

- d. Hausa ( $\hat{v}$  = low tone,  $\acute{v}$  = high tone)
- |               |           |                  |                          |
|---------------|-----------|------------------|--------------------------|
| <i>búgàa</i>  | 'beat'    | <i>búbbùgáa</i>  | 'beat many times'        |
| <i>táakàa</i> | 'step on' | <i>táttàakáa</i> | 'trample'                |
| <i>dánnèe</i> | 'oppress' | <i>dáddànnèe</i> | 'oppress (many (times))' |
- (Newman 2000: 424)
- e. Tagalog
- |                 |              |                   |                 |
|-----------------|--------------|-------------------|-----------------|
| <i>ibigay</i>   | 'give'       | <i>ibinigay</i>   | 'gave'          |
| <i>ipaglaba</i> | 'wash (for)' | <i>ipinaglaba</i> | 'washed (for)'  |
| <i>ipambili</i> | 'buy (with)' | <i>ipinambili</i> | 'bought (with)' |
- f. German
- |               |        |                 |         |
|---------------|--------|-----------------|---------|
| <i>finden</i> | 'find' | <i>gefunden</i> | 'found' |
| <i>singen</i> | 'sing' | <i>gesungen</i> | 'sung'  |
| <i>binden</i> | 'tie'  | <i>gebunden</i> | 'tied'  |

4. In what way is the Tzutujil paradigm of Exercise 3 in Chapter 1 similar to the Finnish paradigm of (2.32)?
5. The distinction between strong suppletion, weak suppletion and non-suppletion is a continuum rather than a clear-cut three-way distinction, as is shown by Italian inhabitant nouns, which exhibit different degrees of similarity to the corresponding city names. Order the following pairs of city names and inhabitant names on a scale from clear suppletion to clear non-suppletion with affixation, depending on the number of segments in which the derivative differs from the base (see Crocco-Galèas 1991).

CITY NAME	INHABITANT NOUN	
Ancona	Anconetano	
Bologna	Petroniano	
Bressanone	Brissinese	
Domodossola	Domossolano	
Gubbio	Eugubino	
Ivrea	Eporediese	
Milano	Milanese	'Milan'
Napoli	Partenopeo	'Naples'
Palermo	Palermitano	
Palestrina	Prenestino	
Piacenza	Piacentino	
Savona	Saonese	
Trento	Trentino	
Treviso	Trevigiano	
Venezia	Veneziano	'Venice'
Volterra	Volaterrano	

# Lexicon and rules

# 3

## 3.1 Productivity and the lexicon

We have seen that the morphology of a language is (the study of) the knowledge that speakers have of the structure of complex words in their language. Now it turns out that defining and delimiting the set of complex words of a language is not an easy matter. This set contains both words that are familiar to most speakers (such as *mis-represent* and *global-ize* in English) and words that are novel and were perhaps never used before (such as *mis-transliterate* and *bagel-ize*, two words that I have just made up). Morphologists refer to these two types of words as **actual words** and **possible words** (or *usual* and *potential words*). Thus, the set of words in a language is never quite fixed. Speakers have the capacity to create, and hearers can understand, an almost unlimited number of new words. Dictionaries can record only the actual words, but at any time a speaker may use a possible (but non-actual) word, and, if it is picked up by other speakers, it may join the set of actual words (thus, if the number of bagel restaurants in Europe continues to grow, people will perhaps start saying that Europe is being *bagelized*). Attested novel lexemes that were not observed before in the language are called **neologisms**, and neologisms that do not really catch on and are restricted to occasional occurrences are called **occasionalisms**.

Morphological patterns or rules (such as the *mis-* prefixing rule and the *-ize* suffixing rule in English) that can be used to create new words are called **productive**. Not only derivational rules, but also inflectional rules are often productive. Thus, the German pluralization rule that suffixes *-en* (e.g. *Fahrt* 'trip', plural *Fahrt-en* 'trips') can create new word-forms when it is applied to new bases such as loanwords (e.g. *Box* 'loudspeaker unit', borrowed from English *box*, plural *Box-en*). The fact that many morphological rules are productive means that a computer program for natural language processing will not work properly if it just contains a dictionary and a set of

syntactic rules. True novel words are far less common than novel sentences, and most of the time we use words that we have used many times before. But, in principle, morphology is like syntax in that its rules may be productive.

From this perspective, what is really remarkable about morphology is that morphological rules may also be **unproductive**. An example of an unproductive derivational rule is the English suffix *-al* that forms action nouns (some of which are listed in (3.1a)). As the hypothetical but unacceptable forms in (3.1b) show, there are many verbs to which this suffix cannot be applied.

- (3.1) a. *refusal, revival, dismissal, upheaval, arrival, bestowal, denial, betrayal*  
b. *\*repairal, \*ignorance, \*amusal, \*belial, \*debuggal*

But the crucial point is one that cannot be made by giving examples: the suffix *-al* cannot be used at all to form novel lexemes in English. The list of nouns formed with *-al* is fixed (it contains 35 nouns according to the *OED*), and no new nouns can be added to this list. An example of an unproductive inflectional rule is the plural-forming German suffix *-er*, which occurs with dozens of German nouns (some of which are listed in (3.2a)), but cannot be extended to new nouns such as loanwords or abbreviated words (see (3.2b)).

- (3.2) a. *Feld/Felder* 'field(s)', *Kind/Kinder* 'child(ren)', *Kalb/Kälber* 'calf/calves',  
*Wort/Wörter* 'word(s)', *Mann/Männer* 'man/men'  
b. *Film/\*Filmer* 'film(s)', *Skateboard/\*Skatebörder* 'skateboard(s)',  
*ICE/\*ICEer* 'Inter-City Express train(s)'

English, too, has unproductive plural formations (*ox/oxen, child/children, man/men, foot/feet*, and others), but these are so idiosyncratic that they can be easily dismissed as 'irregular', i.e. not subject to any rule at all. One could hypothesize that speakers simply memorize both the singular and the plural form and do not establish a morphological relation between them. But not all unproductive formations are irregular or rule-less. It would be much less plausible to claim that German *-er* plurals are irregular in this sense, simply because there are so many of them. And, in fact, the notion of an unproductive rule is widely accepted among morphologists, both for word-formation and for inflection. Unproductive rules are a remarkable property of morphology, because there is no direct analogue to them in syntax.

