Chapter 7

Conclusions

The purpose of this thesis was to use an evolutionary approach in the field of historical linguistics, and to discuss several cases of language change from this perspective, using agent-based computer models. As such, this thesis aimed to explain specific phenomena of language change as instances of more general behavior of evolutionary systems. In this final chapter, I will give a short overview of these case studies and their results, and discuss the general conclusions that can be drawn from them.

The approach to take language as an evolutionary system and to use computer modeling techniques has been used in several studies in recent years. Many of these studies focus on ‘language origin’: the question how a system like language can have evolved in early hominids (see Fitch 2005:15 for an overview of recent publications). Other studies focus on language change (e.g. Niyogi & Berwick 1997, Nettle 1999, Yang 2000), and the present work should be regarded as a contribution to the latter field. At the same time, this thesis differs from it in that it is written from a strong linguistic perspective, using concrete linguistic examples and linguistic theory (cf. Croft 2000, Bybee 2006), while most of the aforementioned studies are more mathematical or artificial intelligence-based. Needless to say, this is not a judgment, but rather a remark on the perspective of these works. This thesis’ intended audience are historical linguists, who are concerned with very specific linguistic questions on language change, and who have little or no knowledge of evolution theory or computer modeling. The thesis’ goal is to present to them an approach that may at first seem complicated, but on closer inspection turns out to be insightful and explanatory, and a useful tool in research on language change.

For this reason, I have discussed a number of case studies on different issues in historical linguistics, such as unidirectionality, isomorphism, and preservation or loss of original meaning. I have used actual linguistic material to illustrate these cases.
An overview of the chapters and their conclusions

The case studies in this thesis deal with different topics, and I will review each of them and their conclusions briefly before turning to more general conclusions.

Chapter 2 deals with general tendencies in semantic change, and chapter 3 with isomorphism and the problem of free variation. Chapters 4-6 all deal with the Dutch verb *krijgen*, but can be read as independent chapters. Chapter 4 differs from all other chapters in that it is the least ‘evolutionary’ and contains no computer modeling, but rather a ‘traditional’ historical linguistic study on the development of *krijgen*. I have used these findings in the subsequent chapters 5-6. In chapter 5, I discuss how semantic change as observed in *krijgen* can be modeled, and discuss mechanisms affecting preservation and loss of original meanings. In chapter 6, I show a new technique to reconstruct diachrony based on synchronic data, and compare its outcome with the results from chapter 4.

In chapter 2, I discussed a general computer model of semantic change. In this model, agents have knowledge of the meaning of one word, and this ‘meaning’ is polysemous, consisting of multiple related senses (cf. Geeraerts 1997). Semantic change is a change in this polysemy: there can be a change in the number of senses, or a shift in the kind of senses that make up the total meaning. The main result of the computer simulation was that unidirectionality in semantic change can be understood as a result of different usage properties of lexical meaning versus functional meaning. First, functional meanings are more general and abstract, which enables them to be used in more contexts. This gives them a frequency of use that is higher than that of lexical meanings, and that produces unidirectional change. Second, the assumption that lexical meaning can be manipulated more easily than functional meaning has a similar effect. The latter can be conceived of as an asymmetry in the occurrence of mutations, and it also leads to unidirectional change.

In chapter 3, I discussed the principle of competitive exclusion in language. This principle explains the one form-one meaning tendency in language as a result of competition: two forms that compete for the same resource (meaning) cannot remain in a stable co-existence. Instead, due to stochastic processes, one of the two forms will become the single form linked to the particular meaning, at the expense of the other form. The only way for two competing forms to both remain in existence is either full or partial differentiation of the resource, that is, the meaning. To illustrate this, I used the example of adjective-noun combinations in German, Dutch and English, which function as category names and appear as both compounds (*grandson, software*) and as lexicalized phrases (*full moon, cold war*). Interestingly, both forms appear in the three languages in a seemingly stable equilibrium, which is at odds with the principle of competitive exclusion. I have proposed to consider the domain of AN-combinations as a ‘niche’ for which the two
linguistic variants compete, and discussed two main selection pressures that are at work in this system. First, certain factors of usage (frequency, special meaning) and form cause phrases to enter the system regularly, and second, the presence of a case system leads to a preference for compounds over phrases.

Such a system of competing forms is in principle unstable, as I have shown with a computer model. Because phrases enter the system at a slow but steady rate, they will eventually always drive compounds to extinction. A selection pressure against phrases, due to the presence of a case system, can slow this process down, but cannot stop it.

