Chapter 1

Introduction

This book presents an evolutionary framework for understanding language change, interprets major current theories in the context of this framework, and makes certain new proposals for aspects of the theory of language change. Although this is an ambitious agenda, there has been much interesting work in the theory of language change in the past two decades, and I believe the time is ripe for an attempt to integrate the various advances and insights into the nature of language change.

1.1 On theories of historical phenomena

Why do languages change? This is a difficult question to answer. But part of the difficulty lies in our view of the thing about which the question is being asked, namely, a language.

Language change is a historical phenomenon. Hence the study of language change – historical linguistics – must satisfy certain basic requirements. The first requirement is that one must clearly distinguish historical entities from the types they represent. A historical entity is a spatiotemporally bounded individual, that is, it is a specific entity that exists in a specific place for a specific period of time. This is basically the distinction between a token of something and the type it belongs to. The distinction is clear when describing physical phenomena: a droplet of water is a collection of tokens of the molecular type H_2O. Tokens of water can come into existence and pass away via various chemical processes. There are general chemical laws to describe the chemical processes undergone by water.

The distinction is not so clear when dealing with entities such as languages. Certainly, it is recognized that particular languages exist during a particular time and place. Proto-Germanic arose somewhere in northeast Europe (or farther east) at a certain time, expanded its range, and came to an end with its breakup into what ultimately became English, German, Swedish, etc. More precisely, Proto-Germanic was identified as the language of a finite speech community, whose origin, spread and breakup determined the spatiotemporal boundaries of the historical entity of Proto-Germanic. Its daughter languages, that is the languages used by certain other speech communities, in turn arose in certain locations, perhaps migrated or spread, and will eventually die out or break up themselves.

But this historical view is often set aside for a different characterization of a language. In this characterization, a language such as German is a system of rules and forms, divided into a phonology, morphology, syntax, semantics and so on (in varying ways depending on one's grammatical theory). This system is treated as an idealized entity, abstracted away from any particular speaker's mental knowledge or its uses in particular discourse contexts. Is this entity a token or a type? It is neither. The German language system is not a token because it has been removed from its historical context: one is not analyzing the mental knowledge of actual speakers, or actual occurrences of use. The German language system is not a type because it is still a specific entity: German is still a specific language; its rules do not apply to language in general but to the particular language of German. To the extent that its rules apply at all, it is only to an abstract yet particular entity that has only an ideal existence.

One consequence of the idealization of a particular entity is that it gives the impression that there could be laws governing processes of change in the German language system, that is, the impression that one of the tasks of historical linguistics is to predict what changes to the German language system will occur and at what time, just as one predicts what will happen to molecules of H_2O when subjected to electrolysis. Yet this is patently not the case: we cannot predict what changes will happen to the German language system. H_2O is a type; the German language system is not a type. This fact has led some linguists to argue that historical linguistics cannot be a science because it cannot provide a predictive explanation (Lass 1980:xi).

I suggest that a reason why historical linguistics – and perhaps linguistics itself – as practiced by some might not be a science has to do with what the object of study is taken to be. When linguists analyze language as an abstract system, they are not looking at a historical entity, nor are they looking at a type about which predictions can be made. In fact, they are not looking at anything that is real at all, either as a type or as a token. An empirical science must examine real, existing entities, and then construct generalizations about what types are involved, as well as principles and constraints governing the structure and behavior of those types.

In the study of linguistics, the real, existing entities are utterances as they are produced in context, and speakers and their knowledge about their language as it is actually found in their minds. From these basic tokens, we can describe more complex tokens, such as a specific language or a speech community; and then we can construct types, such as 'language' or 'grammar' (mental representation), over which constraints and generalizations can be made.

I am not arguing that in doing so, we can construct a predictive model of language change. In all probability we will not be able to make detailed predictions, any more than historical sciences of natural phenomena, such as meteorology, astrophysics or geology, are able to do. There are two possible reasons for this, one 'optimistic', one 'pessimistic'. The 'optimistic' one is that we simply do not know the facts in particular cases in enough detail to predict the changes; if we did know, we would be able to make predictions (cf. Keller 1990/1994:159). The 'pessimistic' one is that we would never be able to predict the change because there is at least some element of randomness in the process, as is the case with the randomness of mutation in biological reproduction and the random factors for survival of individual organisms.

