The acquisition of interlanguage morphology

Lowie, Wander Marius

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-

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[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-

[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 prin-

ciple 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 mod-

els (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).

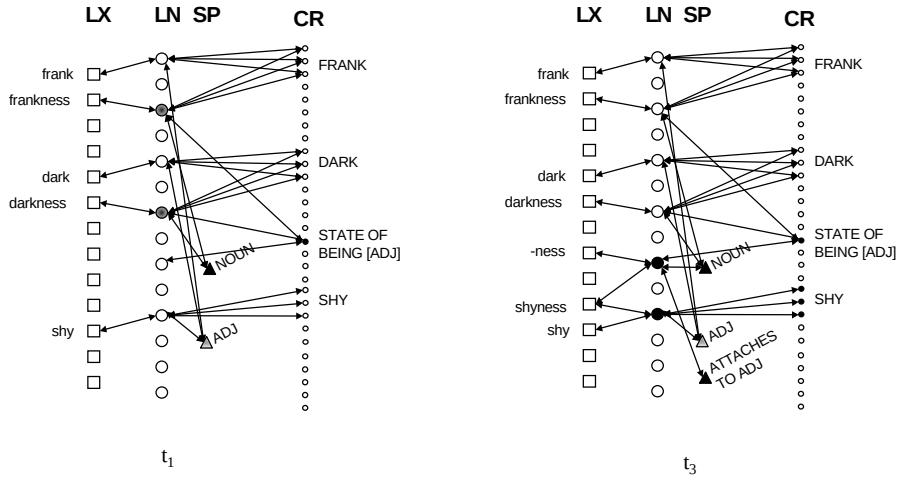

Figure 12. The acquisition of the suffix -ness at two moments in time. Lexemes (LX); Lemma nodes (LN) with Syntactic Properties (SP); Conceptual representations (CR). The level of resting activation is indicated by the shading of the nodes.

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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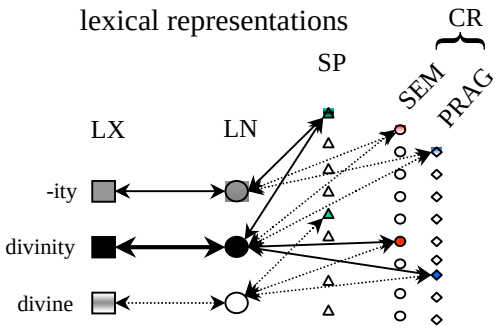

Figure 13. Levels of activation for lexemes (LX), syntactic properties (SP) and conceptual representations (CR) as a result of partial co-activation of some of the properties. The level of activation is reflected by the degree of shading of the symbols.

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.

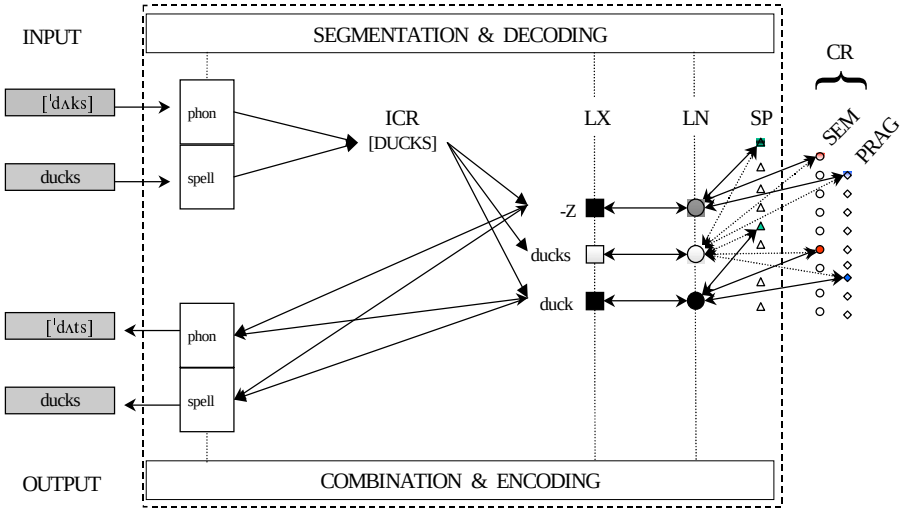

Figure 14. Production and Comprehension in a model of lexical access, exemplified by the production and comprehension of the word ducks.