The reason why languages may have unproductive rules is that complex words, like simple words, may be **listed** in the **lexicon**. The lexicon is the linguists' term for the mental dictionary that language-users must be equipped with, in addition to the grammatical rules of their language. When a linguist says that something is listed in the lexicon, this really means that it must be **stored** in speakers' **memories**, but linguists generally prefer more abstract, less psychological-sounding terminology. The lexicon

must contain at least all the information that is not predictable from general rules. For instance, the English lexicon must contain the monomorphemic English verbs *arrive, refuse, deny*, and it must contain words showing semantic peculiarities (e.g. *awful*, which is not the same as 'full of awe'). And, since it cannot be predicted that these verbs have an action noun in *-al*, the lexicon contains the nouns *arrival, refusal, denial* as well.

Thus, morphological rules play a dual role. When they are used to create a new word that is not listed in the lexicon, they have a **creative role**. If the neologism becomes current in the language, it may be added to the lexicon, and morphology thus serves to enrich the lexicon. But the fact that morphologically complex words may be listed in the lexicon means that morphological rules may also have a purely **descriptive role**, helping speakers to memorize and organize words in the lexicon. When English speakers use a noun like *arrival*, in all likelihood they simply retrieve it from their lexicon rather than constructing it on the fly. Thus, the *-al* rule is not needed to make words, but it helps organize the existing words in such a way that they can be used more efficiently. For example, a speaker whose grammatical knowledge includes the *-al* rule will find it easier to learn a new *-al* word never encountered previously.

However, although the existence of unproductive morphological rules with a purely descriptive role is widely assumed by linguists, it is difficult to find hard evidence that such rules are indeed learned by speakers and are cognitively real. Linguists are very eager to find patterns and rules everywhere in language structure, and no linguist would want to miss the generalization that one class of German nouns has an *-er* plural, or that one class of English action nouns ends in *-al*. But we do not really know whether speakers show the same eagerness for rules as linguists. Since they have to remember every word with an *-er* plural and every action noun in *-al* anyway, they might well be content with this information in list format and not abstract a rule from it. Only when a rule is productive and is observed to be extended to new bases can we be sure not only that the rule exists in linguists' descriptions, but that it is also cognitively real.

Even though most morphologists agree that all simple and at least some complex words are listed in speakers' lexicons, it is difficult to say which complex words are listed and which ones are not. One of the reasons for this is that morphological rules do not fall neatly into two types, productive and completely unproductive. Productivity is rather a matter of degree, and there are many rules of intermediate productivity. An example of an English derivational rule with a high degree of productivity is the English quality-noun suffix *-ness*, which can combine freely with almost any adjective that expresses a quality. The prefix *mis-* and the suffix *-ize* seem to be less productive, because many neologisms created with them sound rather awkward at first (cf. *?mis-pay, ?paper-ize*). Another English suffix with limited productivity is *-ee* (as in *employee, invitee*). There are quite a few neologisms with this suffix throughout the twentieth century (e.g. *arrestee*,

*offendee, mergee, editee, enrollee, abusee* (see Barker 1998)), but some of them sound peculiar, and, when one encounters such a neologism, it does not go unnoticed (in contrast to *-ness* neologisms, many of which are not even perceived as new). And, finally, there are also suffixes that are almost unproductive, but not completely unproductive, like English *-eer*, which has given rise to fairly recent neologisms such as *Common Marketeer* 'advocate of the Common Market'.

Thus, word-formation patterns in English can be arranged on a scale ranging from the most productive to the least productive. Figure 3.1 shows such a scale with a few examples of affixes and exemplary derivatives. In addition to the affixes mentioned so far in this section, Figure 3.1 also shows the unproductive deadjectival quality-noun suffix *-th* (as in *warmth, width, length*) and the action-noun suffix *-ter*, which occurs only with a single base (*laugh-ter*). Strictly speaking, a scale as in Figure 3.1 of course presupposes that we have a rigorous method for measuring the degree of productivity of a pattern. So far, Figure 3.1 is based only on impressionistic observations, but in Chapter 6 we will see ways of quantifying the productivity of a pattern.

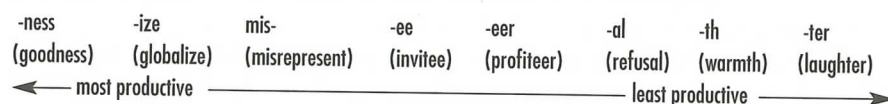


Figure 3.1 A scale of productivity: Some examples from English

If it is admitted that the productivity of word-formation patterns is not an all-or-nothing question but a matter of degree, the question of which words are listed in the lexicon becomes more difficult to answer. We cannot simply say that all non-productively derived words are listed, and all others are not listed, but we would need to specify some threshold degree of productivity beyond which listing is no longer required. This theoretical problem is completely analogous to the practical problem of deciding which words should be listed in a dictionary. Dictionary-makers seem to find it more urgent to list English words with the suffixes *-th* and *-al* than words with the suffix *-ness*, simply because the latter is much more productive.

One radical solution to this problem that has been adopted by some linguists is the hypothesis that no regular complex words are listed in the lexicon. On this view, the lexicon contains just simple, monomorphemic elements, i.e. roots and affixes, plus idiosyncratic complex words. This hypothesis is associated with an extreme version of the morpheme-combination approach to morphology (see Definition 2 in Section 1.1). The lexicon is a **morpheme lexicon**, and all complex words, whether productively or unproductively derived, are created by rules. In addition to avoiding the decision of which complex words to include in the lexicon, this approach has the advantage of requiring only a minimal lexicon. But

the morpheme lexicon must somehow also specify which unproductively formed lexemes are possible and which ones are not. If complex words cannot be listed directly, this information must be associated with the root morphemes by adding **diacritic features** to them, i.e. features that give information beyond the phonological and semantic make-up of the lexical entry. Thus, the root *warm* must bear a diacritic feature '[combines with *-th*]' (because *warmth* is an English word), and the root *arrive* must bear a diacritic feature '[combines with *-al*]' (because *arrival* is an English word). The disadvantage of this solution is that it claims that the existence of words like *warmth* and *arrival* is a property of their respective roots, although intuitively it is a property of the lexemes themselves. Moreover, the problem of the productivity continuum comes back eventually: for the affixes in the middle of the continuum, it is not so clear whether the roots need a diacritic or not.

Another radical solution to the problem of which words are listed in the lexicon takes exactly the opposite view: not just some, but all complex words are listed in the lexicon, whether they are regular or idiosyncratic, whether they are formed productively or unproductively. On this view, the lexicon is a **word-form lexicon**. One strong argument against the most radical version of this view comes from languages with richer inflectional systems than English. In Turkish, every verb can have hundreds of inflected forms, so that it seems completely impossible to memorize all verb forms that a speaker might want to use (Hankamer 1989). However, it is possible to assume a weaker version of the word-form lexicon, according to which a speaker memorizes all word-forms that they have heard, or that they have heard a certain number of times.

