translation equivalents are not always equally productive in both directions. This asymmetry is most obvious for the relations between *-iteit* and *-ity* and between *-heid* and *-ness*; *-iteit* can almost always be translated by *-ity*, but *-ity*, like *-ness*, is almost always translated by *-heid* (see Figure

41) The asymmetry between *-able* and *-baar* is most striking. *-Able* is a translation equivalent of a wide range of Dutch affixes: *-lijk*, *-zaam*, *-baar* and *-vol* (see Figure 42). This seems to point to a wide range of meanings covered by the affix *-able*.

It has been pointed out in 4.4.1.4 that homonymous affix types could not be distinguished other than by manual selection. It should thus be taken into account that some of the figures presented here may be affected by homonymous types. A global investigation on two of these types, instrumental *-er* and quantitative *-ful* revealed that both of these types had higher translation equivalence values than the types they were embedded in. Whereas the overall translation equivalence of the pair *-ful*/*-vol* is 20 per cent, the translation equivalence for the type of *-ful* referring to a particular quantity (*plateful*, *pailful*) amounts to a translation equivalence of about 60 per cent.

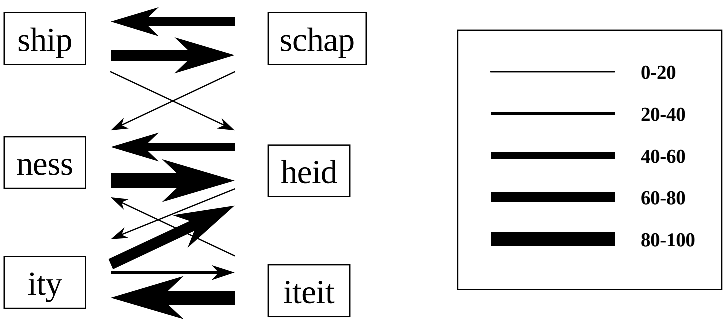


Figure 41. Dutch and English morphological translation equivalents for nominalisation. The width of the arrows reflects the degree of translation equivalence (see inset).

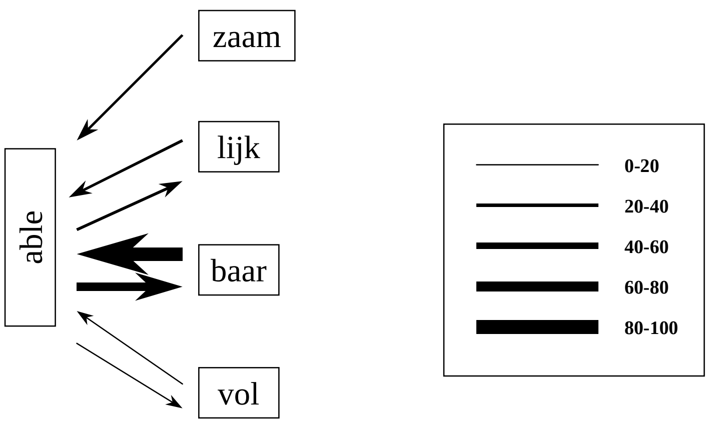


Figure 42. Dutch and English morphological translation equivalents English morphological type -baar. *The width of the arrows reflects the degree of translation equivalence (see inset).*

Translation equivalence thus determined expresses for each affix pair listed above the chance that the affix type in the target language could translate the affix type in the source language. Similar to productivity, learners can be expected to become sensitive to these chances due to exposure, leading to consistent co-activation. If this is indeed the case, translation equivalents computed in this way might be an accurate predictor of the learner's acquisition of morphological types, as was argued in Chapter 3. However, it will be obvious that translation equivalence cannot straightforwardly predict the areas of difficulty learners experience in the acquisition and use of morphological types. Like all aspects of cross-linguistic influence, translation equivalence must be seen as a factor that interacts with numerous other factors to determine the influence of the learner's first language on the acquisition of a second language. Cross-linguistic influence interacts with the learner's age, stage of learning, sociolinguistic factors et cetera. Not all these factors could be included as independent variables in the study presented here, but will be controlled as far as possible. There are three other factors, however, that can be expected to interact with translation equivalence (see Chapters 2 and 3): transparency, frequency and productivity. Translation equivalence itself will greatly contribute to the transparency of L2 morphological types, i.e. the psychotransparency of morphologically complex words for learners of a second language. A type that bears much similarity to a type the learner is already familiar with in her L1 will facilitate the acquisition process of that type due to an increase of transparency. On the other hand, morphologically complex words that seem transparent judged by L1 rules, but in fact are not ("deceptive transparency") are likely to impede acquisition of the types concerned. Transparency, we have seen, is a necessary condition for the acquisition of productivity. Hence, it can be expected that transparency interact with productivity in the acquisition of L2 morphology. To explore the relations between frequency, productivity and translation equivalence, an experiment was set up.

4.4.2 Testing translation equivalence

4.4.2.1 Introduction

The corpus study outlined above quantifies the translation equivalence of Dutch and English affix pairs. In the bilingual mental lexicon, morphological translation equivalence represents the amount of syntactic and semantic information that is shared by the L1 and the L2 affix types. Through interlingual activation feedback, it has been argued in Chapter 3, co-activation occurs between the "equivalent" affix types. Consistent interlingual co-activation as the result of translation equivalence can thus be said to represent the L1 influence in the production of (transparent) morphologically complex L2 words. L1-L2 affix pairs with a low degree of translation equivalence will hamper the production of morphological complex words representing that type. The more consistently an L1 affix overlaps with an equivalent L2 affix (i.e. the higher the degree of translation equivalence is), the more facilitation will occur for the production of morphologically complex L2 words representing that affix type.

The productivity of affix types, also determined on the basis of a corpus study, can be seen as the L2 factor affecting the production of morphologically complex words in the L2. Contrary to the translation equivalence of L1-L2 affix pairs, the productivity of an L2 affix type is solely determined by L2 factors, without any influence of the L1 (see 2.5.1). To determine the degree of productivity of an L2 affix type, a large amount of exposure to the L2 is required. Therefore, the "knowledge" of the productivity of L2 affix type will increase over time.

An experiment was conducted to investigate the role of the morphological translation equivalence and the productivity of L2 types in the production of transparent, morphologically complex L2 words.[53] In this experiment, Dutch learners of English were required to produce morphologically complex words that varied in their degree of translation equivalence and productivity. The experiment consisted of a cross-linguistic translation task and a monolingual gap-filling task in the L2. The sequence of L2 development in the production of morphologically complex words was incorporated in this study cross-sectionally by including three naturally occurring groups representing different levels of L2 proficiency. It was attempted to control the frequency effect in this experiment by exclusively including low-frequency target items.

4.4.2.2 Method

In this experiment, 116 Dutch learners of English from three different levels of proficiency were asked to produce morphologically complex English words in two contexts: cross-linguistically in a translation task and in an L2 gap filling task in which no reference to L1 affix types was made. The target items in this test were all transparent morphologically complex words representing varying degrees of productivity and translation equivalence.

4.4.2.2.1 Subjects

As this study focuses on L2 learners of English, groups of learners had to be found representing different levels of English proficiency. In the Dutch situation, these groups can best be found at secondary schools, as English is a compulsory subject for all pupils there. There are, however, some disadvantages to using these groups. First, there may be internal differences within these groups in terms of age, exposure to English and years of formal instruction in English (see section 4.2). Another limitation is that the lowest levels of L2 proficiency could not be included in a morphological test, as these learners appeared not to deal with the rather abstract tasks in this experiment. In a pilot test, it was found that the lowest level at which pupils could be reliably tested on their written morphological performance was the third form of Dutch VWO (pre-university education). The three levels were third and fifth

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[53] I would like to express my gratitude to two of my students, Wil Hamminga and Gudy Buitink, for their assistance in this experiment.

form pupils from secondary schools and first-year students of English[54]. All tests were taken towards the end of the final teaching term.

4.4.2.2.2 Materials and procedure

Dutch-English Affix pairs were selected in such a way that different levels of both translation equivalence and productivity would be included. For translation equivalence the selection of pairs was based on the figures presented in 4.4.1. The productivity of these affixes was computed by dividing the number of hapaxes for a particular English affix by the number of tokens occurring in the Cobuild corpus, using the CELEX lexical database (as discussed in 2.5.1). The results of these calculations are represented in Table 12.

Table 12. Productivity data of a representative set of English affixes. n_1 stands for the number of hapaxes for the affix type found in the corpus; P stands for productivity (as defined in 2.5.1).

Affix	Types	tokens	n1	P	P.$^{10-3}$	Fgem	types/ tokens
DOM	21	3253	0	0	0	154,9	0,006
LING	24	1125	0	0	0	46,9	0,021
FUL(2)	115	15813	4	0,00025	0,253	137,5	0,007
MENT	288	55784	15	0,00027	0,269	193,7	0,005
FUL(1)	147	16426	6	0,00037	0,365	111,7	0,009
EE	40	3972	2	0,00050	0,504	99,3	0,010
ITY	525	45488	44	0,00097	0,967	86,6	0,012
SHIP	77	7125	7	0,00098	0,982	92,5	0,011
ISH	138	10929	12	0,00110	1,098	79,2	0,013
HOOD	27	2548	3	0,00118	1,177	94,4	0,011
ABLE	437	21870	29	0,00133	1,326	50,0	0,020
SOME	31	1205	2	0,00166	1,660	38,9	0,026
ER	1742	83928	157	0,00187	1,871	48,2	0,021
LESS	213	7096	20	0,00282	2,818	33,3	0,030
STER	19	708	2	0,00282	2,825	37,3	0,027
ING	62	1132	6	0,00530	5,300	18,3	0,055
NESS	1353	20179	209	0,01036	10,357	14,9	0,067
LIKE	34	268	5	0,01866	18,657	7,9	0,127

[54] As has been shown in the study described earlier, the learners in these groups do not only differ in terms of L2 proficiency, but may also differ in terms of cognitive maturation. The selection of learners from the highest level of secondary education was an attempt to reduce this effect.

In compiling the Dutch-English affix pairs for this experiment, a compromise had to be worked out between methodological soundness and feasibility. The most reliable results would have been gained if the pairs had consisted of extreme values for translation equivalence and productivity. For instance, a pair like *-vol/-able* (translation equivalence of the pair = 3%; productivity of the target affix = 1.3) could be selected to represent low translation equivalence combined with low productivity. However, hardly any target words could be found to test this pair. Eventually, the seven pairs were selected that are listed in Table 13 and Table 14. The starting point in selecting these pairs was to include two levels of productivity of the target affix and two levels of translation equivalence, both of which would be represented by two different pairs. For productivity, 1-9 was regarded as low and 10 to 19 as high. For translation equivalence, 3-47 was regarded as low and 48 to 93 as high. Unfortunately, only one pair could be found to combine a high level of productivity with a relatively high level of translation equivalence. Furthermore, attributing a translation equivalence value of 43 per cent to the "low" category and 52 per cent to the "high" category is not the most ideal division. However, since the alternative, dividing translation equivalence into three levels, would leave us without a representation of the high/high category, this was the only feasible solution for which sufficient target items could be found.

Table 13. Dutch-English affix pairs selected for the experiment. These pairs represented high and low levels of both translation equivalence (Teq) and Productivity ($P{\cdot}10^{-3}$)

affix pair	TEq	$P{\cdot}10^{-3}$	Levels
heid/ness	52	10	High/high
baar/able	93	1	High/low
iteit/ity	93	1	High/low
achtig/like	33	19	Low/high
iteit/ness	3	10	Low/high
heid/ity	11	1	Low/low
schap/ship	43	1	Low/low

Table 14. Affixes selected for the different levels of productivity and translation equivalence

		Productivity	
		High	*Low*
Translation Equivalence	*High*	-heid / -ness	-baar / -able -iteit / -ity
	Low	-iteit / -ness -achtig / -like	-heid / -ity -schap / -ship

Two separate tests were devised. Excerpts of the test forms, including the instructions given, have been included in Appendix 3. In the first test, subjects had to translate morphologically complex Dutch words into English words ("L1 context"). The translation of the roots of the words was given:

Kaalheid (kaal = bald) __________________

In the second test, subjects had to fill in morphologically complex words in English sentences ("L2 context"). Sufficient context was provided for the meaning and the syntactic category of the target word to be unambiguously clear. In this test, the roots of the words were given:

Susan is always very radical. Her radical______ can be rather annoying.

For each affix pair included, six target words were selected (see Appendix 3). A pilot test showed that extremely high proportions of correct scores were found for transparent morphologically complex words with high item frequencies. For some high-frequency items, like *leadership* (F=718) and *friendship* (F=514)[55], the subjects even scored 100 per cent correct. Clearly, these frequencies are high enough for these words to have their own lexical representation, in spite of their transparency. Since the focus of this study was the subjects' ability to use morphological types, rather than their knowledge of vocabulary, only low-frequency target items were selected. In the majority of all cases, the COBUILD frequency was kept below 10. However, for some target affixes (for instance *-ity*) somewhat higher frequencies could not be avoided. A further restriction on the target items used in the test was that they should preferably not contain more than one affix. This was done to avoid morphological environments in which particular affixes are more productive than in neutral contexts. For instance, as Baayen & Lieber (1991) have demonstrated, *-ity* is much more productive than *-ness* if preceded by *-able*. Finally, it was attempted not to include roots ending in a vowel if the affix type to be attached to that root started with a vowel, if this lead to deletion of the vowel in the root (as, for instance in *bribable*). The six target items were equally distributed among two subgroups (data sets *a* and *b*): half of the pupils were given set *a* in the translation task and set *b* in the gap filling task; the other half were given set *b* in the translation task and set *a* in the gap filling task.