I am inclined towards the pessimistic view with respect to language change, which implies that even with perfect knowledge of the initial state, we would not be able to predict a language change. But not all explanations of historical phenomena need predict the outcome of individual cases. With some types of processes, what really matters is probabilities of change: the cumulative effect of the probability leads ultimately to an overall change. Historical explanations can be, and often are, probabilistic. Probabilistic explanations are particularly effective when the object of study is a population: a gene pool or a population of organisms, for example – or a population of speakers, or of utterances. Both speakers and utterances form populations, and that is what allows probabilistic mechanisms of language change to be effective explanations.

Processes can be roughly divided into two types (see Hull 1988:410). One involves INHERENT CHANGE: a single object that exists over time changes in some way or other. An example of inherent change is human physiological development over its lifetime. Another example is human linguistic development, that is, the development of mental structures that we interpret as representing linguistic knowledge, over the lifetime of the speaker.

The other type of process involves REPLICATION: the creation of a new entity that preserves in large part the structure of its parent entity (or entities). An example of replication is the creation of the DNA of the offspring of an organism, replicated in MEIOSIS. Another example of replication is the production of a linguistic utterance, which replicates grammatical structures of previously occurring utterances of the language, according to patterns of knowledge in the minds of their producers. Another example which is often thought of as replication, but is much more indirect, is the learning of grammatical knowledge on the part of a child, compared with the grammatical knowledge in the minds of its parents and/or caregivers.

One of the problems with treating language as an idealized abstract system is that it makes language change into an inherent process: a single object – the abstract language system – changes over time. But the real, existing entities of linguistics are utterances and speakers' grammars. The evolution of both of those entities, particularly utterances, occurs through replication, not inherent change.

Replication can result in change at two levels. At one level, change can occur because the structure of the replicate is not exactly the same as the structure of the original. For example, I may pronounce *bad* in an utterance with a slightly higher vowel than in earlier utterances which I heard and internalized. I will call this ALTERED REPLICATION. Altered replication produces variants of a structure. At the other level, change can occur by the shift in the frequencies of variants of a structure. For example, more and more utterances occur with a higher vowel in *bad* than with the lower variants. Perhaps *bad* with the lower vowel variants will eventually die out. This sort of change is called DIFFERENTIAL REPLICATION (Hull 1988:409).

The position taken in this book is that the study of language is about empirically real entities, not idealized abstract systems. The real entities of language are utterances and speakers' grammars. Language change occurs via replication of these entities, not through inherent change of an abstract system. In chapters 2–3, I will argue that the primary replicators are in fact utterances, not speakers' grammars; but the point that matters here is that a theory of language change must be a theory of replication of empirically real entities, either grammars or utterances.

1.2 Desiderata for a theory of language change

We are now in a position to outline some desiderata for a theory of language change.

First, a theory of language change must avoid the reification or hypostatization of languages. If one speaks of 'forces' causing a language to change, such as Sapir's concept of drift (Sapir 1921), then one is speaking as if language change is an inherent change applying to an abstract system. Descriptions such as '[a phoneme's] performance represents an extreme phonetic possibility as when it is an /i/ badly pressed by an invading /e/ with surrounding diphthongs which block all way of escape' and 'Isolated phonemes do not rush into structural gaps unless they are close enough to be attracted' (Martinet 1952/1972:147, 159) are examples of reification taken to excess. Languages don't change; people change language through their actions (Croft 1990:257). Keller describes this desideratum as the principle of methodological individualism: 'the explanation [of a language change] is based on acting individuals, not languages, structures, processes, or collectives' (Keller 1990/1994:121).

Second, a theory of language change must explain why languages do NOT change in many ways, sometimes over many generations of speakers (see Milroy 1992b:10–13). Many theories of language change focus their attention on mechanisms to bring about change. But if those mechanisms were the only mechanisms around, then languages would be changing constantly in all of their respects. Yet they are not. A theory of language change must provide for mechanisms that act as forces for stability as well as for change, and ideally get the proper balance in order to account for rates of change. Another way of putting this desideratum is to say that a theory of language change must provide mechanisms of NORMAL (identical) REPLICATION as well as altered replication (and also mechanisms for nondifferential replication as well as differential replication).