Of course, the big disadvantage of this approach is that it seems uneconomical, and thus inelegant. One important goal of linguistics is to provide an elegant description of language structure (see Section 1.2), and lists are inherently inelegant. A general methodological principle of linguistics (as in any other science) is that as many facts as possible should be subsumed under general rules and principles rather than merely stated in the form of a list. Since the rules are needed anyway for the creative role they play, they might as well be exploited for descriptive purposes, so that regularly derived words do not have to be listed. This is particularly true of inflected word-forms. No English dictionary would bother to list all regular third person singular forms and regular past tenses (*call, calls, called; like, likes, liked; etc.*), so why should a linguistic theory do so?

This is a classical case in which different goals lead to a conflict. As we saw in Section 1.2, another important goal of morphology is to provide a cognitively realistic description of morphological structures. The only way that the two goals of economy and cognitive realism would not come into conflict would be if speakers always chose the most economical analysis in their internal grammars. But there are strong indications that this is not the case. Speakers remember a word not only if it is unpredictable, but also if it

is very frequent. This is a general feature of animal (including human) cognition: the more often a cognitive stimulus occurs, the more easily it is remembered (for instance, the more often a pianist plays a piece, the sooner she will be able to play it by heart). This applies to words, whether predictable or unpredictable, as to anything else. Thus, it is quite likely that speakers store highly frequent complex words such as *things, goes, wanted, happiness* in their memories (i.e. their mental lexicons), although they are completely predictable and could easily be derived by productive rules from *thing, go, want, happy*. One piece of evidence for this is the fact that regular inflected forms may undergo an idiosyncratic sound change and thus become irregular. For instance, the past-tense forms of *have, say* and *make* used to be perfectly regular in earlier English (*haved, sayed, maked*). Since these are among the most frequently occurring verbs of the English language, they were vulnerable to an idiosyncratic shortening (see Section 12.3), and as a result they are now somewhat irregular (*had, said* [sɛd], *made*). If speakers had never stored these words in their lexicons, if they had stored just the stem and applied the *-ed*-suffixation rule each time the words were used, then it is difficult to see how they could have become irregular in the first place.

Thus, the cognitively most plausible model is probably one in which the mental lexicon consists of all idiosyncratic words (whether simple or complex) and some regular complex words. For regular words, all we can say is that the less productive the morphological rule is and the more frequent they are, the likelier it is that they are stored in the mental lexicon. This statement implies that we would not be able to make a general decision for the language as a whole, because word frequency is a performance phenomenon that is different for different speakers.

## 3.2 The form of morphological rules

By **morphological rule** (or **pattern**, or **process**), we mean any kind of regularity or generalization that is noticed by speakers and reflected in their unconscious linguistic knowledge. Morphologists try to develop a descriptive apparatus for expressing morphological rules, and the ultimate goal is to mimic the mental organization of speakers' linguistic knowledge in the form of morphological descriptions. There is, of course, a vast number of conceivable possibilities, and, compared to the complexities of human cognition, linguistic models are quite simplistic and probably not very realistic.

On the whole, the emphasis in this book is on questions of substance rather than questions of formal description. But in this section, two representative formalisms for morphological rules will be presented and contrasted, and it will be seen that questions of formalization can be enlightening and help to bring some major issues into clear focus. The two

formalisms that will be discussed are variants of the morpheme-based model and of the word-based model.

### 3.2.1 The morpheme-based model

In the morpheme-based model, morphological rules are thought of as combining morphemes in much the same way as syntactic rules combine words (see Section 2.2). In order to describe the structure of English words like *cheeseboard, bags, unhappier, eventfulness*, one could make use of the word-structure rules in (3.3), which are quite analogous to familiar phrase-structure rules as they might be used in syntax (see (3.4)).<sup>1</sup>

#### (3.3) Word-structure rules

- |                        |  |
|------------------------|--|
| a. word-form           | = stem (+ inflectional suffix)                                       |
| b. stem                | = (i) {deriv. prefix +} root (+ deriv. suffix)<br>(ii) {stem + stem} |
| c. inflectional suffix | = -s, -er, ...   |
| d. derivational prefix | = un-, ...   |
| e. root                | = <i>bag, event, cheese, board, happy, ...</i>                       |
| f. derivational suffix | = -ful, -ness, ...   |

#### (3.4) Phrase-structure rules

- |                |  |
|----------------|--|
| a. sentence    | = noun phrase + verb phrase                                |
| b. noun phrase | = (i) {determiner (+ adjective) + noun}<br>(ii) {sentence} |
| c. verb phrase | = verb (+ noun phrase)                                     |
| d. determiner  | = <i>the, a, some, ...</i>                                 |
| e. noun        | = <i>cat, rat, bat, ...</i>                                |
| f. verb        | = <i>chased, thought, slept, ...</i>                       |
| g. adjective   | = <i>big, grey, ...</i>                                    |

We can use the word-structure rules in (3.3) to create complex words by replacing elements in the left-hand column by elements in the right-hand column ('X ⇒ Y' means 'insert Y for X'). In the following, we see the individual steps by which the words *bags, unhappier* and *cheeseboard* can be created using the rules in (3.3).

- |  |                  |
|--|------------------|
| (3.5) word-form ⇒ stem + inflectional suffix | (by 3.3a)        |
| stem ⇒ root ⇒ <i>bag</i>                     | (by 3.3bi, 3.3e) |
| inflectional suffix ⇒ -s                     | (by 3.3c)        |
| word-form: <i>bag-s</i>                      |                  |

- |  |            |
|--|------------|
| (3.6) word-form ⇒ stem + inflectional suffix | (by 3.3a)  |
| stem ⇒ derivational prefix + root            | (by 3.3bi) |

<sup>1</sup> Elements in parentheses are optional; curly brackets and commas represent a choice between alternative options.

derivational prefix  $\Rightarrow$  *un-* (by 3.3d)  
 root  $\Rightarrow$  *happy* (by 3.3e)  
 inflectional suffix  $\Rightarrow$  *-er* (by 3.3c)  
 stem: *un-happy*  
 word-form: *un-happi-er*

(3.7) word-form  $\Rightarrow$  stem (by 3.3a)  
 stem  $\Rightarrow$  stem + stem (by 3.3bii)  
 stem  $\Rightarrow$  root (by 3.3bi)  
 root  $\Rightarrow$  *cheese* (by 3.3e)  
 root  $\Rightarrow$  *board* (by 3.3e)  
 stem: *cheese-board*  
 word-form: *cheese-board*

Since this approach assumes a close parallelism between morphology and syntax (and in the extreme case denies the distinction between the two domains altogether), it is sometimes called **word syntax**. The last four 'rules' of (3.3) are of course nothing but lists of morphemes, i.e. a morpheme lexicon. Thus, the word-syntactic approach fits well with the view that the lexicon contains just morphemes.