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 preverbal 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.

[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.

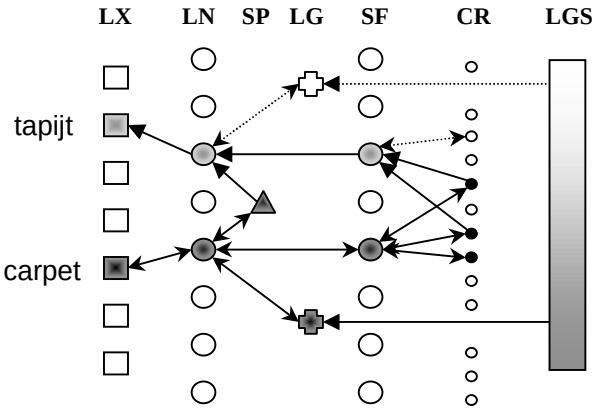

Figure 15. Example of interlingual activation feedback

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

[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".

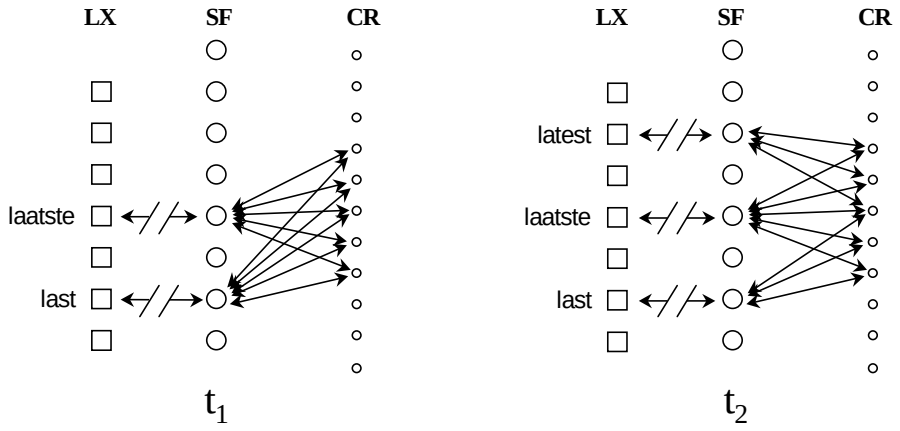

Figure 16. Simplified representation of two time slices in the process of acquiring the new L2 concept "latest". In this figure, the lemma nodes have been left out.

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 coactivation 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.

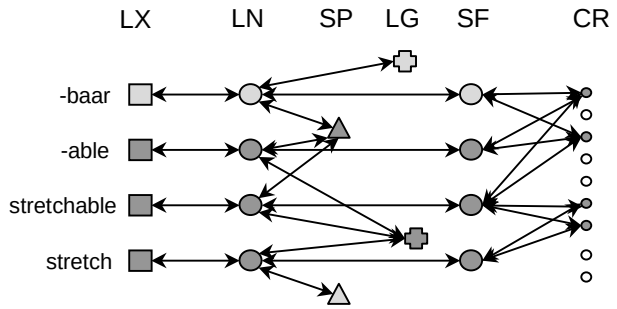

Figure 17. Example of the lexical connections for English -able *and Dutch* -baar. *These affixes share much syntactic and semantic information, but are different by their connection to different the language subsets.*

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

[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 trans-

formed 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 recog-

nised 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-linguistic 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*:

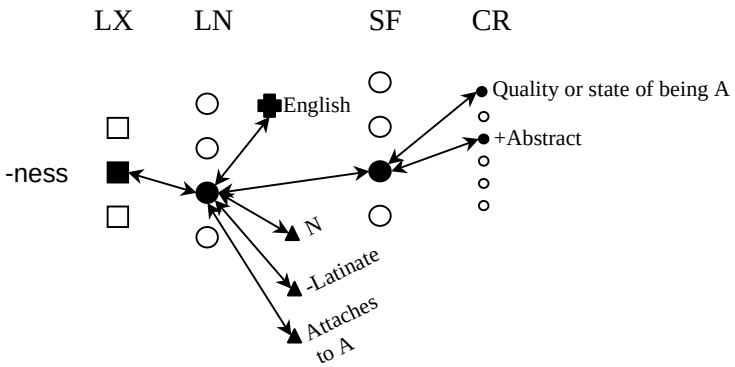

Figure 18. Lexical entry of the morphological type -ness, comprising*: Lexeme (LX), lemma node (LN) plus syntactic properties and language subset information, semantic form (SF) and its associated conceptual representations (CR).*

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.