Table 15. Data sets in the experiment

	L1 context	L2 context
sub-group 1	data set a	data set b
sub-group 2	data set b	data set a

A pilot test indicated that the order in which items were presented might strongly influence the results. Once a particular affix had been used, the subjects tended to

[55] All frequencies reported here are cumulative COBUILD frequencies for written and spoken language, as included in the CELEX lexical database.

keep on using that particular affix as a "default" affix that was filled in for virtually all items. Although it could not be avoided that subjects were given the impression that the issue of the experiment was affixation, it was attempted to conceal the focus of attention of the experiment, i.e. the seven affix types mentioned above. To attain this, twice as many decoys were added as there were items: each subject was presented with three target items per affix pair in each context (L1 and L2), whereas the number of items that had to be filled in amounted to 63 items per context. To ensure a random presentation of items, the following procedure was followed: first groups were compiled consisting of one target item from each affix pair, complemented with fourteen decoys. Next, both the groups and the items within each group were randomly ordered. Finally, the item file thus composed was presented in two orders, so that eventually eight different forms were used in the experiment. Each subject was given one set of items in each context, containing items from different data sets.

Table 16. Conditions and data sets

	L1 context		L2 context	
	order 1	*order 2*	*order 3*	*Order 4*
data set a	1a	1c	2b	2d
data set b	1b	1d	2a	2c

The subjects were asked to fill in their name and form on the test forms. At the secondary schools the tests were administered by the pupils' own English teacher, who had been instructed to give as little information as possible. The first-year students of English were requested to complete the forms after a one-hour history exam. On the test forms, the subjects were asked to fill out the form seriously and carefully. In the instructions about the correct way of filling out the forms, it was stressed that all gaps had to be filled. To avoid an initial focus on translation equivalents, the monolingual L2 task was always administered before the cross-linguistic task. For both parts of the test (the L1 form and the L2 form), an example was provided, using an affix type that was not in any of the target items. Of the 120 forms filled in, 4 were rejected, either because large parts of the forms had not been filled in or because the task had obviously not been taken seriously.

4.4.2.2.3 Variables

An overview of the major variables included in this experiment is given in Table 17. Not represented in this table are the variables that were included to increase the validity and reliability of the design: data set; order of presentation of the targets; the affix pairs representing the different levels of translation equivalence and productivity and the targets representing the affix pairs.

Although the frequency of the target items had been kept as low as possible, frequency was included in the design to investigate the possible effect of the small differences in frequency that occurred within the affix pairs (see 2.5.6). To this end, the targets representing the affix types were divided into high and low frequency within each affix pair, regardless of their absolute frequency. In this way, frequency could be entered in the MANOVA.

Table 17. An overview of the variables in the experiment.

Variable	Function in design	Levels
Group	Independent between-subject factor	3
Translation Equivalence	Independent within-subject factor	2
Productivity	Independent within-subject factor	2
Frequency (relative)	Independent within-subject factor	2
Context	Independent (moderator) within-subject factor	2
Use of target affix	Dependent variable	Binary scores, converted into percentage correct
Use of appropriate syntactic category	Dependent variable	Binary scores, converted into percentage correct

4.4.2.2.4 Predictions

In regard to the model outlined in the previous chapters, the following predictions can be made about the effect of the variables included in this experiment and the way they interact.

Group and Context: these variables had predominantly been included to test their interaction with the main factors, translation equivalence and productivity. Obviously, larger proportions of correct scores can be expected at higher levels of proficiency. The overall scores in the L1 context can be expected to be higher due to the nature of the task. In the L2 gap-filling task, the English sentence has to be interpreted, while in the translation task no interpretation is involved. Since the ability to interpret the English sentences can be expected to increase with increasing proficiency, an interaction is predicted between group and context, where less difference between the tasks is expected for the higher levels of proficiency. Furthermore, providing the L1 affix (in the L1 context) may either facilitate or hamper the production of morphologically complex L2 words. It is predicted that this facilitates production where translation equivalence is high, but impedes production where translation equivalence is low. In the latter case, the L1 affix is likely to interfere (interaction context x translation equivalence, see below).

Translation equivalence: It has been argued in Chapter 3 that translation equivalence can be expected to facilitate the acquisition and use of L2 morphological types, as it will contribute to the psychotransparency of morphologically complex L2 words (3.4.3.3). It follows from this that the more consistent the relation is between an L1 affix type and an "equivalent" L2 affix type (i.e. the higher the degree of translation equivalence is), the more facilitation will occur for the production of morphologically complex L2 words representing that affix type. Conversely, low translation equivalence is likely to hamper the use of a particular affix type, as learners will be forced to use an alternative affix type with a higher degree of translation equivalence. In terms of levels of proficiency, it can be expected that no effect of translation equivalence is found at very low levels of proficiency, since beginning learners have not yet been sufficiently exposed to the L2 to have noticed the co-activation of highly equivalent affix types due to the overlap of conceptual representations. Therefore, it can be expected that the influence of translation equivalence increase with higher levels of proficiency (see 3.3.2.2). In regard to the different tasks included in this experiment, expressed in the variable context, an interaction with translation equivalence can be expected. In the L1 context, the L1 affix is explicitly shown, which emphasises the relation of the L1 affix provided and the L2 affix asked. In the L2 context, the "equivalent" affix is not explicitly shown, and translation equivalence can only implicitly affect production.

Productivity: The resting activation level of more productive affix types can be expected to be higher, as these types occur with many different roots and more often lead to successful type-familiar processing for the comprehension and production of morphologically complex words. A higher degree of productivity will lead to a larger proportion of correct scores in the current experiment. Since the productivity of an affix type is determined by frequency of successful type-familiar processing of morphologically complex words, the facilitating effect of productivity will particularly show at higher levels of proficiency. In regard to the different tasks in this experiment, it can be expected that the strongest impact of productivity is found in the L2 context, as less L1 interference (through translation equivalence) can be expected in that context. The facilitating effects of translation equivalence and productivity can be expected to be cumulative: the highest proportion of accurate L2 production may be expected for affix pairs with a high translation equivalence and a highly productive target affix. However, in contexts where either productivity or translation equivalence is low, one effect will interfere with the other.

Frequency: The frequency of occurrence of morphologically complex words will affect the performance of L2 learners, as high-frequency morphologically complex words will be approached item-familiarly, rather than type-familiarly: the activation level of these items will be higher than the activation level of their constituents. In the case of item familiar processing, it is not likely that an affix is chosen different from the target affix.

Syntactic category: The syntactic category of the affix type is a more global feature than the semantic similarity of affix types, because many specific affix types share the category. Therefore, the overall proportion of correct scores for the syntactic category can be expected to be higher than the scores for the choice of the target affix. It is particularly interesting to consider the cases where another affix was selected than the target affix. It can be expected that for affix pairs with a low translation equivalence a different affix is selected, which forms an L1-L2 pair with a higher degree of translation equivalence.

In sum, the predictions with regard to the main variables in this experiment and their interaction are as follows:

1. A higher degree of translation equivalence will lead to a larger overall proportion of correct scores.
   a. The impact of translation equivalence will be strongest at high levels of L2 proficiency.

   b. The impact of translation equivalence will be strongest in the cross-linguistic task.
2. A higher degree of productivity will lead to larger overall proportion of correct scores.
   a. The impact of productivity will be strongest at higher levels of L2 proficiency.
   b. The impact of productivity will be stronger in the monolingual tasks than in the cross-linguistic task.
3. A higher degree of item frequency will lead to a larger overall proportion of correct scores.
4. The overall scores for the syntactic category will be higher than the scores for the specific affix types.
   a. For affix types with low levels of translation equivalence, more often an alternative affix of the appropriate syntactic category will be chosen, viz. the affix type that forms a higher translation equivalent for the L1 affix.

4.4.2.2.5 Analyses

The answers provided by 116 subjects were scored on two dependent variables, once for the use of the target affix, and once for the syntactic category. Binary scoring (correct=1; incorrect=0) was used for both the affix and the syntactic category: the affix was only scored "correct" if the affix provided was identical to the target item. Spelling variations (*-able* and *-ible)* and spelling errors were ignored. Blank scores were given a separate code (9). Two sorts of analyses were carried out. A MANOVA was applied with context, translation equivalence and productivity as within-subject factors (with two levels all) and group as a between-subject variable (three levels). Furthermore, χ^2 analyses were carried out to investigate the frequency of occurrence of correct, incorrect and blank scores in the test. χ^2 analyses were also used to investigate the effect of the order in which the items were presented and to check the similarity of the data sets. Finally, some correlation analyses were carried out to investigate the effect of absolute item frequency on the proportion of correct scores.

4.4.2.3 Results

First, it was checked whether the data sets (*a* and *b*) and the order of presentation of the target items had affected the results. For this purpose, some cross-tabulations were compiled with these variables and the number of correct, incorrect and blank scores for the target affix. The difference between the data sets appeared not to be significant (χ^2=3.9; *df*=2; p=.137). However, the differences between the two orders turned out to be significant (χ^2=6.7; *df*=2; p=.03). The results for each of the independent variables will be discussed separately below. All data refer to percentage of correct use of the target affixes; analyses involving the syntactic categories of the "incorrect" scores will be reported on afterwards. A first impression of the resulting scores per affix is provided in Figure 43 and Table 18. The differences between the affix pairs representing the levels of translation equivalence and productivity (see

Figure 43) was separately analysed. This analysis showed that the differences between the affixes within the levels were not significant at p<0.05 between *-heid/-ity* and *-schap/-ship* (χ^2=2.9; *df*=1); *-iteit/-ity* and *-baar/-able* (χ^2=0.9; *df*=1), but were significant between *-iteit/-ness* and *-achtig/-like* (χ^2=22.5; *df*=1).

Table 18. Mean percentage correct scores for the affix pairs in the experiment

		Productivity			
		High		*Low*	
Translation Equivalence	*High*	-heid / -ness:	59	-baar / -able: -iteit / -ity:	69 81
	Low	-iteit / -ness: -achtig / -like:	21 32	-heid / -ity: -schap / -ship:	67 39

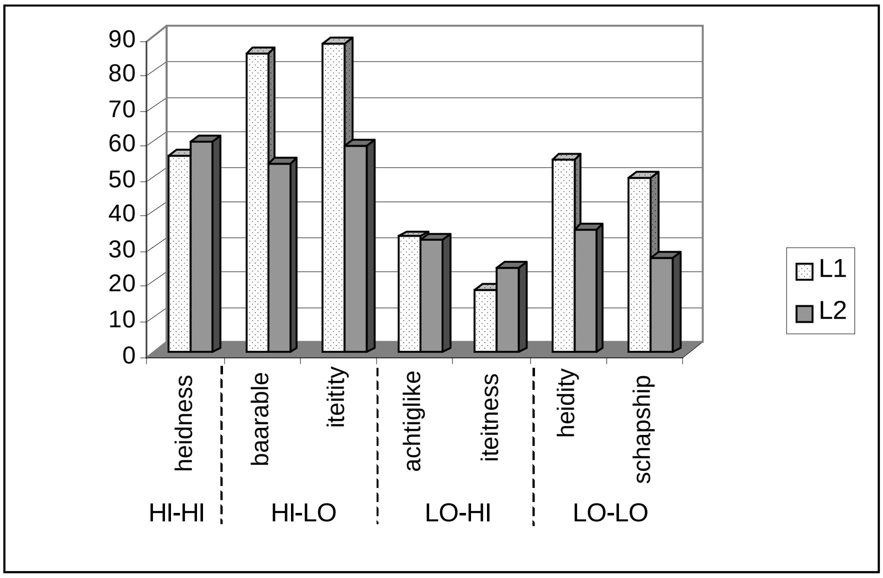

Figure 43. Mean scores for all affix pairs in the two tasks. At the bottom the respective levels have been provided for Translation equivalence and Productivity that the affix pair represents. The level of frequency for these data is "low".

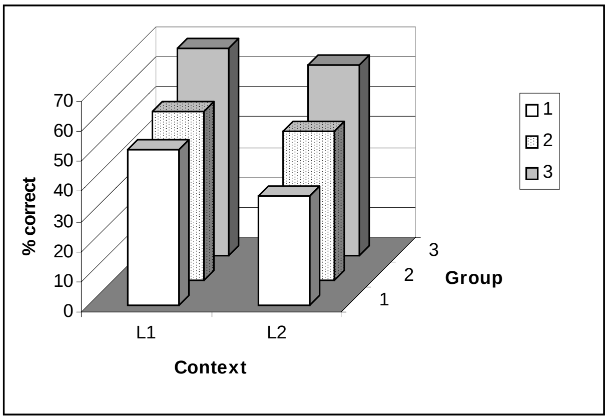

Figure 44. The overall differences with regard to the proportion of correct scores on the target affixes between the three groups participating in the experiment.