Many syntacticians have called into question the need for phrase-structure rules like (3.4a–c), on the grounds that the **combinatory potential**<sup>2</sup> of words is already contained in their lexical entry, so that the general rules are a redundant duplication. For example, the verb *chased* must be listed in the lexicon as having the combinatory potential [ $\_\$  NP],<sup>3</sup> the verb *thought* has the combinatory potential [ $\_\$  sentence] and the verb *slept* has no combinatory potential, i.e. it does not need to combine with any other syntactic element within the verb phrase. The verb-phrase rule (3.4c) is thus not really needed.

Similarly, in morphology we can dispense with word-structure rules in (3.3) and put all the relevant information into the lexical entries. Like full words, affixes may be said to have a combinatory potential that contains, among other things, information on the word-class of the base. Thus the comparative suffix *-er* combines with adjectives (combinatory potential [A  $\_\$  ]), the suffix *-ful* combines with nouns ([N  $\_\$  ]) and the prefix *un-* again combines with adjectives ([  $\_\$  A]).

When lexical entries of roots and affixes are enriched in this way, morphological description seems to reduce largely to the description of the lexical entries of morphemes, illustrated in (3.8). These contain at least information on the pronunciation, on the syntactic properties and on the meaning of the morpheme. In (3.8), the pronunciation is given between

slashes in phonetic transcription; the syntactic properties consist of the word-class (for roots) or of the combinatory potential (for affixes); and a rough indication of the meaning is given in quotation marks (naturally, a lot more needs to be said on the semantics of morphemes, but the details can be ignored for present purposes; see Section 11.1.1 for some aspects of the semantics that are relevant to morphology).

(3.8) proposed lexical entries for some morphemes:

a. <i>bag</i>	b. <i>-s</i>	c. <i>happy</i>	d. <i>un-</i>
$\left[ \begin{array}{c} /bæg/ \\ N \\ \text{'bag'} \end{array} \right]$	$\left[ \begin{array}{c} /z/ \\ N\_ \\ \text{'plural'} \end{array} \right]$	$\left[ \begin{array}{c} /hæpi/ \\ A \\ \text{'happy'} \end{array} \right]$	$\left[ \begin{array}{c} /ʌn/ \\ \_A \\ \text{'not'} \end{array} \right]$

Assuming that affixes have lexical entries much like roots (as in (3.8b) and (3.8c)) has the advantage that special rules for combining affixes and roots can be largely dispensed with. Root morphemes and affix morphemes are very similar on this view, differing mainly in that affixes have an obligatory combinatory potential and roots belong to one of the lexical word-classes (in Section 5.3 we will see that affixes, too, have sometimes been assigned word-class features). Moreover, a lexicon that contains only morphemes and no complex words is attractive because it is very economical, as we saw in Section 3.1. For these reasons, the morpheme-based approach to morphological description has been quite popular among theoretically minded morphologists.

### 3.2.2 The word-based model

In the word-based model, the fundamental significance of the word is emphasized and the relationship between complex words is captured not by splitting them up into parts, but by formulating **word-schemas** that represent the common features of sets of morphologically related words. For instance, the similarities among the English words *bags*, *keys*, *gods*, *ribs*, *bones*, *gems* (and of course many others) can be expressed in the word-schema in (3.9b).

(3.9) a. *bags, keys, gods, ribs, bones, gems, ...*

b.  $\left[ \begin{array}{c} /Xz/ \\ N \\ \text{'plurality of xs'} \end{array} \right]$

A word-schema is like a lexical entry in that it contains information on pronunciation, syntactic properties and meaning, but it may contain variables. In this way, it abstracts away from the differences between the related words and just expresses the common features. The schema in (3.9b) expresses the fact that all words in (3.9a) end in /z/, that they all

<sup>2</sup> Another term for *combinatory potential* that is widely used is the term *subcategorization frame*.

<sup>3</sup> In the formal description of combinatory potentials, a straight line is a variable for the element that is characterized by the combinatory potential (so here '[  $\_\$  NP]' means that *chased* is followed by an NP).

denote a plurality of things and that they are all nouns. The phonological string preceding the /z/ is quite diverse and is thus replaced by the variable /X/. Likewise, semantically these words share nothing besides the plurality component, so again the semantic part of the schema contains a variable ('x'). We will use the terms *match* and *subsume* for the relation between concrete words and the abstract schema: words **match** a schema, and a schema **subsumes** words (for example, the schema in (3.9b) subsumes the nouns in (3.9a) and many others, but not all English plural nouns match it; for instance, the plural *feet* does not match its phonological part).

Crucially, a word-schema stands for complete words, not for individual morphemes. In the word-based model, the lexicon consists of words, not of morphemes, and word-schemas capture the relationships between the words in the lexicon. Now what makes the word-schema in (3.9b) really significant for morphology is the fact that there exists a closely related schema (3.10b) that subsumes a very similar set of words (3.10a).

- (3.10) a. *bag, key, god, rib, bone, gem, ...*  
 b.  $\left[ \begin{array}{c} /X/ \\ N \\ 'x' \end{array} \right]$

The morphological relationship between these sets of words can now be represented in the morphological correspondence in (3.11).

- (3.11)  $\left[ \begin{array}{c} /X/ \\ N \\ 'x' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /Xz/ \\ N \\ 'plurality of xs' \end{array} \right]$

The double arrow means that, for some words matching the schema on the left, there is a corresponding word matching the schema on the right. (3.11) thus shows what a morphological rule looks like in the word-based model. Unlike the morpheme-based model, the word-based model has no way of dispensing with morphological rules, but it does not require lexical entries that are not words (i.e. neither affixes nor bases or roots). In fact, in the word-based model, the notion of morpheme is not necessary at all for the formal description. The rule in (3.11) is the word-based equivalent of the plural morpheme in (3.8b). Just as the morpheme-based model fits with the morpheme-lexicon view of Section 3.1, the word-based model fits with the word-form-lexicon view of Section 3.1. The basic idea is that speakers can form abstract categories or schemas of similar mental entities, and that morphological structure arises when speakers form a schema in which a formal aspect corresponds to a semantic aspect.

A striking advantage of the word-based model is that all kinds of non-concatenative processes can be described with it quite naturally, whereas such phenomena are difficult to accommodate in morpheme-based models.