However, the system of AN-combinations turns out to be more complex. Three different semantic types of AN-combinations can be distinguished, and free variation only occurs in one of these types. I show that this semantic differentiation can explain the stable equilibrium. Both forms appear exclusively in one of the semantic sub-niches, which guarantees them a basic frequency. In turn, this basic frequency leads to preservation in the shared sub-niche. Thus, I claim that the possibility for semantic specialization leads to linguistic preservation. Theoretically, this gives rise to the proposal to replace the traditional isomorphism principle with the (biologically inspired) exclusion principle.

As I mentioned earlier, chapter 4 is a traditional study of the history of the Dutch verb *krijgen*. This verb’s development is a classic case of grammaticalization: it gradually changes from a main verb with a concrete and agentive meaning into a verb with a general, abstract meaning, both as a main verb and as an auxiliary. Originally, it is exclusively used with intentional, human subjects, but over time, the use with inanimate subjects increases. Also, its overall frequency increases as well. I proposed how the development of the verb can be explained by mutations in the use of the direct object. The extension of the set of direct objects from concrete objects to that of ‘inner states’ (such as ‘luck’ and ‘peace of mind’), allowed a less agentive interpretation, and in turn, a reanalysis of the role of other participants. Thus, the agent role became less strongly linked to the grammatical subject, which led to both non-agentive uses of *krijgen* (comparable to English ‘get’ in uses like *I feel like I’m getting sick*) and uses in which the grammatical subject had a recipient role (comparable to ‘get’ in uses like *I’m getting a new bike from my parents*). These ‘bleached’ meanings in turn enabled the development of auxiliary uses, such as that of semi-passive marker.

In chapter 5, I continued the study of *krijgen*, with a focus on the development of its transitive use. The main goal of this chapter was to present how a computer model of semantic change can be constructed, and to show what mechanisms affect preservation and loss of an original meaning in the system. The computer model is based on existing exemplar models of language. The basic assumption of these models is that language users are continuously sensitive to
linguistic experience, and that their linguistic knowledge consists of representations of both specific instances (exemplars), and of abstractions based on these instances. In this chapter, I show how such an approach can be applied to model semantics as well. Meaning is transmitted indirectly, but the interpretation of meaning can be linked to aspects of transmission that take place (more) directly, such as the properties of the direct object in the usage of *krijgen*.

In such a system, it turns out that it is much easier to obtain semantic extension in which the original meaning is preserved, than to obtain semantic shift, in which the original meaning is lost. By allowing more innovation in the system, the range of meanings for *krijgen* grows, but the original meaning remains present in the system. The addition of a skewed frequency of use, in which less agentive uses will be used more frequently than the original agentive uses, led to a loss of the original meaning. With such a set-up, it was also easy to account for the frequently occurring cases of semantic shift, in which the original meaning survived only in highly concrete uses.

Finally, in chapter 6, I investigated the use of phylogenetic inferencing in the field of historical linguistic research. This method makes it possible to reconstruct historical relationships between particular uses on the basis of synchronic variation. I applied this technique to the verb *krijgen*, and compared the outcome with the results of the diachronic study in chapter 4. Phylogenetic inferencing is a biological technique that is used mainly in the classification of species in larger families, but recently, it has also been applied in linguistic classification studies. Its strength is that it uses present-day data to reconstruct the past, and as such it can be a valuable addition to historical research. Historical data is often incomplete, in that material from some centuries can be hard to find. Also, collecting and interpreting historical material is time-consuming. For these reasons, phylogenetic inferencing is a welcome new tool, although I need to stress that it will have to be used as an additional tool, and not as a replacement of conventional methods.