4.4.2.3.1 Groups

The difference between the groups (see Figure 44) turned out to be significant (F[2,113]=20.32; p<.01). Larger proportions of correct scores were found at higher levels of proficiency.

4.4.2.3.2 Context

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=.002). Moreover, a significant interaction was found between context and group (F[2,113]=6.49; p=.002). The context effect was stronger at higher levels of L2 proficiency: in group 3 only a minor difference was found between the scores on the L1 task and the L2 task (see Figure 44).

4.4.2.3.3 Translation equivalence

The effect of translation equivalence turned out to be significant (F[1,113]=246.7; p<.001). That is, the proportion of correct scores increased with increasing degrees of translation equivalence. A significant interaction occurred between group and translation equivalence (F[2,113]=5,75; p=0.004). This interaction is graphically represented in Figure 45: the differences between the groups was larger at high level of translation equivalence, or, in other words, the difference in the effect of translation equivalence was strongest at higher levels of proficiency. No interaction was found between context and translation equivalence (F[1,113]=1.22; p=.27).

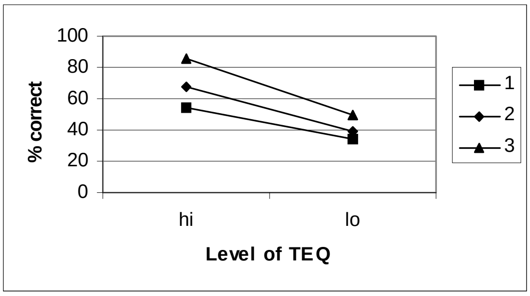

Figure 45. The interaction between the levels of translation equivalence and the groups.

4.4.2.3.4 Productivity

The effect of productivity was significant (F[1,113]=99.2; p=<.001). However, the largest proportion of correct scores was found at low levels of productivity. A significant interaction was found between group and productivity (F[2,114]=22.6; p<.001). The largest (negative) effects for productivity were found at lower levels of proficiency (see Figure 46). Further interaction was found for Context x Productivity (F[1,113]=79.72; p<.001): the negative effect of high productivity was stronger in the L1 context. The three-way interaction Group x Context x Productivity (F[2,113]=3.09; p=.049) showed that the strongest interaction between Context x Productivity was found at the highest level of proficiency. The interaction of Context x Productivity was very peculiar for Group 3 (see Figure 47).

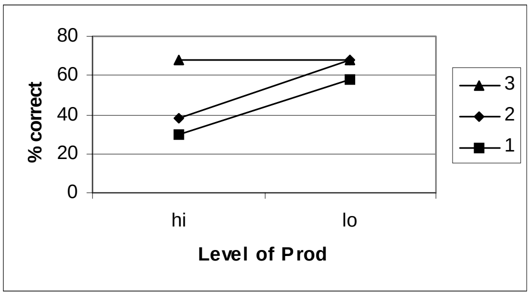

Figure 46. Interaction between group and productivity.

4.4.2.3.5 Higher order interactions

Several significant interactions were found between the main variables.

First, context interacted significantly with productivity (F[1,113]=79.72; p<0.001). In the L2 context, hardly any effect of productivity could be determined, while in the cross-linguistic context ("L1") a negative effect of productivity was found: larger proportions of correct scores coincided with low levels of productivity. The three-way interaction between context, translation equivalence and productivity was also significant (F[1,113]=4.07; p=.046): the interaction between translation equivalence and productivity was strongest in the L2 context, and showed a reversed effect in the L1 context (see Figure 47).

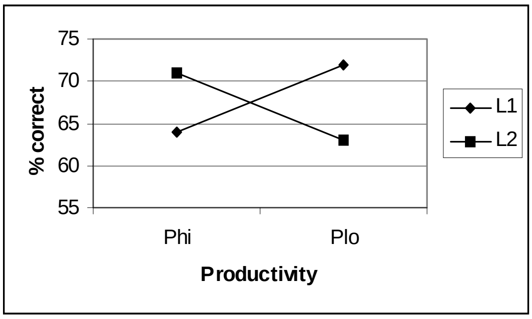

Figure 47. Interaction of context x productivity in group 3.

Second, a significant interaction was found between translation equivalence and productivity (F[1,113]=11.65; p=.001). The (negative) effect of productivity was strongest at the low level of translation equivalence (see Figure 48). In the L2 context, no productivity effect was found at the high level of translation equivalence.

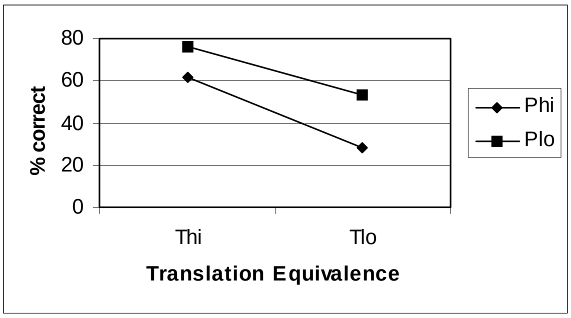

Figure 48. Interaction between translation equivalence and productivity.

4.4.2.3.6 Frequency

In spite of the attempt to restrict item selection to words with frequency values below 10, this appeared not to be possible for the less productive L2 affixes. It is for these affixes that somewhat higher word frequencies had to be selected (see *Figure 50*). Consequently, no absolute frequency values could be included into the

MANOVA. Yet, a strong correlation was found between absolute item frequency and the percentage of correct scores (r_{xy}=.81; p=<0.001, two-tailed; see Figure 49.

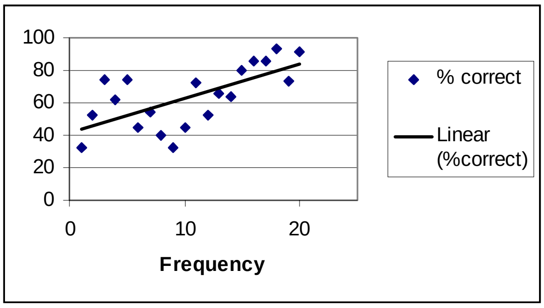

Figure 49. Correlation between the absolute frequency and the overall percentage of correct scores

Although absolute item frequency could not be included in the experiment, an alternative measure of frequency was included in the MANOVA applied to analyse this experiment. This (relative) measure of frequency was based on a division into degrees of frequency within each affix pair. For instance, at the high level of translation equivalence and the high level of productivity (HIHI in Figure 50), frequencies between 0 and 8 were categorised as "low" and frequencies between 10 and 13 were categorised as "high". For the HILO levels, however, that line had to be drawn between 1 and 2 (see Figure 50); value 1 was attributed to low and value 2 was attributed to high. Frequency thus categorised turned out to be significant (F[1,113]=83.01; p<0.001) and significant interactions were found with frequency and context (F[1,113]=10.54; .002), productivity (F[1,113]=46.83; p<0.001), and translation equivalence (F[1,113]=13.12; p<.001).

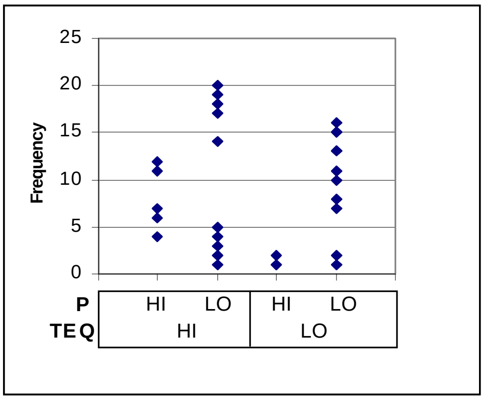

Figure 50. Distribution of levels of productivity (P) and translation equivalence (TEQ) over the item frequency of the target items.

In all cases, larger proportions of correct scores were found at the high level of frequency. The effect of frequency in the L2 context was stronger than the effect in the L1 context, at the low level of productivity, and at the low level of translation equivalence. The interaction between translation equivalence and productivity was strongest at the high level of frequency.

4.4.2.3.7 Syntactic category

The other dependent variable, syntactic category, is related to the score on the target affix. When the target affix was used, the syntactic category was always correct. In total, the correct syntactic category had been selected in 83 per cent of all scores (73, 90 and 91 per cent for groups 1, 2 and 3 respectively). Further analyses were run to investigate if a different affix was used of the same syntactic category, like a more productive affix or an affix which forms a better translation equivalent with the L1 affix. A cross-tabulation showed that for 68 per cent of all incorrect scores an alternative affix was used of the correct syntactic category. A MANOVA was run to investigate those cases where the targets affix was not used, but an alternative affix of the same syntactic category. The between-subject variable, Group, turned out to be significant at $p<0.05$: higher levels of proficiency more often filled in an alternative affix of the correct syntactic category ($F[2,5]=13.7$; $p=0.009$). The effect of translation equivalence, productivity and context were not significant at $p<0.05$. Significant interactions were found for translation equivalence x productivity ($p=0.033$; see Figure 51), translation equivalence x productivity x frequency ($p=0.013$) and group x translation equivalence x productivity x frequency ($p=0.017$). Finally, the scores of the affix pairs were considered (see Figure 52). The difference between the affix pairs was significant ($F[6,222]=11.46$; $p<0.001$). The largest proportions of correct syntactic category were found for the affix pairs -achtig/-like and *-iteit/-ness*. In the majority of cases, alternative affixes were used with higher values of translation equivalence, in spite of their lower productivity: *-achtig/-ish* and *-iteit/-ity* respectively.

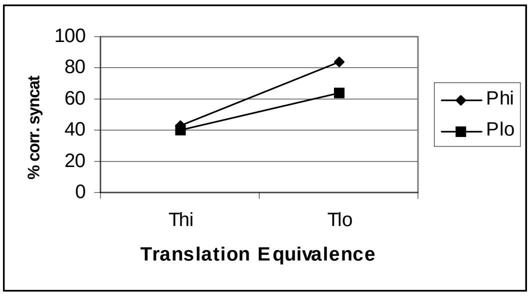

Figure 51. Interaction of translation equivalence and productivity for cases where affixes were used other than the target affix, but of the correct syntactic category.

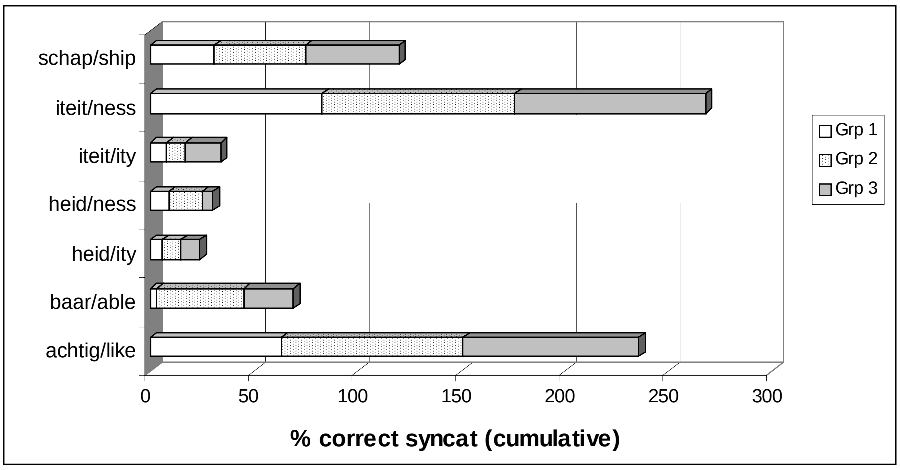

Figure 52. Use of an alternative affix of the correct syntactic category instead of the target affix. These percentages have been neutralised for frequency.

4.4.2.4 Discussion

The proportions of "correct" scores (i.e. use of the target affix) in this experiment were clearly affected by the main factors incorporated in the experiment: productivity, translation equivalence and frequency. These effects and their interactions will briefly be discussed in the light of the predictions stated earlier and the model presented in the previous chapters.

Apparently, the individual target items that had been selected to represent the affix pairs did not affect the results; the difference between the item sets was not significant. However, the order in which the items were presented did have a significant influence on the scores. This was a surprising finding in regard to the careful randomisation of the items. Since the orders had been equally distributed among all conditions for all subjects, the effect of the order will have been neutralised. This finding does indicate, however, that learners are very sensitive to affixes previously encountered. This is in line with the results of a pilot study carried out for the current experiment, where learners showed the tendency to use the first affix they were able to apply as the default type for the production of all morphologically complex words.

4.4.2.4.1 Frequency

The initial intention to exclude frequency as a variable in this experiment by exclusively selecting low-frequency target items did not succeed. Even the minor differences in COBUILD frequency incorporated in this experiment have clearly affected the resulting scores: higher proportions of correct scores were obtained at the high level of frequency. This observation corroborates the well-attested frequency effect: morphologically complex words that are highly frequent are not produced on the basis of type-familiarly, but have been given their own representation in the mental lexicon.