As an example, (3.12b–c) shows the English rule for noun–verb conversion of nouns denoting instruments.<sup>4</sup>

- (3.12) a. *hammer<sub>N</sub>/hammer<sub>V</sub>, saw<sub>N</sub>/saw<sub>V</sub>, spoon<sub>N</sub>/spoon<sub>V</sub>, funnel<sub>N</sub>/funnel<sub>V</sub>, ...*  
 b.  $\left[ \begin{array}{c} /X/ \\ N \\ 'x (= \text{an instrument})' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X/ \\ V \\ 'use x (= \text{an instrument})' \end{array} \right]$   
 c.  $\left[ \begin{array}{c} /X/_{N} \\ 'x (= \text{an instrument})' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X/_{V} \\ 'use x (= \text{an instrument})' \end{array} \right]$

Here the word-schema on the right differs from the schema on the left only in word-class and meaning, but not in phonological form. Processes of base modification can be easily described by elaborating the phonological variable somewhat. For instance, shortening in Hindi/Urdu can be represented as in (3.13b), where /V/ stands for any short vowel and /VV/ stands for any long vowel.

- (3.13) a. *maar-/mar-* 'kill/die'  
 b.  $\left[ \begin{array}{c} /XV_1V_1Y/_V \\ 'A \text{ causes } B \text{ to happen}' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /XV_1Y/_V \\ 'B \text{ happens}' \end{array} \right]$

Reduplication is described by copying part of the phonological string in one of the word-schemas. (3.14b) shows the rule for the Somali duplifix *-aC* that we saw in (2.19) in the previous chapter (here /C/ is a variable for an arbitrary consonant).

- (3.14) a. *buug/buugag* 'book(s)', *fool/foolal* 'face(s)', *koob/koobab* 'cup(s)', ...  
 b.  $\left[ \begin{array}{c} /XC_1/_N \\ 'x' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /XC_1aC_1/_N \\ 'plurality of xs' \end{array} \right]$

Moreover, the word-based model can explain how **back-formations** (like *to babysit* from *babysitter*) are possible. In the morpheme-based model, it is quite puzzling that speakers should be able to create a verb *babysit*, because English does not have a productive rule combining a noun and a verb in this way, and there is no explanation for the fact that *babysit* is semantically closely related to *babysitter*. In the word-based model, this can be readily described. The noun *babysitter* happens to match two word-schemas simultaneously. First, it matches the nominal compound schema in (3.15), and everyone agrees that it was first created using this rule.

- (3.15)  $\left[ \begin{array}{c} /X/_N \\ 'x' \end{array} \right] \& \left[ \begin{array}{c} /Y/_N \\ 'y' \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /XY/_N \\ 'a y \text{ that has to} \\ \text{do with } x' \end{array} \right]$

(Note that, for compounds, the left-hand side of the correspondence must consist of two word-schemas.) And, second, it matches the word-schema of

<sup>4</sup> In (3.12c) I give an abbreviated notational variant of (3.12b), in which the word-class information is shown as a subscript. To save space, I will henceforth use only this notation.

non-compound agent nouns given on the right in (3.16). (Here 'do<sub>x</sub>' represents a variable action meaning.)

$$(3.16) \left[ \begin{array}{c} /X/_{\text{V}} \\ \text{'do}_x \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X\text{ər}/_{\text{N}} \\ \text{'a person who} \\ \text{(habitually) does}_x \end{array} \right]$$

Crucially, the correspondence in (3.16) is not inherently directed, as the bidirectional arrow indicates. In addition to the creation of *-er* nouns from verbs (like *bak-er*, *writ-er*, *sinn-er*, etc.), this rule also allows the creation of verbs lacking the element *-er* from nouns containing *-er* that denote an agent of some sort. In fact, back-formation is so natural in this model that one wonders why it does not occur more often: why do we not get *\*to butcher* from *butcher*, *\*to past* from *pastor*, and so on? However, it should be kept in mind that the rule format of our word-based model is neutral with respect to productivity. The arrows do not represent the productivity of the rule; they just record the existence of a correspondence. Clearly, the rule (3.16) is much more productive from left to right than from right to left. Under what sort of circumstances a rule is productive or unproductive is an important question that we return to in Chapter 6 (see also Section 9.2).

Finally, in the word-based model it is possible to describe relations between more than two sets of words. Consider the three sets of English words in (3.17).

(3.17)	<i>attract</i>	<i>attraction</i>	<i>attractive</i>
	<i>suggest</i>	<i>suggestion</i>	<i>suggestive</i>
	<i>prohibit</i>	<i>prohibition</i>	<i>prohibitive</i>
	<i>elude</i>	—	<i>elusive</i>
	<i>insert</i>	<i>insertion</i>	—
	<i>discuss</i>	<i>discussion</i>	—
	—	<i>illusion</i>	<i>illusive</i>
	—	<i>aggression</i>	<i>aggressive</i>

In order to describe the relations between these three sets, we minimally need the two rules in (3.18a–b), or in the morpheme-based model the morphemes [ /-ion/ ; N ; V\_\_ ] and [ /-ive/ ; A ; V\_\_ ]. (For the sake of simplicity, we use the spelling rather than the pronunciation in representing the affixes *-ion* and *-ive* here.)

$$(3.18) \text{ a. } \left[ \begin{array}{c} /X/_{\text{V}} \\ \text{'do}_x \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X\text{ion}/_{\text{N}} \\ \text{'action of doing}_x \end{array} \right] \quad \text{b. } \left[ \begin{array}{c} /X/_{\text{V}} \\ \text{'do}_x \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X\text{ive}/_{\text{A}} \\ \text{'prone to doing}_x \end{array} \right]$$

But these two rules do not suffice, because there are pairs like *illusion/illusive*, *aggression/aggressive* that lack a corresponding verb (*\*aggress*, *\*illude*). This means that we also need the rule (3.18c).

$$(3.18) \text{ c. } \left[ \begin{array}{c} /X\text{ion}/_{\text{N}} \\ \text{'action of doing}_x \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X\text{ive}/_{\text{A}} \\ \text{'prone to doing}_x \end{array} \right]$$

This morphological relationship cannot be described so easily in a pure morpheme-based model. The three rules (3.18a–c) can be collapsed into a single rule with three mutually corresponding word-schemas if we allow the two-dimensional triangular representation shown in (3.19).

$$(3.19) \left[ \begin{array}{c} /X/_{\text{V}} \\ \text{'do}_x \end{array} \right] \leftrightarrow \left[ \begin{array}{c} /X\text{ion}/_{\text{N}} \\ \text{'action of doing}_x \end{array} \right] \\ \swarrow \quad \searrow \\ \left[ \begin{array}{c} /X\text{ive}/_{\text{A}} \\ \text{'prone to doing}_x \end{array} \right]$$

Such rules involving more than two corresponding word-schemas will become important again later when we discuss inflectional morphology. We therefore introduce a further notational convention: sets of corresponding word-schemas are enclosed in curly brackets and separated by commas. Thus, (3.20) is a more convenient alternative notation for (3.19).

$$(3.20) \left\{ \left[ \begin{array}{c} /X/_{\text{V}} \\ \text{'do}_x \end{array} \right], \left[ \begin{array}{c} /X\text{ion}/_{\text{N}} \\ \text{'action of doing}_x \end{array} \right], \left[ \begin{array}{c} /X\text{ive}/_{\text{A}} \\ \text{'prone to doing}_x \end{array} \right] \right\}$$

### 3.3 Morphological change

This book is primarily about synchronic morphology, the nature of morphological patterns as they function in a particular language at a given time. But, in order to understand synchronic patterns better, it is sometimes useful to consider also the diachronic aspect of morphology, i.e. the way in which morphological patterns change over the centuries. Morphological change will be mentioned at various points later in this book. Here only some basic notions will be introduced. Four main types of morphological change will be distinguished: pattern loss, coalescence, analogical change, and reanalysis.