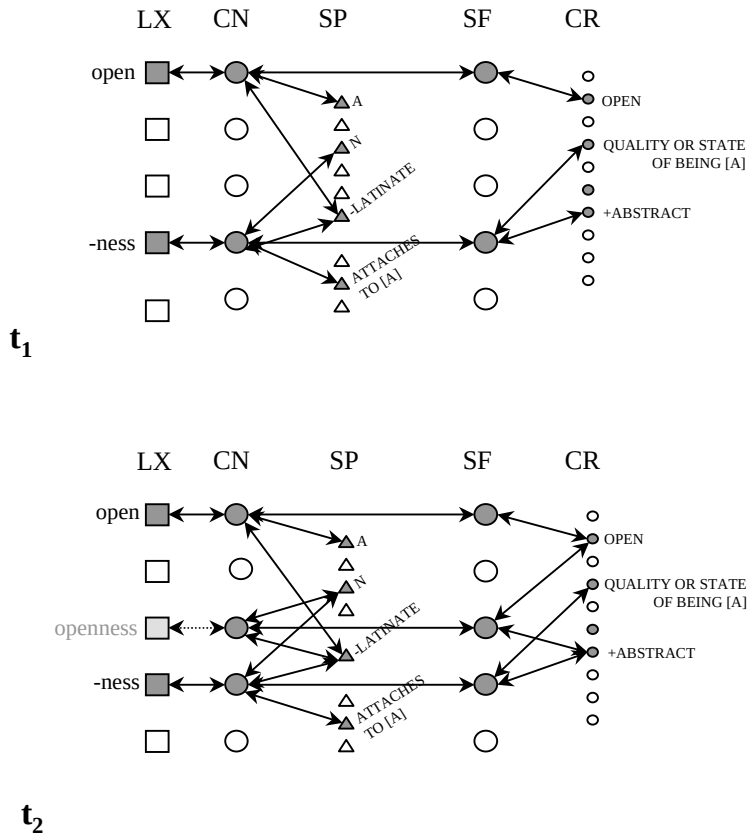

Figure 19. Example of a licensed combination. t_1 and t_2 represent subsequent time steps in the process of licensing and combining the word openness*, for which no lexical representation was available. The degrees of shading represent the level of activation. (Freely adapted from Schreuder & Baayen, 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 con-

junction 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 $[un[[do]_V[able]_A]_A]_A$ or $[[un[do]_V]_Vable]_A$. 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.

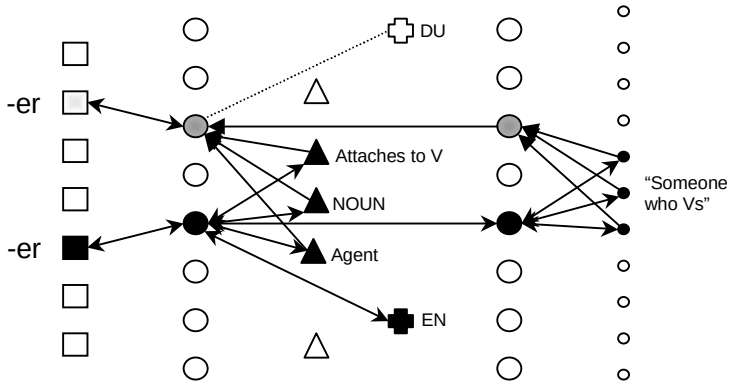

Figure 20. Simplified example of cross-linguistic co-activation of similar concepts in L1 and L2.The degree of shading reflects the level of activation. The dotted line represents a link that is marginally activated.

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 occur-

rence 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.