As a first investigation, the phylogenetic reconstruction of *krijgen*’s past is successful. With only a small set of characteristics, it is possible to reconstruct the general development of *krijgen*. However, the limited size of the set of characteristics also turns out to be the method’s weak point as far as historical research of a particular linguistic item is concerned. With a low number of characteristics, branches in the phylogenetic tree are sometimes unreliable, being based on a single shared characteristics value. The best candidates to be investigated with this method are therefore those linguistic items that have undergone significant changes on all linguistic levels: syntax, semantics, phonology and pragmatics, and thus allow for a large set of characteristics. Of course, another important condition is that these different uses are still present in the item’s present-day use.
In summary, the following conclusions can be drawn from this thesis:

- Unidirectionality in change can be understood as a result of different usage properties of lexical versus functional meaning.
- The biological principle of competitive exclusion can be used in linguistics to explain the tendency for meaning to be uniquely linked to a single form.
- (Partial) semantic specialization can lead to a violation of the principle of competitive exclusion.
- The semantic bleaching of Dutch *krijgen* can be understood as the result of an extension of its direct object use.
- In the absence of competing words, semantic extension occurs more easily than semantic shift.
- Semantic shift can occur by assuming a higher frequency of use for non-agentive senses than for agentive senses.
- It is possible to reconstruct the historic development of single words within a language (such as *krijgen*) with synchronic data, using phylogenetic inferencing techniques.

**General conclusions and recommendations for further research**

This thesis did not have a single main research question. It is the result of a project that intended to apply evolutionary computer models to language in different case studies, and, by doing this, to show the benefits of such an approach. If, however, a single conclusion had to be drawn on the basis of this starting point, it would be that an evolutionary approach is indeed a valuable tool in the study of language change. In the chapters in which I presented agent-based models, I showed that the approach makes it possible to reduce complex linguistic phenomena to a set of mechanisms that can be studied independently. In the chapter on phylogenetic reconstruction, I showed that the development of a single verb can be reconstructed using techniques from evolutionary biology.

Behind the argument that the evolutionary approach is a valuable tool lies the assumption that language can be considered an evolutionary system in its own right: a system consisting of a vast number of utterances that by use are transmitted from one individual to the other, and that are subject to mutation and selection. A system, also, that is never static but constantly changing, sometimes rapidly, sometimes so slowly that it can hardly be witnessed. The evolutionary approach to language shows how usage and change are tightly linked.

From the three chapters in which I used agent-based models, another conclusion can be drawn. In these three cases, I showed how different linguistic phenomena – unidirectionality, violations of the isomorphism principle, and
preservation versus loss of meaning – can be explained by very basic mechanisms like innovation and frequency of use: general mechanisms that are present in all evolutionary systems. This is an interesting finding, because it shows that, at least in some ways, these linguistic phenomena are not ‘special’ to human language, but that they are manifestations of behavior that can also be witnessed in other evolutionary systems.

Another conclusion that can be drawn from this thesis is that it has only scratched the surface of what can be achieved in this field. In many ways I had to restrict myself in this study, both in scope and in depth. As I hope to have shown, computer models are very useful in gaining a better understanding of how particular processes work and what role certain conditions and parameters play. However, it is important to remain aware of their limitations. A particular model does not necessarily have to represent reality: although its results make it feasible to make claims about certain parameters, this does not rule out the possibility that similar results could also be obtained with different parameters. The computer models I have used consisted of small populations with no population structure (such as social networks) and no or only negligible generation effects. This means that I have not considered the possible roles of these factors in the phenomena I investigated. Although this limitation has to be kept in mind, it certainly does not make the results from computer modeling less interesting. I have shown that explanations can be given for certain linguistic phenomena on the basis of non-social factors that are basic components of elementary linguistic communication (including frequency of use and frequency of communication between individuals). Whether or not social factors are also involved in these phenomena, this does not affect these results. In fact, this issue again shows the value of the evolutionary modeling approach, in that the role of different mechanisms can be independently studied. I would even like to argue that they must be studied independently, because only then will it be possible to fully understand their proper role in some phenomenon, and only then can the inference that other mechanisms produce this phenomenon be rejected.

Apart from further investigation of the effects of social factors on language change using computer models, another interesting path for future research is the implementation of more realistic data on language use. A recent study (which unfortunately appeared too late to be incorporated in the research in this thesis) measured the actual language use of individuals per day (Mehl, Vazire, Ramírez-Esparza, Slatcher & Pennebaker 2007). With this finding, it becomes possible to estimate the actual use of a particular word (using word frequency tables), and to incorporate this into a computer model. Comparable to this are two recent studies in which quantitative data has been used to get a better understanding of the role of frequency in lexical replacement (Pagel, Atkinson & Meade 2007) and in the
regularization of irregular verbs in English (Lieberman, Michel, Jackson, Tang & Nowak 2007).

Again, this indicates the range of work that still is to be done in the exciting field of evolutionary linguistic computer modeling. A field to which I hope that this thesis, in one way or another, has contributed.