Besides the relative frequency effect incorporated in the analysis, the absolute frequency of the items may well have affected the results. The reason for this is that the absolute frequency appeared not to be equally distributed over the affix pairs or over the levels of productivity and translation equivalence.

4.4.2.4.2 Groups

An earlier experiment (see 4.2) showed that the type of naturally occurring groups used in these experiments did not only differ in terms of the level of L2 proficiency. Other between-subject variables like age and L1 experience may have affected the difference between the groups in the present experiment. Yet, L2 proficiency makes up important part of the differences between these groups. With this reservation, the variable Group in the present experiment will be regarded as an operationalisation of the level of L2 proficiency. The analysis has shown that the effect of the group was significant and that higher overall proportions of correct scores were found at the higher levels of this variable. This is in line with what can obviously be expected: the higher the level of proficiency of the learner, the higher the proportion of correct scores. However, the more interesting findings concerning this variable were found in its interaction with some of the other variables in this experiment. These will be reported in the sections concerned.

4.4.2.4.3 Context

The scores in the L1 context were generally higher than the ones in the L2 context. This finding is in agreement with what had been expected (see 4.4.2.2) and can be attributed to the nature of the task. In the L1 context, no interpretation of a sentence is involved, which decreases the chance of making errors. The interaction between context and group showed that learners at lower levels of proficiency have more problems at interpreting the English sentences than the learners at the higher levels of proficiency. At the highest level of proficiency, the difference between the scores in the two contexts has almost disappeared. This effect is not very surprising and in line with what had been expected.

4.4.2.4.4 Translation equivalence

The most important effect tested in this experiment was translation equivalence. The analyses show that the larger proportion of target affix use was found at the higher level of translation equivalence. This shows that in producing morphologically complex words in the L2, learners tend to rely on the equivalence relation between affix types in the L1 and the L2. This is in agreement with what had been predicted.

The interaction with the subject groups shows that the role of translation equivalence is strongest at high levels of proficiency. This, too, is in line with what had been expected. At higher levels of proficiency, learners have been exposed to English more and, therefore, have become more “aware” of the shared conceptual characteristics of affix pairs with a high degree of translation equivalence.

Contrary to what had been expected, no interaction was found between context and translation equivalence. It had been expected that translation equivalence would play a more prominent role in the translation task than in the L2 gap-filling task, as focus on the L1 affix might increase the activation of the equivalence with the L2 affix. Apparently, even in the L2 context learners are guided in their choice of the affix type by the degree of implicit equivalence to an L1 affix type.

4.4.2.4.5 Productivity

The effect of productivity was significant, but contrary to what had been expected, higher values of productivity lead to lower proportions of target affix use. The explanation for this contradictory finding must be sought in the interaction with other variables and in a methodological problem.

For the method employed in this experiment, a rigid division had to be made in finding affix pairs representing high and low levels of translation equivalence and productivity. However, the absolute values of translation equivalence and productivity were not always equally distributed across these levels. For instance, in the combination of high translation equivalence and high productivity, the respective values were 52/10. In the combination of high translation equivalence and low productivity, these values were 93/1 (for both affix pairs included). This means that the absolute values of translation equivalence may have affected the results in this category. Similarly, the average absolute value of translation equivalence was higher in the category combining low translation equivalence and high productivity than in the category where both variables were low (see Table 19). Because of the attribution of affix pairs to high/low levels, the higher absolute values of translation equivalence have affected the productivity scores. However, had productivity been a strong effect in itself, this problem would probably not have shown.

Table 19. Absolute values of translation equivalence and productivity across the levels.

		Productivity	
		High	*Low*
Translation	*High*	52/10	93/1
Equivalence	*Low*	18/14	27/1

The interference of translation equivalence was clearly less strong where several other factors interacted: at high levels of translation equivalence, in the L2 context, at high levels of proficiency and at low levels of frequency, either no effect of productivity was found or, especially where these factors interacted, productivity positively affected the proportion of correct scores. For instance, at high levels of L2 proficiency in the L2 context, productivity does have a clear positive effect on the proportion of correct scores. The effect of the context can easily be accounted for. In the L1 context, providing the L1 affix reinforces the interfering effect of the absolute values of translation equivalence. Obviously, in a pure L2 context L1 interference is less likely to occur. The effect of the Group is in agreement with what had been expected. At low levels of proficiency, the learners have not yet been sufficiently exposed to the second language to reach a relative high resting activation of productive affixes. For these learners, there is no positive contribution to the production of productive types. In these groups, therefore, the interfering influence of the high translation equivalence values can indeed be expected to be strongest.

Finally, the high scores at the low level of productivity are further reinforced by the combination with the high absolute frequency of the low-productivity target items. Especially for the items of the *-ity* type higher absolute frequency values were found, and the data show a positive significant correlation between the absolute item frequency and the proportion of correct scores (see *Figure 49*).

4.4.2.4.6 Syntactic category

When a choice has to be made for the use of a particular affix type, it is obvious that learners in the vast majority of cases did manage to select a type referring to the appropriate syntactic category. In cases where an affix was used other than the target affix (the "incorrect scores"), 68 per cent of the alternative affix were of the appropriate syntactic category. For two affix pairs, *-iteit/-ness* and *-achtig/-like*, an alternative affix of the appropriate syntactic category was used in the majority of cases. Both of these affix types have a high level of productivity and a low level of translation equivalence. As predicted, in the majority of cases the alternative that was used instead of the target affixes was an affix with a higher value of translation equivalence that was less productive. This again emphasis the importance of Dutch-English translation equivalence for Dutch learners of English.

4.4.3 Conclusions about translation equivalence

For the experiment described in this section, the translation equivalence of several Dutch-English affix pairs was calculated in a corpus study. The translation equivalence of an affix pair was defined as the number of times a transparent morphologically complex L1 word comprising the L1 affix could actually be translated by an L2 word comprising the "equivalent" L2 affix, expressed in a percentage. Following the discussion in the previous chapter, it was claimed that translation equivalence would affect the production and comprehension of L2 words, due to interlingual co-activation of the concepts representing the affix types.

The second variable included in this experiment, productivity, was also calculated on the basis of corpus data. It was expected that the effect of productivity depended on the exposure to L2; L2 learners in the early stages of L2 acquisition have not yet acquired the productivity of all productive affix types in L2. Increased exposure to the L2 would lead to more highly activated lemma nodes of productive morphological types. Therefore, it had been expected that the role of productivity increase with increasing exposure to L2.

To test the effects of translation equivalence and productivity, three groups of Dutch L2 learners of English participated in two production tasks. The results of this experiment show that for these learners translation equivalence plays an important role in the production of morphologically complex words in the L2.

The effect of productivity was not in agreement with the expectations, due to the interference of the actual degrees of translation equivalence used in the experiment and the interference of the absolute degree of item frequency. However, in those conditions where productivity had been expected to be strongest, these interference effects were overcome. The fact that the strongest effect of productivity was found at higher levels of L2 proficiency confirms the idea of gradual acquisition of productivity. The finding that the strongest impact of productivity is found in the L2 context demonstrates that the effect of productivity is affected by L1 interference (i.e. translation equivalence).

With regard to the model presented in the previous chapters, it can be concluded that the effect of the L1 in the production of morphologically complex L2 words should not be underestimated. At all levels of proficiency, the production of L2 affix types is strongly dependent on the presence of a consistent equivalent affix in the L1. The facilitating effect of a consistent translation equivalent can be interpreted as evidence for the occurrence of overlapping semantic representations in the bilingual mental lexicon.

The frequency effect found in this experiment constitutes an influence of a different kind. Frequent morphologically complex items will have their own lexical representation, and no affix types are involved for the production of these words. The only affix characteristic that can be expected to affect the choice of these words is the syntactic category of the word.

4.5 Conclusion

In this chapter, several approaches have been used to investigate some implications of the model outlined in the previous chapters. The main emphasis has been to investigate the role of the first language in the type-familiar production and interpretation of morphologically complex words in the L2: how do several aspects of the first language contribute to the transparency of morphologically complex L2 words? To this effect three aspects have been investigated: the role of form-based vs. semantic similarity of L1 and L2 morphological types, the role of interlingual activation feedback, and relative contribution of translation equivalence and productivity to the correct type-familiar production of L2 words. In most of the experiments, some form of language development has been incorporated, to provide an insight into the process of the acquisition of L2 morphology over time.

In the first series of experiments it has been demonstrated that L2 learners are most proficient in the production and perception of L1 affix types that have similar representations in L1 and L2 in terms of form and are also semantically similar. Semantic similarity, i.e. an overlap between the properties of the L1 and L2 affix types for a particular L2 affix form, appears to be a prime condition for the acquisition and use of morphological types. If the overlap of conceptual properties is absent or is inconsistent, transparent production or interpretation of morphologically complex words in the L2 is hampered.

An attempt to measure the amount of interlingual activation in an experimental setting has failed. Probably the amount of activation is too small to be demonstrated in the type of task administered and different techniques may have to be used. Moreover, the experiment yielded an inexplicable interaction between the random groups and the priming effect. This seems to indicate that the technique applied is not sufficiently reliable. More research has to be done to determine the interfering variable(s) that caused this effect. Another effect that was found in this experiment was that the reaction times on the less productive affix type *-able* was considerably faster than the more productive affix type *-ness*. The advantage of *-able* over *-ness* can be accounted for in terms of translation equivalence. In a third experiment, the degree of translation equivalence was determined on the basis of a corpus study. Analogous to the definition of productivity, translation equivalence was defined as the chance that a particular L1 affix form can be translated by using an equivalent L2 affix form. Since the starting point is that one particular form represents one particular type (except for homonyms), the consistent translation equivalence of an L1-L2 affix pair implies a high degree of overlap of the morphological types in L1 and L2. Translation equivalence is the quantification of the degree of similarity expressed in the first series of experiments. The translation equivalence study shows that a high degree of consistency of translation equivalence largely determines the extent to which L2 words are produced and interpreted type-familiarly. This study also clearly shows that L2 productivity is much less important for the L2 learner than the perceived transparency based on the L1, especially for beginning learners. An interfering factor in this experiment was the strong impact of item frequency: even small differences in (a low degree of) productivity appeared to have affected the results. The frequency effect especially interfered with the objective measurement of productivity, as low productivity inherently coincides with high frequency. The fact that in the priming experiment the affix type *-able* outperforms *-ness*, both in reaction time and in the number of errors, confirms the conclusion that L1-induced transparency (i.e. translation equivalence) takes precedence over productivity.

In the first series of experiments and in the translation equivalence experiment several between-subject factors had been included. Both experiments show that learners at higher levels of L2 learning are better at using L2 morphological types. However, it could not be consistently determined that this effect was due to the exposure to English (including the number of years of formal instruction in English) or to some age-related factor. The correlation that was found between a subject's performance in L1 morphology and in L2 morphology seems to indicate that the increased morphological skills are (partly) due to experience and development in L1. The translation equivalence experiment shows that learners at higher levels of proficiency are increasingly affected by L2 productivity, especially in contexts where the L1 does not interfere. The same holds for translation equivalence. Both of these factors are gradually acquired as a result of increased exposure to the L2.

It should be noted that the production and interpretation of morphologically complex L2 words in the experiments described here are examples of forced production and the results cannot be generalised to everyday "spontaneous" discourse. However, if no effect of type-familiarity had been found in these experiments, these effect would not be likely to occur in spontaneous speech either, as the experimental settings in most of the experiments achieve a maximum of attention on morphology.

Once type-familiar interpretation of morphologically complex words in the L2 has been established, further studies can be devised to investigate this phenomenon in more natural contexts.

In conclusion, it can be argued that the transparent interpretation and production of morphologically complex words in L2 is strongly dependent on the extent to which the L1 and L2 affixes are similar in form and consistently represent overlapping semantic representations. Through psychotransparency, the learner's first language is of primary importance in the acquisition and use of morphological types. It is only at later stages of L2 acquisition that L2 productivity starts to play a significant role in this.

Chapter 5

General Conclusion

In this conclusion, the model outlined in Chapter 3 will be briefly evaluated in the light of the results of the empirical investigation in Chapter 4. For a more detailed description of the model, the reader is referred to Chapter 3 (3.5.1). After this evaluation, some implications and applications of the model will be listed. Finally, some suggestions are made for further research.