#### 3.3.1 Pattern loss

When a morphological pattern disappears from the language, sometimes this means that all the words formed by that pattern disappear. Such loss without traces seems to happen primarily in inflection. For instance, in older Ancient Greek a distinction between dual number ('two') and plural number ('more than two') was made in nouns, as illustrated in (3.21).

(3.21)	SINGULAR		DUAL		PLURAL
	<i>adelph-ós</i>	'brother'	<i>adelph-ō</i>	'2 brothers'	<i>adelph-oí</i> 'brothers'
	<i>ánthrōpos</i>	'human'	<i>ánthrōp-ō</i>	'2 people'	<i>ánthrōp-oi</i> 'people'

This distinction was lost in later Ancient Greek and is, for instance, absent by the time of New Testament Greek (first century CE). After the change, the

plural had to be used even if two items were referred to, and no dual-marked noun in *-ō* survived. In Latin, nouns distinguished at least five different case forms (nominative, genitive, dative, accusative, ablative), but all case distinctions have been lost in modern Romance languages such as Italian and Spanish. No genitive, dative or ablative noun has survived. The meaning distinctions that were expressed by cases are now carried by other means (prepositions and syntactic constructions).

Derivational patterns may also be completely lost. This happens when all lexemes formed according to a derivational pattern disappear from the language. Thus, Old English had a quality-noun pattern ending in *-u* (e.g. *menig* 'many' / *menigu* 'multitude', *eald* 'old' / *ieldu* 'old age', *strong* / *strengu* 'strength'). None of these nouns survived into modern English, so the pattern was lost without trace.

But morphological patterns often leave plenty of traces when they die. For example, English used to have a suffix *-t* that formed action nouns from verbs:

(3.22)	VERB	ACTION NOUN
	<i>draw</i>	<i>draft</i>
	<i>drive</i>	<i>drift</i>
	<i>may</i>	<i>might</i>
	<i>weigh</i>	<i>weight</i>
	<i>freeze</i>	<i>frost</i>
	<i>shove</i>	<i>shift</i>

In most cases, both the semantic and the formal connection between the two lexemes was lost, as a result of semantic and phonological change that did not affect all words equally. The verb *may* used to mean 'have power', but in its contemporary meaning 'be allowed' it is no longer semantically connected to *might*. Perhaps with the exception of *weigh/weight*, the above pairs of words are no longer morphologically related, and the suffix *-t* has ceased to exist in English. However, many of the words that were once derived with *-t* survive, and, although they are no longer morphologically complex, they bear witness to the former existence of a rule of *t*-suffixation.

Pattern loss with lexical traces also occurs in inflection. For instance, older Slavic used to have a singular-dual-plural distinction, much like older Classical Greek (e.g. Old Church Slavonic *roka* 'hand', *ročě* 'two hands', *roky* 'hands'). In modern Polish, the dual was lost as a morphological distinction, and nouns have only a singular and a plural form (e.g. *żona* 'wife', *żony* 'wives'). However, in a few nouns the modern plural form is identical to the former dual (e.g. in *ręka* 'hand', plural *ręce* 'hands'). Thus, although the dual as a pattern disappeared, not all dual word-forms disappeared from the language.

### 3.3.2 Coalescence

By far the most important way in which new morphological patterns arise is by **coalescence** of several formerly free syntactic elements. When the two elements that coalesce are full, non-auxiliary words, the result of the coalescence is a compound (the process of coalescence that results in a compound is also called **univerbation**). For example, the pattern exemplified by the Swedish compound *kyrkomusik* 'church music' (cf. *kyrka* 'church', *musik* 'music') comes from a syntactic phrase in which the genitive NP precedes the head (*kyrko* was the genitive form of *kyrka* in older Swedish). After the univerbation, this phrase had become a single word. The vowel *-o* is no longer a genitive suffix (all nouns now take the genitive suffix *-s*, so 'church's' is *kyrkas*), but an affix that is peculiar to the compound pattern.

When one of the coalescing elements is a semantically abstract, auxiliary element, the result of the coalescence is an affixed word, and the process by which this happens is called **grammaticalization**. Let us consider an example from Spanish, which has a future tense that is formed by adding the suffix *-r* to the stem, followed by a series of special person-number suffixes:

(3.23)	PRESENT TENSE	FUTURE TENSE
1SG	<i>cant-o</i> 'I sing'	<i>canta-r-é</i> 'I will sing'
2SG	<i>canta-s</i>	<i>canta-r-ás</i>
3SG	<i>canta</i>	<i>canta-r-á</i>
1PL	<i>canta-mos</i>	<i>canta-r-émos</i>
2PL	<i>cantá-is</i>	<i>canta-r-éis</i>
3PL	<i>canta-n</i>	<i>canta-r-án</i>

In Latin, Spanish's ancestor, there existed a future tense (e.g. *cantabo* 'I will sing'), but this pattern disappeared from the language without trace, and instead a completely new future-tense pattern was created. Originally this was a syntactic pattern, involving the auxiliary verb *habere* 'have' (Spanish *haber*), which was combined with the infinitive to express obligation, as in English: *habeo cantare* or *cantare habeo* 'I have to sing'. Then the meaning shifted from obligation to future, and the verb *haber* lost its freedom of position and came to occur only immediately after the main verb. As a result of phonological reduction, the infinitive lost its final *-e* (*cantare* became *cantar*) and the forms of the verb *haber* were shortened (*he, has, ha, habemos, habéis, han*). Finally, the infinitive and the forms of *haber* were fused together to form a set of single complex words:

(3.24)	<i>cantar he</i>	>	<i>cantaré</i>
	<i>cantar has</i>	>	<i>cantarás</i>
	<i>cantar ha</i>	>	<i>cantará</i>
	<i>cantar (hab)emos</i>	>	<i>cantarémos</i>
	<i>cantar (hab)éis</i>	>	<i>cantaréis</i>
	<i>cantar han</i>	>	<i>cantarán</i>



Such grammaticalization changes are extremely common in languages, and the vast majority of all (non-compound) morphological patterns seem ultimately to go back to such syntactic phrases with auxiliary words. In most contemporary cases, we cannot tell exactly what happened because the changes occurred in prehistoric times. Thus, it is a quite plausible hypothesis that the English past-tense suffix *-ed* goes back to the form *did* (so *walked* comes from *walk did*, etc.), but, since this change occurred at least 2000 years ago, we will never know for sure. However, there are enough attested cases of grammaticalization like the Spanish future that help us understand the way grammaticalization works.