5.1 A brief evaluation

The multidisciplinary approach taken in this book to account for the acquisition and use of L2 morphology resulted in a model with a broad spectrum of implications reflecting the different areas of research on which it was based. The greatest strength of the resulting model is its power to account for the range of empirical data derived from all these areas of research. The core of the model, based on Schreuder & Baayen's (1995) Meta model of morphological processing, can account for the acquisition and comprehension of morphologically complex words. Moreover, it answers most of the questions concerning storage and retrieval of morphemes and words. This is done by referring to the activation metaphor and by emphasising the important position of semantic transparency and morphological productivity. An important notion in this model is the independent representation of (productive) morphological types in the lexicon. Schreuder & Baayen's model was adjusted to account for the role of morphology in speech production by referring to the model of Levelt (1989, 1993). It has been shown that after these adjustments, the model can account for the (L1) acquisition of morphology as this appears from the longitudinal studies reported by Clark (1993) and others. Next, the discussion about the bilingual mental lexicon led to another adjustment, concerning the differences and similarities of the L1 and L2 entries in the mental lexicon. It was hypothesised that lexical entries related to the respective languages have their own representation, but share their relation to extra-linguistic concepts. Finally, data from studies involving L2 morphology, especially regarding the order of acquisition of grammatical morphemes, could be accounted for by referring to the same principles as had been referred to for L1 acquisition. The importance of the learner's L1 in the type-familiar interpretation of morphologically complex L2 words was expressed in terms of the "psychotransparency" of these words. In the model, Psychotransparency is regarded as a crucial condition for the comprehension, acquisition and production of L2 morphological types.

The model presented in Chapter 3 is partly theoretical in nature and not all assumptions and implications are suitable to be empirically investigated. The empirical part of this study has therefore concentrated on the role of the first language in the acquisition and use of L2 morphological types. The main objective of the empirical investigations was to determine the factors that contribute to the psychotransparency of morphologically complex words in the L2. These investigations focused on two important questions raised by the model. First, to what extent does the form-based overlap of L1 and L2 morphological types affect comprehension and production of these types in L2? Second, to what extent does a consistent semantic overlap between L1 and L2 entries affect the acquisition and use of morphological types in L2? In Chapter 3, this overlap was labelled “translation equivalence”. In contrast to the influence of these different kinds of L1 similarity, the effect of L2 productivity had been included in one of these experiments.

The effect of form-based similarity of L1 and L2 morphological types clearly showed in the first series of exploratory studies: form-based similarity facilitates the comprehension and production of these types in the L2, if it coincides with semantic overlap. Form-based similarity of L1 and L2 types will increase the psychotransparency of these types, as learners will assume a similarity relationship between affix types that are similar in form. Consequently, if form-based similarity does not coincide with semantic overlap, learners may incorrectly assume a semantic relationship. This clearly showed in the same experiment: types that are similar in form, but not similar in meaning yield more errors in both comprehension and production tasks.

To further investigate the effect of semantic overlap, two studies were conducted: a priming experiment aimed at measuring the amount of activation feedback caused by the conceptual and syntactic overlap of L1 and L2 lexical entries, and an L2 production study including different levels of translation equivalence and productivity. Unfortunately, the first experiment failed to demonstrate the occurrence of activation feedback, which was attributed to an interfering factor that could not be detected. The second experiment convincingly showed the positive contribution of translation equivalence to the production of L2 morphology. In this experiment, a different approach was taken to translation equivalence. Instead of actually measuring the amount of overlap of conceptual representations by activation feedback, the overlap was inferred by calculating the chance that translation equivalence would occur based on a corpus study. The quantification of translation equivalence yielded by this approach perfectly suits the model, because translation equivalence must not be seen as an all-or-nothing affair, but as a continuum. The strong effect of translation equivalence that appeared in this experiment convincingly shows that learners acquire knowledge about the consistency of the relationship between the L1 and L2 affix types.

Contrary to the effect of translation equivalence, L2 productivity appears not to provide a facilitating effect for the production of L2 morphological types. When the interfering effect of frequency had been taken into account, only at the highest level of L2 proficiency in the test the effect of L2 productivity began to show in some contexts. Apparently, the majority of the subjects had not yet acquired the productivity of the L2 types in this test. This effect does not come as a complete surprise. In Chapter 3 it has been argued that in formal language learning contexts, learners may not be sufficiently exposed to L2 morphological types to acquire the degree of productivity of these types. After all, productivity was defined in terms of the frequency of the morphological type relative to the words in which this type occurs, and is thus strongly dependent on exposure. It is to be expected that the role of L2 productivity will increase at L2 proficiency levels higher than the levels included in these experiments. At the same time, the experiments provided no reason to assume that the role of translation equivalence diminishes as a result of the increase of the productivity effect. In situations where translation equivalence and productivity compete, translation equivalence is bound to be stronger. Additional support for this position comes from the priming experiment. Faster reaction times and fewer errors were found for *-able* words primed by *-baar*, compared to *-ness* primed by *-heid*. The corpus study showed that the affix type -ness is much more productive than - -able, but that the translation equivalence between -able and -baar is much higher than that of -heid and -ness.

The experiments reported in this study appeared not to be flawless, mainly because it has not been possible to sufficiently control all interfering factors in all experiments. Especially the failure of the priming effect is rather unfortunate, as this would have provided a strong piece of evidence for the model proposed. However, the strong effect of morphological translation equivalence convincingly shows the importance of a consistent conceptual overlap between types in the two languages. This effect, in conjunction with the effect of form-based similarity, indicates that the L2 learner strongly depends on her first language in the acquisition and use of L2 morphological types. This finding corroborates the model advocated in Chapter 3. Furthermore, an advantage of the model is that it allows for different degrees of semantic overlap between L1 and L2 affix types. This effect could, for instance, not be accounted for by a model positing that L1 and L2 types represent different forms of the same lemma.

Certainly, the multidisciplinary model advanced in this book contains elements that must be specified, and further studies must be devised to investigate this model in all its aspects. Yet, the model provides a framework that is based on a spectrum of different areas of research on which further research can build.

5.2 Some implications and applications

In the introduction, reference has been made to the possible contribution of morphological knowledge to the acquisition of L2 vocabulary. Although this has not been the main issue of this study, some implications of the model in regard to the acquisition of L2 vocabulary will be listed here.

Since many words in a language are morphologically complex and semantically transparent (see Chapter 1), language learning can be enhanced by making use of this fact. By training learners to use morphological types or, in Aitchison's (1994) terms, to teach them to use “the tools” they have in their “toolkit”, complex words can more easily be interpreted and produced. Considering the importance of the role of translation equivalence, the morphological types presented to learners should be restricted to the ones that have a high degree of semantic overlap. For types with a high degree of translation equivalence, relating L2 morphological types to equivalent L1 types can be expected to have a facilitating effect. The results of the corpus study reported in Chapter 4 could serve as an excellent starting point for the selection of affix pairs with different degrees of translation equivalence. To stimulate the acquisition of productive morphological types, learners should ideally be exposed to large amounts of natural L2 data and their input should certainly not be limited to speech of non-native speakers.

It has been noticed in several studies (e.g. Coenen, 1988; Freyd and Baron, 1982) that paying attention to the internal morphological structure of words not only increases knowledge about these types, but induces an increase of the general awareness of morphological types and stimulates type-familiar processing in general. Once learners have discovered the power of morphology, their urge to match (word-) form with meaning will be stimulated. This observation was confirmed in the current study. On the one hand, strong individual differences were found between learners in the L2 tasks, while on the other hand a significant correlation was found between the learners’ comprehension and production in L1 and L2 morphology. This shows that individual learners have reached a higher general awareness of type-familiar processing. This finding is further confirmed by the surprising observation (in 4.2) that the ability to apply morphological types in L1 increased with the level of L2 proficiency, indicating that the study of a second language may raise morphological awareness more generally.

In second language learning, paying attention to the internal structure of morphologically complex words may have the additional advantage of providing a cue that facilitates learning and that improves eventual attainment of words. This effect need not be limited to productive types (examples of this can be found in morphological types of Latin origin). There is some evidence that words that are inferred through morphological cues are better retained than words that are presented in a highly predictable context (e.g. Haastrup, 1989). When a word is inferred through context, the word itself will not receive much of the learner's attention, as a salient context will invite holistic processing. When the meaning of a word is acquired through morphological inferencing, however, the word will receive maximal attention. There are many arguments against this position (see e.g. Mondria, 1996), but it would at least be worthwhile to incorporate morphology into studies investigating the acquisition of L2 morphology.

Applying these observations to the field of L2 instruction, it can be concluded that L2 learners should be presented with two types of morphological instruction. First, specific attention should be restricted to a limited number of productive morphological types that have a high degree of semantic overlap with L1 types, with reference to the equivalent L1 types. The data show that especially at lower levels of foreign language acquisition, learners have acquired little of the productivity of L2 affix types. Providing sufficient input is the only way to ensure the acquisition of L2 productivity. Second, general attention should be paid to the internal structure of words to raise the awareness of morphological complexity.

Another implication of this study is that findings from this field may provide more insight into general processes of second language acquisition. A preference for transparent structures and the avoidance of opaque formations seems to be a general tendency in language that may be able to account for both language change and language acquisition. Transparency may be an overall guiding principle of second language learning. Referring to the similarity of the learner's L1 in accounting for SLA data has gone out of fashion since the failed attempts of contrastive analysis. In a different framework, however, accounting for the interaction of several factors (see 3.4.3), cross-linguistic influence should certainly be taken seriously.

5.3 Suggestions for further research

The study reported here gives rise to many questions that merit empirical investigation.

First, it would be worth replicating the priming experiment to determine the cause of the unexpected interaction found between the priming effect and the between-subjects factor. This could be done by including more subject-dependent factors like the subject's level of L2 proficiency as determined by, for instance, a simple vocabulary test.

Second, research methods should be developed to investigate other implications of the model advanced here. For instance, it could be attempted to determine the degree of psychotransparency of a morphologically complex word by comparing reaction times of morphologically complex words based on different types. A pilot experiment[56] demonstrated that type-familiar processing can be measured by comparing reaction times of pseudo words and existing words based on a particular affix type. This line of research could provide an insight in the development of L2 morphological acquisition by comparing the processing of morphologically complex words by groups representing different acquisition levels. In addition, the separate representation of morphological types in the lexicon could be investigated in a repetition priming experiment comparing reaction times of stems and affixes representing different degrees of transparency and productivity.

Third, the current study raises some questions about the role of the productivity of L2 morphological types. Why is it that no effect of morphological productivity could be found in early stages of L2 learning? Can the negative effect found for productivity completely be attributed to the frequency? And does productivity indeed play a role only at very high levels of L2 proficiency?

Fourth, the model does not require a different framework for derivational and inflectional morphology, as this difference can be expressed in terms of productivity. Yet, the empirical studies in Chapter 4 have all focused on derivational morphology. Devising experimental studies incorporating inflectional as well as derivational affixes could provide empirical support for this position.

Fifth, the studies in Chapter 4 raise some intriguing questions concerning the nature of the individual differences between learners in the acquisition and use of (L2) morphological types. Studies including variables like the learner's aptitude, cognitive styles and learning strategies could be conducted to investigate the relation

[56] Reported in a presentation at the 1995 AAAL annual conference, Long Beach (Ca.), March 26, 1995.

between the acquisition of morphology and these individual differences. It has been suggested (e.g. Singh & Martohardjono, 1988) that cognitive strategies are particularly relevant for the acquisition of morphology. In Chapter 4, it has been suggested that some of the results could be accounted for by referring to the learner's stage of cognitive development.

Finally, for the more practical applications of the model, it would be interesting to include morphological factors into research in the area of vocabulary acquisition. In addition, the effect of different types of morphological instruction (see 5.2) is worth further empirical study.

Appendices

Appendix 1

Excerpts of the experimental materials in Experiments 1, 2 and 3.

1. Experiment 1

Experiment 1a (production)

Instruction:

In deze toets vind je een aantal Nederlandse woorden. Vertaal deze woorden in het Engels. Gebruik daarbij de woorden die tussen haakjes staan.

Schrijf de vertaling achter het woord, op de stippellijn.

Items:

Kleurloos (kleur = colour	…………………
Bereikbaar (bereiken = to reach)	…………………
Doofheid (doof = deaf)	…………………
Rijkdom (rijk = rich)	…………………
Zaagsel (zagen = to saw)	…………………

Experiment 1b (comprehension)

Instruction:

In deze toets vind je een aantal Engelse woorden. Vertaal deze woorden in het Nederlands. Gebruik daarbij de woorden die tussen haakjes staan.

Schrijf de vertaling achter het woord, op de stippellijn.

Items:

Bitterness (bitter = bitter)	…………………
Changeful (to change = veranderen)	…………………
A speedster (to speed = hard rijden)	…………………
A smoker (to smoke = roken)	…………………
Parenthood (a parent = een ouder)	…………………

2. Experiment 2

Experiment 2a (Dutch sub-test)

Instruction:

Deze toets bestaat uit een rij Nederlandse woorden. Sommige van deze woorden zijn 'goed', sommige zijn 'fout'. Het gaat er NIET om of de woorden wel of niet echt bestaan, maar alleen of je zou begrijpen wat ze betekenen. Welke van deze woorden zou een goed Nederlands woord KUNNEN zijn? Kruis de GOEDE woorden aan. Voorbeeld: ☒Leesbaar ☒Lampbaar

Items:
Donkerzaam
Mooiloos
Roersel
Tilbaar
Toegeefzaam

Experiment 2b (English sub-test)

Instruction:

Deze toets is gelijkaan de vorige, maar danmet Engelse in plaats van Nederlandse woorden. Kruis de woorden aan waarvan je denkt dat ze WEL mogelijk zijn in het Engels Voorbeeld: ☒Readable ☒Lampable

Items:
A drinker (to drink = drinken)

Learnsome (to learn = leren)
Stirsel (to stir = roeren)
Partnership (a partner = een kameraad)
Rainable (to rain = regenen)

3. Experiment 3

Experiment 3a (Dutch sub-test)

Instruction:

Deze toets bestaat voor iedere vraag uit twee delen. Beide vragen die hieronder staan moeten dus voor ieder woord worden beantwoord.

A. Is het woorden een werkwoord, een zelfstandig naamwoord of een bijvoeglijk naamwoord?
B. Welke omschrijving past het best bij de betekenis van het woord?

De woorden waar het om gaat bestaan niet echt in het Nederlands. Er wordt hier niet gevraagd of de woorden bestaan, maar wat ze ZOUDEN betekenen ALS ze bestonden

Voorbeeld:

sproekachtig

Sproekachtig is een:
☒ Bijvoeglijk naamwoord
❑ Werkwoord
❑ Zelfstandig naamwoord

En betekent:
a. Lijkend op een sproek
b. Iemand die sproekt
c. Erg sproek

Items:
1. Een graker

een graker is een:
- ❑ Werkwoord
- ❑ Zelfst. naamwoord
- ❑ Bijvoeglijk naamwoord

En betekent:
- ❑ Iemand die graakt
- ❑ Iets dat je graken
- ❑ Iets dat er uitziet als een graak

2. Droesheid

Droesheid is een:
- ❑ Werkwoord
- ❑ Zelfst. naamwoord
- ❑ Bijvoeglijk naamwoord

En betekent:
- ❑ Iemand die droest
- ❑ Hoe droes iets is
- ❑ Zonder droes

3. Daasbaar

Daasbaar is een:
- ❑ Werkwoord
- ❑ Zelfst. naamwoord
- ❑ Bijvoeglijk naamwoord

En betekent:
- ❑ Iets dat kan worden gedaasd
- ❑ Iets dat gewoonlijk daast
- ❑ Iets dat er daas uiziet

Experiment 3b (English sub-test)

Deze toets is hetzelfde als de vorige, maar nu met Engelse woorden.

De woorden waar het om gaat bestaan niet echt in het Nederlands. Er wordt hier niet gevraagd of de woorden bestaan, maar wat ze ZOUDEN betekenen ALS ze bestonden

Voorbeeld:

slovish

slovish is een:
☒ Bijvoeglijk naamwoord
☒ Werkwoord
☐ Zelfstandig naamwoord

En betekent:
d. Like a slove
e. Someone who sloves
f. Very slove

Items:
1. A norter

norter is een:
☐ Werkwoord
☐ Zelfst. naamwoord
☐ Bijvoeglijk naamwoord

en betekent:
☐ Someone who norts
☐ Something that can be norted
☐ Something that looks like a nort

2. Frickless

frickless is een:

- ❑ Werkwoord
- ❑ Zelfst. naamwoord
- ❑ Bijvoeglijk naamwoord

en betekent:

- ❑ Looking like a frick
- ❑ Without frick
- ❑ Something that can be fricked

3. A boadster

boadster is een

- ❑ Werkwoord
- ❑ Zelfst. naamwoord
- ❑ Bijvoeglijk naamwoord

en betekent:

- ❑ A woman who boads
- ❑ A person who boads
- ❑ (something) that can be boaded

Appendix 2
Experimental materials priming experiment

1. Primes and targets Group A

CONDITION 1 (*-able* target set 1)

RT	ERR	PRIME	TARGET
637	3	REGELBAAR	THINKABLE
565	3	TOONBAAR	PLAYABLE
734	3	MEETBAAR	STRETCHABLE
618	13	REKBAAR	WASHABLE
586	3	GANGBAAR	TEACHABLE
690	13	LEVERBAAR	PRINTABLE
568	0	KLAPBAAR	DRINKABLE
709	0	WERKBAAR	ALTERABLE
627	3	STAPELBAAR	RENTABLE
655	13	BREEKBAAR	PARDONABLE

Mean RT = 638

CONDITION 2 (*-ness* target set 1)

RT	ERR	PRIME	TARGET
715	6	ECHTHEID	ROBUSTNESS
633	10	BITTERHEID	PLEASANTNESS
605	3	EENHEID	BROADNESS
710	24	ZWAKHEID	WEIRDNESS
657	17	HARDHEID	YELLOWNESS
667	10	BLINDHEID	HUGENESS
689	10	GROFHEID	SMARTNESS
691	34	WIJSHEID	CUTENESS
635	6	MATHEID	SOLIDNESS
701	17	DROEFHEID	LOWNESS

Mean RT = 670

CONDITION 3			(*-able* target set 2)
RT	ERR	PRIME	TARGET
661	3	BRANDKAST	SPEAKABLE
651	10	BRUIKLEEN	EXPORTABLE
608	3	DEELNAME	COUNTABLE
580	3	WEERWOORD	TOUCHABLE
643	13	KIESDREMPEL	BREAKABLE
724	31	PLAATSNAAM	CASHABLE
731	17	PEILSTOK	WEARABLE
699	20	TESTBEELD	SPREADABLE
647	10	STRAFSCHOP	SUPPORTABLE
630	0	HOORSPEL	MENTIONABLE

Mean RT = 657

CONDITION 4			(*-ness* target set 2)
RT	ERR	PRIME	TARGET
711	13	NAAKTSTRAND	FALSENESS
616	0	BLIJSPEL	CLEARNESS
814	17	LEEGSTAND	DEVIOUSNESS
680	6	KAALKOP	ROUNDNESS
627	6	VALSMUNTER	FAINTNESS
789	44	DICHTWERK	APTNESS
801	24	VRIJBUITER	SOLEMNNESS
840	44	KOUDVUUR	GROSSNESS
705	3	IJDELTUIT	DUMBNESS
741	27	MENSAAP	CRUELNESS

Mean RT = 732

Primes and targets Group B

NUMBER OF SUBJECTS = 29

CONDITION 1 (*-able* target set 2)

RT	ERR	PRIME	TARGET
581	0	BRANDBAAR	SPEAKABLE
616	0	BRUIKBAAR	EXPORTABLE
556	0	DEELBAAR	COUNTABLE
540	6	WEERBAAR	TOUCHABLE
547	3	KIESBAAR	BREAKABLE
713	17	PLAATSBAAR	CASHABLE
688	6	PEILBAAR	WEARABLE
729	17	TESTBAAR	SPREADABLE
628	3	STRAFBAAR	SUPPORTABLE
632	0	HOORBAAR	MENTIONABLE

Mean RT = 623

CONDITION 2 (*-ness* target set 2)

RT	ERR	PRIME	TARGET
634	3	NAAKTHEID	FALSENESS
572	0	BLIJHEID	CLEARNESS
685	13	LEEGHEID	DEVIOUSNESS
635	10	KAALHEID	ROUNDNESS
620	6	VALSHEID	FAINTNESS
804	41	DICHTHEID	APTNESS
772	24	VRIJHEID	SOLEMNNESS
756	34	KOUDHEID	GROSSNESS
640	3	IJDELHEID	DUMBNESS
707	6	MENSHEID	CRUELNESS

Mean RT = 682

CONDITION 3			(*-able* target set 1)
RT	ERR	PRIME	TARGET
573	0	REGELNEEF	THINKABLE
589	3	TOONBANK	PLAYABLE
704	3	MEETKUNDE	STRETCHABLE
558	0	REKSTOK	WASHABLE
547	0	GANGMAKER	TEACHABLE
608	0	LEVERWORST	PRINTABLE
540	3	KLAPZOEN	DRINKABLE
692	6	WERKTUIG	ALTERABLE
626	13	STAPELBED	RENTABLE
648	10	BREEKIJZER	PARDONABLE

Mean RT = 608

CONDITION 4			(*-ness* target set 1)
RT	ERR	PRIME	TARGET
729	31	ECHTPAAR	ROBUSTNESS
632	3	BITTERBAL	PLEASANTNESS
631	6	EENDRACHT	BROADNESS
688	3	ZWAKZINNING	WEIRDNESS
610	6	HARDHOUT	YELLOWNESS
608	13	BLINDDOEK	HUGENESS
638	10	GROFVUIL	SMARTNESS
723	34	WIJSNEUS	CUTENESS
631	10	MATGLAS	SOLIDNESS
630	3	DROEFGEESTIG	LOWNESS

Mean RT = 652

2. Instructions on the computer screen before the start of the experiment:

In the following experiment you will
alternately be shown Dutch and English words.

If you know the word appearing
or if you understand what it means,
press the YES-button.

If you don't know the word,
press the NO-button.

You will be given 20 words to practise
before the real test starts

3. Instructions to the experimenter

- Make sure the Dmastr program has been installed in the directory c:\bin\dm (you can use "instal.bat" included on the diskette) and that this directory has been included in the PATH command in autoexec.bat.
- Dmastr can only be run in a pure DOS environment, so not in a Windows DOS-box.
- Go to the directory: C:\BIN\DM\PRIME.
- Start the DMastr program by typing DM.
- Type the following code: G[password][filename]. The password is a combination of two letters; (you could use your initials here). The filename is either PRIME1 or PRIME2, depending on the group.
- The experiment will start by pressing the Space bar.
- When the subject has gone through the practising items, ask whether the task is clear. If not, abort the test by typing: A[password], and start again at 5. If the task is clear, let the subject finish the test. Make sure you do not give any information about the morphological types included in this test!
- When the test has terminated, type S[password] to save the results. Start again at 5 with a new subject , or
- Press Control-Enter to leave the program.

4. Summary of reaction times

Table 20 Summary of mean reaction times for all factors in the experiment

Experimental Condition				Control Condition			
-able		*-ness*		*-able*		*-ness*	
Grp 1	Grp 2	Grp 1	Grp 2	Grp 1	Grp 2	Grp 1	Grp 2
637	581	715	634	661	573	711	729
565	616	633	572	651	589	616	632
734	556	605	685	608	704	814	631
618	540	710	635	580	558	680	688
586	547	657	620	643	547	627	610
690	713	667	804	724	608	789	608
568	688	689	772	731	540	801	638
709	729	691	756	699	692	840	723
627	628	635	640	647	626	705	631
655	632	701	707	630	648	741	630

Matrices per factor

NO. OF ITEMS PER CONDITION: 10
NO. OF LEVELS OF FACTOR A: 2
NO. OF LEVELS OF FACTOR B: 2
NO. OF LEVELS OF FACTOR C: 2
NON-REPEATED FACTORS: C

ABC MATRIX
638.90 623.00 670.30 682.50 657.40 608.50 732.40 652.00
ABMATRIX
630.95 676.40 632.95 692.20
A MATRIX
653.68 662.58
B MATRIX
631.95 684.30
BC MATRIX
648.15 615.75 701.35 667.25
C MATRIX
674.75 641.50
A C MATRIX
654.60 652.75 694.90 630.25

Appendix 3

Experimental materials in the Translation equivalence experiment

1. Target items

Table 21. Mean scores of all affix pairs and targets in the translation equivalence experiment.

L1/L2 Pair	TEQ	P	Dataset	Target	Ftarget	% correct
achtiglike	33	19	a	hairlike	0	18
				motherlike	0	29
				paperlike	0	39
			b	babylike	0	53
				hornlike	1	22
				springlike	0	33
baarable	93	1	a	countable	3	82
				detachable	7	74
				stretchable	3	67
			b	alterable	4	63
				kissable	1	62
				rentable	1	68
heidity	12	1	a	banality	33	79
				humidity	33	82
				plasticity	9	51
			b	fatality	19	66
				fecundity	10	40
				virility	41	86
heidness	58	10	a	baldness	16	68
				coarseness	8	45
				steepness	9	62
			b	briskness	9	47
				greyness	15	72
				plumpness	4	60
iteitity	93	1	a	futility	52	86
				immunity	62	93
				nasality	0	81
			b	elasticity	29	66
				fertility	154	91
				totality	81	73
iteitness	3	10	a	inventiveness	0	26

				radicalness	0	11
				subtleness	0	19
			b	depressiveness	0	26
				massiveness	0	32
				sportiveness	0	11
schapship	43	1	a	authorship	16	36
				emperorship	0	37
				seamanship	1	54
			b	clerkship	0	31
				professorship	14	45
				receivership	12	32

2. Examples of the test forms

Vakgroep Engelse Taal- en Letterkunde
Rijks*universiteit* Groningen

Deze toets maakt deel uit van een experiment voor wetenschappelijk onderzoek. De onderzoekers vragen je deze toets zorgvuldig en serieus in te vullen. De toets bestaat uit twee gedeeltes en het invullen kost ongeveer 30 minuten. Bedankt voor je medewerking!!

Naam:
Klas:

1. Deze test bestaat uit een aantal Engelse zinnen. Het is de bedoeling dat je op de lijn het juiste achtervoegsel invult. Vul iets in waardoor de betekenis van de zin duidelijk wordt. Als je niet onmiddellijk een antwoord weet, probeer dan iets te verzinnen wat eventueel zou kunnen; vul in elk geval iets in.

   Voorbeeld:
   Peter likes to surf. He is an enthusiastic surf_er__.