### 3.3.3 Analogical change

An analogical change is said to occur when speakers form a new word on the model of (or **by analogy** with) another word. For instance, the English verb *dig* used to have past tense formed with the suffix *-ed* (*digged*), but at some point the past-tense form *dug* was created, clearly on the model of verbs like *sting/stung*, *stick/stuck*, and so on. In order to show clearly what happens in analogical change, linguists often use **proportional equations** as in (3.25). The two terms on the left-hand side of the equation represent the model, and the X on the right-hand side represents the word that is newly created by analogy.

$$(3.25) \text{ stick} : \text{stuck} = \text{dig} : X \\ X = \text{dug}$$

Two main types of analogy are distinguished: analogical extension and analogical levelling. The creation of the past-tense form *dug* is an example of **analogical extension**: the *i/u* pattern is extended to a new lexeme. Another example is the Polish plural suffix *-owie*. Originally this occurred only with a few nouns (those belonging to the *u*-declension), e.g. *syn* 'son', plural *synowie* 'sons'. But later it was extended to quite a few other nouns denoting male humans, e.g. *pan* 'lord, sir', plural *panowie*.

$$(3.26) \text{ syn} : \text{synowie} = \text{pan} : X \\ X = \text{panowie}$$

Analogical extension also occurs in derivational morphology. For instance, on the model of pairs of French loanwords such as *change*, *changeable*, adjectives in *-able* were formed from native English words like *wash*:

$$(3.27) \text{ change} : \text{changeable} = \text{wash} : X \\ X = \text{washable}$$

However, analogical extension in derivation is not usually regarded as analogical 'change', because new lexemes like *washable* simply enrich the lexicon and do not (or not necessarily) oust other forms that are replaced by them.

**Analogical levelling** occurs when a morphophonological alternation in the stem is eliminated (or 'levelled'). An example comes from French: the verb *trouver* 'find' used to have two different forms of the stem in older French, *trouv-* and *treuv-*. The former occurred in word-forms that were stressed on the suffix, and the latter occurred in word-forms that were stressed on the stem. This alternation resulted from a sound change that treated the original stem vowel differently in different environments. When the old stem vowel *o* was unstressed, it turned into *ou*, but when it was stressed, it turned into *eu* (compare Italian *trovare*, which underwent neither of these sound changes). (In (3.28), a dot below the syllable indicates the position of the stress.)

	older French	modern French
(3.28) 'I find'	<i>je treuve</i>	<i>je trouve</i>
'you find'	<i>tu treuves</i>	<i>tu trouves</i>
'he finds'	<i>il treuve</i>	<i>il trouve</i>
'we find'	<i>nous trouvo<sup>ns</sup></i>	<i>nous trouvo<sup>ns</sup></i>
'you(PL) find'	<i>vous trouvez</i>	<i>vous trouvez</i>
'they find'	<i>ils treuvent</i>	<i>ils trouvent</i>

As (3.28) shows, this stem alternation no longer exists in modern French: all forms of the verb *trouver* have the same stem vowel. This change, too, can be described by a proportional equation. The analogical model might be a verb that never showed a stem alternation because its stem vowel was not subject to stress-sensitive sound changes (e.g. *chercher* 'seek'):

$$(3.29) \text{ chercher} : (\text{je}) \text{ cherche} = \text{trouver} : X \\ X = (\text{je}) \text{ trouve}$$

The description of these changes in terms of analogy and proportional equations is widespread in the study of diachronic morphology, but it should be noted that these changes can also be described in different terms. Analogical extension can simply be described as increase in the productivity of a morphological rule. Thus, the English *i/u* alternation (as in *stick/stuck*) became more productive at a certain stage and came to be applied to new words, in this case to words that used to have a different past-tense form. And analogical levelling can be described as a change whereby a phonological allomorph is lost from the language. The notation in terms of proportional equations as in (3.25)–(3.29) suggests that a single word pair served as the model for the change. But, in fact, there is no particular reason to assume that, for instance, French *trouve* was created on the basis of *chercher* : *cherche*, rather than, say, *chanter* : *chante* ('sing'), or *penser* : *pense* ('think'). It seems that the left-hand part of a proportional equation, the model, has to be understood as a general pattern, a word-schema, rather than as a specific word. If that is the case, then a formula such as *chercher* : *cherche* becomes virtually indistinguishable from word-based rules of the kind we saw in Section 3.2.2 ([/Xer]<sub>v</sub> 'infinitive') ↔ [/Xe]<sub>v</sub> 'first person

singular']). Thus, the solution of an analogical equation is practically the same as the application of a word-based rule to a novel word.

### 3.3.4 Reanalysis

Reanalysis is the commonly used term for a change by which a complex word comes to be regarded as matching a different word-schema from the one it was originally created by. For instance, Ancient Greek has a suffix *-ízō* deriving denominal verbs that denote an activity associated with the base noun, e.g. *kithára* 'guitar', *kitharízō* 'play the guitar'. In addition, there is a suffix *-tés* that derives agent nouns from verbs, e.g. *kitharistés* 'guitar player' (see 3.30a–b). Although *kitharistés* was originally derived from *kitharízō*, it could also be seen as related directly to *kithára*. In other words, because of the formal and semantic resemblances between *kitharistés* and *kithára* (and other similar word pairs), it was possible to set up a new correspondence between the left-hand word-schema in (3.30a) and the right-hand word-schema in (3.30b). The new correspondence or rule is shown in (3.30c).

- (3.30) a.  $[/X/_N 'x'] \leftrightarrow [/Xízō/_V 'do something with x']$   
 b.  $[/Xō/_V 'do_x'] \leftrightarrow [/Xtés/_N 'person who does_x']$   
 c.  $[/X/_N 'x'] \leftrightarrow [/Xistés/_N 'person who does something with x']$

This rule (3.30c) became productive and it was thus possible to create new words in *-istés* (later pronounced *-istís*) without the existence of a verb in *-ízō*. For example, the Modern Greek word for 'spiritist' is *pneumatistís*, directly derived from *pneuma(t)* 'spirit' (there is no verb *\*pneumatízo*). Put somewhat more simply, we can say that *kitharis-tés* was **reanalysed** as *kithar-istés*, and thereby the suffix *-istés* was created (this is, incidentally, the source of the English suffix *-ist*). This type of reanalysis may be called **affix telescoping**, because two formerly independent affixes are combined into a new compound affix.