1. Freddy Mercury used to love singing. Later on he became the lead sing__________ of the band Queen.
2. That sign warns people for playing children near the road. It is a warn__________ for drivers and other traffic.
3. The sky is very grey. The grey__________ of the sky reminds me of England.
4. The queen's jewellery is of great value. Especially the crown is a valua__________ piece of her collection.
5. The dog has the watch over night. When someone dares to enter the house, it barks: it is a watch__________ dog.
6. He used to be a clerk at the office. But now his clerk__________ has come to an end.
7. The birth of the baby filled the couple with great joy. The birth of a child usually is a joy__________ occasion.
8. Frank always has to switch on several lights in his room, instead of one. The light__________ in his house is very bad.

2. Deze test bestaat uit een aantal Nederlandse woorden. Vertaal deze woorden in het Engels. Maak daarbij gebruik van de Engelse vertaling die tussen haakjes staat. Schrijf de vertaling achter het woord op de lijn. Als je niet onmiddellijk een antwoord weet, probeer dan iets te verzinnen wat eventueel zou kunnen; vul in elk geval iets in.

Voorbeeld:

ademloos (adem=breath) _____breathless_____

1. radicaliteit (radicaal = radical) ____________________
2. aanbidder (aanbidden=admire) ____________________
3. aarzeling (aarzelen=hesitate) ____________________
4. haarachtig (haar = hair) ____________________
5. abonnement (abonneren=subscribe) ____________________
6. avontuurlijk (avontuur=adventure) ____________________
7. vormbaarheid (vormbaar = plastic) ____________________
8. beoordeling (beoordelen=assess) ____________________
9. bereiding (bereiden=prepare) ____________________
10. afneembaar (afnemen = to detach) ____________________
11. besparing (besparen=save) ____________________
12. broederlijk (brother=broer) ____________________
13. nasaliteit (nasaal = nasal) ____________________
14. draadloos (draad=string) ____________________
15. dromer (dromen=dream) ____________________
16. keizerschap (keizer = emperor) ____________________
17. erkenning (erkennen=acknowledge) ____________________
18. formulering (formuleren=formulate) ____________________
19. kaalheid (kaal = bald) ____________________
20. foutloos (fout=fault) ____________________
21. geleiding (geleiden=conduct) ____________________
22. subtiliteit (subtiel = subtle) ____________________
23. genadevol (genade=mercy) ____________________
24. hardloper (hardlopen=run) ____________________
25. papierachtig (papier = paper) ____________________
26. hertogdom (hertog=duke) ____________________
27. hopeloos (hoop=hope) ____________________
28. vochtigheid (vochtig = humid) ____________________
29. humorvol (humor=humour) ____________________
30. jager (jagen=hunt) ____________________
31. rekbaar (rekken = to stretch) ____________________
32. kinderachtig (kind=child) ____________________
33. kleurloos (kleur=colour) ____________________
34. immuniteit (immuun = immune) ____________________
35. leider (leiden=lead) ____________________
36. liefdeloos (liefde=love) ____________________

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Samenvatting

Inleiding

Bij het gebruik van woorden die zijn samengesteld uit verscheidene morfologische componenten, zoals bijvoorbeeld *onleesbaar*, kan men zich afvragen of de spreker deze woorden telkens opnieuw samenstelt uit de verschillende morfologische constituenten (*on-*, *-lees* en *-baar*) of dat morfologisch complexe woorden net als morfologisch enkelvoudige woorden integraal zijn opgeslagen in het mentale lexicon. Ook tussenoplossingen zijn denkbaar, waarbij sommige morfologisch complexe woorden als geheel zijn opgeslagen en sommigen worden gegenereerd en ontleed. Bij deze tussenoplossingen speelt een aantal factoren een rol. Zo is bijvoorbeeld de frequentie van het woord en de productiviteit van de affixen van belang. De vraag over opslag of derivatie wordt iets ingewikkelder als ze wordt toegepast op taalverwerving, en nog interessanter als de te leren taal niet de moedertaal is, maar een tweede of vreemde taal. Naast de overeenkomsten tussen het leren van de morfologie van een eerste taal en die van een tweede taal, zijn er ook belangrijke verschillen. Zo kan bijvoorbeeld worden verondersteld dat gelijkenissen en verschillen tussen de affixen in de twee talen de verwerving hiervan beïnvloedt.

Het onderzoek naar de rol van morfologie in de tweede of vreemde taal kan een belangrijke bijdrage leveren aan inzichten in de werking van het mentale lexicon. Bovendien kan inzicht in (derivationele) morfologie een belangrijke bijdrage leveren aan het onderzoek naar vocabulaireverwerving. Met behulp van een beperkt aantal affixen kunnen grote hoeveelheden woorden worden geïnterpreteerd en geproduceerd, en leerders die de morfologie van een tweede taal goed beheersen blijken beter in staat woorden te leren. Dit is niet verwonderlijk, want ondanks het voorkomen van ondoorzichtige woorden kunnen verreweg de meeste morfologisch complexe woorden correct worden geïnterpreteerd op grond van hun morfologische constituenten.

Het hier beschreven onderzoek beoogt vast te stellen welke factoren een rol spelen bij de verwerving en het gebruik van (derivationele) morfologie in een tweede of vreemde taal. Het doel is te komen tot een geïntegreerd model van de verwerving van morfologie in een tweede of vreemde taal, dat is gebaseerd op een interdisciplinaire benadering. Hierbij komen, naast psycholinguïstsche modellen van het mentale lexicon, theorieën over de verwerving van het lexicon van de moedertaal en theorieën en modellen van het tweetalige lexicon ook theorieën van de tweede-taalverwerving en theorieën van de generatieve morfologie ter sprake. Het onderzoek concentreert zich op de verwerving van derivationele suffixen door Nederlandse leerders van het Engels.

Morfologie in het mentale lexicon: een model

De uitgangspunten

Het model dat hier wordt voorgestaan gaat uit van een combinatie van opslag en afleiding. De keuze wordt bepaald door een combinatie van drie factoren: transparantie, productiviteit en frequentie. Productiviteit en frequentie hangen nauw samen. De productiviteit van een affix (*P)* kan worden gedefinieerd als de verhouding van het aantal hapaxen (n_1) en de cumulatieve frequentie van de woorden waarin het affix voorkomt (N): P=n_1/N (Baayen, 1989). Een voorwaarde voor productiviteit is semantische transparantie. Een affix is uitsluitend productief als het gebruik ervan leidt tot morfologisch complexe woorden die transparant zijn. Omgekeerd kan worden gezegd dat morfologisch complexe woorden alleen correct kunnen worden geïnterpreteerd als zij semantisch transparant zijn.

Het model dat hier wordt beschreven is in grote lijnen afgeleid van het Meta Model (Schreuder & Baayen, 1995), aangepast voor productie en voor tweetaligheid. In het voorgestelde model wordt geen afzonderlijke module verondersteld waarin nieuwe woorden worden gevormd door middel van woordvormingsregels, maar worden affixen gezien als elementen die een zelfstandige representatie hebben in het mentale lexicon. Deze elementen worden aangeduid met de term “morfologische types”. Gelijk aan de representatie van morfologisch enkelvoudige woorden, bestaat ieder lexicaal element in het mentale lexicon uit een aantal aan elkaar verbonden knopen. Van ieder element is informatie in het lexicon opgeslagen over de betekenis (de “semantische structuur”), de syntactische kenmerken en de kenmerken over de spelling en uitspraak van dat element (“lexemen”). De kern van het element wordt de “lemma knoop” genoemd. De semantische structuur van een element in het lexicon wordt compositioneel bepaald door verscheidene conceptuele representaties.

Voor de verklaring van lexicale verwerking wordt de activeringsmetafoor gebruikt: ieder lexicaal element, dus ook een morfologisch type, heeft op een zeker moment een bepaald niveau van activering. Dit activeringsniveau is doorlopend onderhevig aan verandering. Wanneer een lexicaal element wordt gebruikt in perceptie of in productie, stijgt het activeringsniveau; wanneer het niet wordt gebruikt daalt het niveau. Hieruit volgt dat lexicale elementen die frequent voorkomen een hoog niveau van activering hebben. Het variabele activeringsniveau vormt de verklaring voor de keuze tussen directe toegang van woorden of het afleiden op grond van de woorddelen. Het uitgangspunt van deze verklaring is een volwassen spreker die beschikt over morfologische types in het mentale lexicon; de verwerving van het lexicon wordt besproken in de volgende paragraaf. Ieder woord dat een luisteraar tegenkomt, genereert de gelijktijdige activering van een reeks in het lexicon aanwezige lexemen, bestaande uit ongelede woorden en morfologische types. Als op basis van de syntactische kenmerken twee geactiveerde elementen kunnen worden samengevoegd (“licensing”) wordt de betekenis van het woord berekend op basis van de gezamenlijke betekenissen van de woorddelen (“combination”). Bij een geslaagde combinatie vloeit activering terug naar de lexemen van de woorddelen en niet naar het lexeem van het gehele woord. Bij een mislukte combinatie is dat andersom: veel activering vloeit terug naar het gehele woord en weinig of geen activering vloeit terug naar de woorddelen. Met andere woorden, de transparantie van de morfologisch complexe vorm bepaalt de mate van terugkoppeling van activering naar de woorddelen en het gehele woord. De activering van een element in het mentale lexicon wordt dus tweezijdig beïnvloed: via de frequentie van voorkomen in het taalaanbod en via terugkoppeling na combinatie. Een woord dat volledig transparant is en niet erg frequent zal geen zelfstandige representatie krijgen in het lexicon (hooguit tijdelijk tijdens de woordverwerking), maar naarmate transparantie afneemt en frequentie toeneemt, is de kans groter dat een woord een zelfstandige representatie krijgt. De rol van de productiviteit schuilt in de relatieve frequentie van het morfologische type: hoe vaker een morfologisch type voorkomt in combinatie met verschillende stammen, hoe hoger de activering van dat type zal zijn.

Dit model van het mentale lexicon is neutraal voor productie en herkenning en kan worden toegepast voor alle modaliteiten. Wel zullen voor de verschillende modaliteiten aparte toegangsprocedures moeten worden verondersteld. Door de neutrale positie van het lexicon past het model in het meer algemene model van spraakherkenning en productie, zoals dit wordt voorgestaan door, bijvoorbeeld, Levelt (1993). Hoewel het model hier vooral wordt toegepast op derivationele morfologie, beperkt het zich niet hiertoe. Ook inflectie kan op soortgelijke wijze worden verklaard: het belangrijkste verschil is dat inflectionele affixen in het algemeen productiever zijn en dat de kans dat woorden die deze affixen bevatten als geheel worden opgeslagen in het mentale lexicon niet erg groot is.

Verwerving van morfologie in eerste en tweede taal

De belangrijkste drijfveer bij het verwerven van taal is het streven betekenis te koppelen aan vormen die voorkomen in spraak. Taalverwerving is een doorlopende poging consistente relaties te vinden tussen vorm en betekenis. Dit principe laat zich gemakkelijk toepassen op de verwerving van morfologie in het mentale lexicon. Naast het herkennen van woorden zullen ook de woorddelen worden gekoppeld aan betekenis. Een logische voorwaarde hiervoor is, dat de relatie tussen vorm en betekenis van een morfologisch type consistent is (transparantie) en dat het in voldoende mate voorkomt (frequentie) in combinatie met veel verschillende stammen (productiviteit). Als een morfologisch type een representatie in het mentale lexicon heeft verworven, kan het ook productief worden gebruikt. De betekenisstructuur van de elementen in het mentale lexicon kan in de verwervingsfase sterk verschillen van die van volwassen moedertaalsprekers. Dit zal ook het geval zijn bij de verwerving van morfologische types, omdat ook hier geldt dat de betekenisstructuur onvolledig of afwijkend kan zijn in de verwervingsfase. Twee principes zijn nodig om de uiteindelijke verwerving van morfologische types te verklaren. Ten eerste moet worden verondersteld dat twee elementen in het mentale lexicon nooit precies dezelfde betekenis kunnen hebben ("uniciteit"). Ten tweede zal bij een conflict op grond van uniciteit, bijvoorbeeld veroorzaakt door nieuwvorming, de voorkeur worden gegeven aan de conventionele vorm ("conventionaliteit"). Deze principes voorspellen dat overgeneralisaties van morfologische types uiteindelijk plaats zullen maken voor conventionele vormen en dus de in een taalgemeenschap meest productieve elementen overblijven.