By the definition of reanalysis given here, back-formation (discussed in Section 3.2.2) is also a kind of reanalysis, because here, too, a new formation becomes possible after a complex word has been associated with a word-schema that played no role in creating the word.

Another kind of reanalysis is **secretion**, whereby an element that used to be part of a root is turned into an affix. Secretion is in general a rare phenomenon, but it happens to be fairly common in contemporary English. At the beginning usually stands a process of blending, e.g. the word *workaholic*, which is a blend of *alcoholic* and *work*. When more blends of this kind are being created (e.g. *tobaccholic*, *marihuana-holic*), we can start recognizing a suffix *-aholic* ('person addicted to something'). This suffix did not arise by coalescence, but was, so to speak, 'secreted' from the original word *alcoholic*.

Thus, like coalescence, reanalysis creates new morphological patterns, but, as we noted in Section 3.3.2, new patterns seem to arise much more often by coalescence than by reanalysis.

### 3.3.5 Other changes

The four main types of change discussed so far in this section do not exhaust the possibilities, and I will mention two more here. Morphological patterns may have their origin in phonological rules that are no longer truly phonologically conditioned and come to be associated with morphological patterns. For instance, the German Umlaut was once phonologically conditioned by a high front vowel in the following syllable (e.g. *Tag* 'day' / *täglich* 'daily', *Gott* 'God' / *göttlich* 'godly, divine'), but the rule has long ceased to be a phonological rule. It is now an operation that accompanies certain morphological patterns and is used productively (e.g. *Revolutionchen* 'little revolution', *Fäxchen* 'little fax'), and sometimes it can signal the plural on its own (e.g. *Mutter* / *Mütter* 'mother(s)' (see Section 2.2). The role of phonology in morphology will be discussed further in Chapter 10.

Another kind of change is simply semantic change. The contemporary future-tense form in Lezgian (*-da*) expresses both future and habitual meaning (e.g. *čüxiüda* 'will wash; washes habitually'), but it must have expressed the ongoing present tense at an earlier point as well (Haspelmath 1998). Such semantic changes in inflectional categories are common and interesting, but they are not normally discussed under the heading of morphology. This particular change would be discussed in the context of the study of grammatical semantics of tense–aspect systems.

## Summary of Chapter 3

In morphology, the relation between listed elements and combinatory rules is more complicated than in syntax because rules vary in productivity and it is difficult to maintain that only simple words and morphemes are listed in the lexicon. The opposite view, that all words (even those formed by the most productive rules) are listed, is not possible either, so the most realistic view is that all idiosyncratic and many regular words are stored in speakers' memories.

Morphological structures can be described by a morpheme-based model, with rules or principles for the combination of morphemes, or by a word-based model in which correspondences between abstract word-schemas are the main formal device. The word-based model naturally accommodates non-concatenative operations, back-formation and relations between more than two sets of words.

There is a wide range of processes of morphological change, the most important of which are pattern loss (with or without traces), coalescence (especially grammaticalization), analogical change (extension and levelling) and reanalysis.

## Further reading

For further references on productivity, see Chapter 6.

A morpheme lexicon and the morpheme-based model is advocated by Bloomfield (1933), Selkirk (1982), Di Sciullo and Williams (1987) and Lieber (1992). A word-form lexicon and the word-based model is advocated by Bybee (1988), Becker (1990) and Bochner (1993).

For morphological change in general, see McMahon (1994: ch. 4) and Anderson (1988). For grammaticalization, see Lehmann (1985, 1995), Hopper and Traugott (1993) and Haspelmath (1999). Analogy and its relation to morphological rules are discussed by Becker (1990), and morphological reanalysis is discussed in Haspelmath (1995).

## Exercises

1. Which of the following English words are actual, possible and impossible?

*replay, libertarian, itinerance, reknow, fraternitarian, penchance, rebagelize, abundance, happytarian*

2. What would be the lexical entries of the following English morphemes (using the formalism of (3.8))?

*hear, -ing* (as in *playing, dancing*, etc.), *re-* (as in *replay, rewrite*, etc.), *good, -s* (as in *sells, knows*, etc.)

3. Formulate the morphological rule in the word-based format of (3.11) (i.e. as a correspondence between word-schemas) for the following pairs of words (each standing for a large set of such pairs):

*warm – warmer*  
*happy – unhappy*  
*play – replay*  
*happy – happily*

4. Formulate the word-based morphological rule for the six sets of word pairs in Exercise 3 of Chapter 2.
5. The word *edit* (first attested in 1791) is a famous example of a back-formation from the noun *editor* (first attested in 1649). Which morphological rule was used in the reverse direction in this back-formation?
6. Formulate the proportional equations for the following analogical changes:

- a. The earlier English vowel alternation in adjectival degree inflection (e.g. *strong/strenger, long/lenger, broad/breader*) underwent analogical levelling on the model of *clean/cleaner*, thus leading to the new comparatives *stronger, longer, broader*.
- b. The Greek noun *patír*<sub>NOM.SG</sub> / *patéra*<sub>ACC.SG</sub> 'father' acquired a new nominative singular *patéras* by analogical levelling of the stem and analogical extension of the nominative singular suffix *-s* (cf. words such as *neanías*<sub>NOM.SG</sub> / *neanía*<sub>ACC.SG</sub> 'young man').
- c. The Old English genitive singular suffix *-es* (as in *stan*<sub>NOM.SG</sub>, *stanes*<sub>GEN.SG</sub> 'stone(s)') was analogically extended to other nouns such as *modor*<sub>NOM.SG</sub>, *modor*<sub>GEN.SG</sub> 'mother' and *sunu*<sub>NOM.SG</sub>, *suna*<sub>GEN.SG</sub> 'son' (cf. Modern English *mother's, son's*).

7. Formulate the morphological rule for the following Tagalog lexeme pairs:

<i>búhay</i>	'life'	<i>buháy</i>	'alive'
<i>gútom</i>	'hunger'	<i>gutóm</i>	'hungry'
<i>tákot</i>	'fear'	<i>takót</i>	'afraid'
<i>hába?</i>	'length'	<i>habá?</i>	'long'
<i>gálit</i>	'anger'	<i>galít</i>	'angry'

8. Go back to the Sumerian example in (1.1) and provide a morphological description.