De verwerving van het lexicon in een tweede of vreemde taal werkt volgens dezelfde principes. Er is echter een belangrijke verschil: de tweede-taalverwerver beheerst al zijn of haar moedertaal. Waar bij het leren van de moedertaal de verwerving van het lexicon gelijk opgaat met de verwerven van concepten, is bij tweedetaalverwerving sprake van volledige concepten, die “slechts” gekoppeld dienen te worden aan de woorden van de tweede taal. Het kan echter niet zo zijn dat er alleen een nieuwe vorm wordt verbonden met een aanwezig semantische representatie in het lexicon. Het uitgangspunt van het hier besproken model is dat ieder element in het mentale lexicon uniek is. Dat betekent dat er weliswaar een conceptuele overlapping kan bestaan tussen lexicale elementen in de twee talen, maar dat die twee elementen nooit identiek kunnen zijn. Anderzijds kan niet worden uitgegaan van volledig aparte lexicons voor verschillende talen. In het huidige model wordt daarom ieder element in het tweetalig mentale lexicon gespecificeerd voor taal. Deze specificatie, die een soortgelijke plaats inneemt als de semantische structuur verbonden aan het lemma, maakt het mogelijk te spreken van zogenaamde “subsets” voor verschillende talen binnen het lexicon. Voor de selectie van een bepaalde subset kan de activeringsmetafoor weer worden toegepast. Het tweetalige systeem voor spraakproductie en -herkenning bevat een taalselectiemechanisme dat zich buiten het lexicon bevindt. Dit mechanisme zorgt voor een relatief hogere startactivering van alle elementen die tot een bepaalde taal-subset behoren. De actieve subset zorgt bij gebruik voor het onderhouden van deze activering via co-activering en terugkoppeling, op een soortgelijke wijze als bij combinatie van stammen en affixen (zie 2.1). Door de hogere activering van een bepaalde subset zal de spreker of luisteraar niet snel een lexicaal element selecteren uit de “verkeerde” taal-subset. Dat kan wel het geval zijn als een element uit een subset die niet is geselecteerd een aanzienlijk hoger activeringsniveau heeft door, bijvoorbeeld, een zeer hoge frequentie of doordat een concept in een bepaalde taal niet of moeilijk “verwoord” kan worden.

Bij het verwerven van de morfologie in een tweede taal is een belangrijke rol weggelegd voor de eerste taal. In het huidige model wordt deze rol vertegenwoordigd door de “psychotransparantie” van morfologisch complexe woorden in de tweede taal en door de wezenlijke semantische overlap tussen lexicale elementen in de eerste en de tweede taal, de “vertaalequivalentie”.

Psychotransparantie moet worden onderscheiden van gewone (“inherente”) transparantie, en kan worden gedefinieerd als de transparantie van een woord voor een bepaalde spreker op een bepaald moment. Het omvat de invloed van alle (linguïstische) kennis van de leerder, inclusief de kennis van de eerste taal. Psychotransparantie kan de verwerving en het gebruik van morfologie in de tweede taal op verschillende manieren beïnvloeden. Ten eerste is het mogelijk dat door de invloed van de eerste taal morfologische transparantie niet als zodanig wordt herkend. Ten tweede kan een morfologisch complex woord in de tweede taal transparant worden geïnterpreteerd, terwijl het woord niet semantisch compositioneel is. Ten derde is het mogelijk dat een vorm in de tweede taal verkeerd wordt geïnterpreteerd door de invloed van de eerste taal.

Psychotransparantie speelt in de eerste plaats een rol bij de (vermeende) herkenning van morfologische types in de tweede taal, maar kan leiden tot een semantische representatie die afwijkt van die van volwassen moedertaalsprekers van de doeltaal.

Een ander soort invloed van de eerste taal op de verwerving en het gebruik van de morfologie van een tweede taal wordt gevormd door vertaalequivalentie. Vertaalequivalentie kan worden gedefinieerd als de mate van conceptuele overlap tussen een lexicaal element in de eerste taal en een lexicaal element in de tweede taal. Zowel psychotransparantie als vertaalequivalentie beïnvloeden de verwerving en het gebruik van morfologische types in een tweede taal.

De twee belangrijke principes voor het verklaren van de verwerving van morfologie in een eerste taal, uniciteit en conventionaliteit, zullen ook moeten gelden voor tweede-taalverwerving, als we ervan uitgaan dat ook de tweede-taalverwerver uiteindelijk de meest productieve types verwerft. Een belangrijke voorwaarde voor het verwerven van productiviteit is dat types in voldoende mate aanwezig zijn in het taalaanbod. Een complicerende factor bij vreemde-taalverwerving is het ontbreken van voldoende authentieke moedertaalspraak. De verwerving van de productiviteit van morfologische types in een tweede taal kan hierdoor worden bemoeilijkt. Daarom kan worden verwacht dat, in tegenstelling tot vertaalequivalentie, productiviteit pas een rol van betekenis zal spelen op hogere niveaus van T2-verwerving.

Onderzoeksvragen

Op grond van het voorgestelde model werd een aantal vragen geformuleerd, die empirisch werden onderzocht.

- Wat is het relatieve belang van een formele overeenkomst ten opzichte van een overeenkomst in betekenis tussen affixen in de eerste en de tweede taal? Volgens het model zou een overeenkomst in vorm tussen morfologische types in de eerste en de tweede taal (leidend tot psychotransparantie) alleen een positieve bijdrage aan de verwerving van morfologische types leveren als deze samengaat met overeenkomst in betekenis (ofwel een hoge mate van vertaalequivalentie).
- Is er sprake van co-activering van morfologische types in de eerste en de tweede taal die een sterke conceptuele overeenkomst vertonen? Op grond van het model kan worden verwacht dat een overeenkomst in betekenis tussen morfologische types in de eerste en de tweede taal door middel van terugkoppeling door activering van gemeenschappelijke conceptuele representaties, zal leiden tot co-activering van overeenkomstige morfologische types in de twee talen.
- Vertaalequivalentie vertegenwoordigt een invloed van de eerste taal op de verwerving van morfologische types in de tweede taal. Productiviteit van een morfologisch type in de tweede taal is daarentegen een invloed van de tweede taal waarop de eerste taal geen invloed heeft. Wat is de rol van (T1-gestuurde) vertaalequivalentie ten opzichte van (T2-gestuurde) productiviteit? Het model voorspelt dat vertaalequivalentie gedurende het gehele traject van tweede-taalverwerving een rol zal spelen, terwijl productiviteit pas op een laat moment in dit traject zal worden verworven.

Toetsing van de onderzoeksvragen

Om deze onderzoeksvragen te toetsen, werd voor iedere vraag één of meer experimenten opgezet.

De eerste onderzoeksvraag werd onderzocht met behulp van een exploratieve studie, waarin drie categorieën van affixen werden opgenomen:

A. Semantisch equivalente morfologische types in de eerste en tweede taal, die ook in hun fonologisch / orthografische vorm overeenkomen (zoals *-er* in *lezer* en *reader*).
B. Semantische equivalente vormen die qua vorm niet overeenkomen (zoals -heid en -ness in openheid en openness).
C. Types die een sterke formele overeenkomst vertonen, maar semantisch verschillen (zoals -ster in schrijfster en speedster).

De productie en de herkenning van deze morfologische types werd getoetst in drie experimenten: een vertaaltoets waarin Nederlandse leerders van het Engels morfologisch complexe woorden moesten vertalen, een lexicale decisie taak en een toets waarin de leerders de betekenis en de syntactische (sub)categorie moesten raden van morfologisch complexe pseudo-woorden (*frickless*). De resultaten van deze experimenten tonen aan dat psychotransparantie een belangrijke bijdrage levert aan de verwerving van morfologische types. De proefpersonen scoorden zonder uitzondering minder goed in de categorie die meest waarschijnlijk leidt tot schijntransparantie (C). Uit de experimenten kwam ook naar voren dat een consistente semantische relatie tussen morfologische types in de eerste en de tweede taal minstens zo belangrijk is als de fonologisch / orthografische overeenkomst tussen die types. Samengevat kan uit dit experiment worden geconcludeerd dat een consistente semantische relatie tussen vorm en type van groot belang is voor de verwerving van morfologische types. Formele overeenkomsten tussen types in de eerste en de tweede taal leveren geen duidelijk extra voordeel op, maar als de formele overeenkomst niet samengaat met een semantische overeenkomst, leidt dit tot schijntransparantie. De rol van de semantische overeenkomsten tussen morfologische types in de eerste en tweede taal werd verder onderzocht in de vervolgexperimenten.

Het eerste vervolgexperiment beoogde een antwoord te geven op de tweede onderzoeksvraag. Als activering optreedt van een lexicaal element in de tweede taal, zou dat via terugkoppeling vanaf de conceptuele representaties ook enige activering kunnen veroorzaken van een sterk overlappend morfologisch type in de eerste taal. Dit werd onderzocht door middel van een "priming" experiment, waarbij in een lexicale decisietaak de reactietijden werden gemeten op morfologisch complexe woorden in de tweede taal na het tonen van een overlappend type in de eerste taal ten opzichte van een niet-overlappend type. De affixparen die voor dit doel werden geselecteerd waren *-able*/*-baar* en *-ness*/*-heid*. De resultaten van dit experiment tonen geen significant effect aan tussen de experimentele- en de controleconditie. Het te verwachten effect was echter klein en kan gemakkelijk zijn beïnvloed door externe factoren.

Het derde en meest omvangrijke experiment onderzocht de relatieve invloed van vertaalequivalentie. Dit is gedaan in twee fasen. Eerst werd met behulp van een corpus-studie de vertaalequivalentie vastgesteld van een groot aantal Nederlands-Engelse affixparen. Bovendien werd de productiviteit van de betreffende morfologische types vastgesteld. Ook de frequentie van de doelwoorden werd meegenomen in het experiment. In de tweede fase werd uit deze affixparen een selectie gemaakt van paren die verschillende niveaus van vertaalequivalentie en productiviteit vertegenwoordigen. Deze affixparen werden opgenomen in een productie-experiment waaraan 116 leerders van het Engels van drie verschillende niveaus deelnamen. De affixparen werden getoetst in twee verschillende contexten: een vertaaltoets ("T1-context") en een invultoets ("T2-context"). De resultaten van dit experiment laten zien dat vertaalequivalentie een belangrijke bijdrage levert aan de verwerving en het gebruik van morfologie in de tweede taal, voor alle niveaus van verwerving die in dit experiment waren opgenomen. Voor de T2 invloed in dit experiment, i.c. productiviteit, werd dat effect niet aangetroffen. Slechts op het hoogste niveau en in de T2 context (waar dus de interferentie van de eerste taal minimaal was) bleek het effect van productiviteit de scores positief te beïnvloeden. De experimenten laten zien dat tweede-taalverwervers de minste fouten maken in het gebruik van morfologische types in de tweede taal, die zowel qua vorm als betekenis overeenkomen. Een consistente semantische overeenkomst tussen de talen blijkt een belangrijke conditie voor de verwerving en het gebruik van morfologische types, mits deze niet wordt gedwarsboomd door schijntransparantie. In verder onderzoek naar de invloed van semantische overlap tussen morfologische types in de eerste en de tweede taal kon geen terugkoppeling van activering worden aangetoond. Het is echter mogelijk dat verschillen in vertaalequivalentie, die in dit experiment niet waren opgenomen, de resultaten hebben beïnvloed. In het derde experiment werd het belang van semantische overeenkomst van morfologische types met types in de tweede taal duidelijk aangetoond in de rol van vertaalequivalentie. De productiviteit van morfologische types in de tweede taal wordt pas zeer laat verworven.

Conclusie

De grootste kracht van het hier voorgestelde model ligt in het interdisciplinaire karakter en in de verklaring van empirische feiten uit eerdere studies. Door middel van het veronderstellen van verschillende niveaus van activering op grond van frequentie, productiviteit en transparantie kunnen de meeste vragen ten aanzien van (derivationele) morfologie in het mentale lexicon worden verklaard. Ook data uit kindertaalverwerving kunnen goed worden verklaard. Door de toevoeging van taalselectiekenmerken is het model bovendien goed toepasbaar voor het tweetalig lexicon. De verwerving van morfologie in het tweetalig lexicon kan worden verklaard aan de hand van de kernbegrippen "pychotransparantie" en "vertaalequivalentie".

Het model is grotendeels theoretisch van aard en niet alle onderdelen zijn geschikt voor empirische toetsing. Het belangrijkste doel van de hier beschreven experimenten was vast te stellen welke factoren bijdrage aan de psychotransparantie van morfologisch complexe woorden in de tweede taal. Daarbij blijkt vooral conceptuele en semantische overlap met morfologische types in de tweede taal een belangrijke rol te spelen. Pas op (veel) hogere niveaus van tweede-taalverwerving begint de productiviteit van affixtypen in de tweede taal een rol van betekenis te spelen, en dan nog slechts in contexten waar weinig of geen T1 interferentie kan plaatsvinden. Hoewel het model op veel aspecten verder zal moeten worden uitgewerkt, vormt het een raamwerk gebaseerd op een breed onderzoeksveld, dat kan dienen als basis voor verder onderzoek.

Uit de bevindingen van dit onderzoek volgt een belangrijke toepassing in de onderwijspraktijk van de vreemde taal, zeker bij de verwerving van het Engels. Aangezien een groot deel van de morfologisch complexe woorden in het Engels waar leerlingen op de middelbare school mee te maken krijgen, semantisch transparant is, loont het zeker de moeite aandacht te vestigen op productieve affixtypen. Derivationele morfologie kan een aanzienlijke bijdrage vormen bij het uitbreiden van de woordenschat in de vreemde taal.