Third, a theory of language change must distinguish the two processes of change, that is, it must distinguish altered replication from differential replication. To use the terminology more typically found in linguistics, the two processes are INNOVATION or actuation – the creation of novel forms in the language – and PROPAGATION or diffusion (or, conversely, loss) of those forms in the language. Both processes are necessary components of the process of language change. The distinction between these two processes, and the fact that both are necessary components of language change, is very rarely recognized in models of language change (but see Jespersen 1922:166–7). Because of this, some apparently contradictory positions have been taken on the nature of language change.

Some linguists argue that only innovation is a language change. Joseph writes, 'language change always takes place in the present, i.e. it always occurs in some speaker's (or group of speakers) present' (Joseph 1992:127; see also Joseph & Janda 1988). Joseph can only be speaking of innovation, as propagation of a novel form does take place over long periods of time, exceeding the life spans of individual speakers. Others argue that only propagation constitutes a language change. James Milroy writes, 'a change in the output of a single speaker might be regarded as the locus of a change in the system, whereas of course a change is not a change until it has been adopted by *more than one* speaker' (Milroy 1992a:79, emphasis original; see also Labov 1982:46). Others do not recognize the distinction, leading to misunderstandings such as that in the following passage:

> How can one 'understand' or get at 'the intention behind' or discover the 'meaning' of a shift from SOV to SVO, or a monophthongization, or a vowel-shift, etc., in any 'cognitive' or empathetic way, or 're-enact' them, or attribute them to 'reasons' and 'beliefs'? Especially as linguistic changes . . . typically unfold over very long periods of time, most often beyond the lifetime of any human 'actor'. (Lass 1997:339)

Lass is criticizing hypotheses about the innovation of a language change – hypotheses appealing to speaker intentions – by citing a fact about the propagation of a language change – propagation typically extends over many generations. Lass may be correct that innovation does not involve intention; but not for the reason he gives. Lass is not alone in this misunderstanding; but neither do the advocates of such explanations (in this case, Anttila 1989) tend to distinguish innovation and propagation, thereby inviting the erroneous criticism.

One consequence of recognizing that innovation and propagation are distinct but jointly necessary processes for language change is recognizing that language change is both a synchronic and a diachronic phenomenon. Innovation is a synchronic phenomenon, as Joseph notes in the quotation above: it occurs in speaker action at a given point in time. Propagation is a diachronic phenomenon: it occurs sometimes over a very long period of time, even centuries. On the other hand, sociolinguistic research has demonstrated that one can observe propagation occurring in less than the lifetime of a speaker (see e.g. Trudgill 1988).

Fourth, a comprehensive framework for understanding language change must subsume structural, functional and social dimensions of language change, or their equivalents. Most current approaches to language change address only one or another of these dimensions. Sociohistorical linguistics examines almost exclusively the social dimensions (although Labov 1994 discusses the phonetics and phonology of vowel shifts and mergers in some detail). Traditional philological and structuralist approaches focus on structure and to a lesser extent on function. Generative theories focus on structure exclusively, though largely because they deny function or social factors any interesting or central role in language change. Grammaticalization theory focuses on structure and function, with a stronger emphasis on the latter. To the extent that function and social factors play a role in language change – and there is strong evidence that both do – they must be integrated in a single framework.

Last, a comprehensive framework for understanding language change must subsume both INTERNAL and EXTERNAL causes of language change. Theories of internal causes are varied, and most attention has been focused on them. Externally caused changes, that is, changes caused by contact such as borrowing and substratum phenomena, tend to be discussed relatively little in theories of language change, and are typically placed in separate chapters from internal causes in textbooks on historical linguistics. Contact-induced change appears to have an obvious source – the other language. Nevertheless, mechanisms for the innovation and propagation of contact-induced change, preferably mechanisms comparable to those posited for internal changes, must be established.

The framework presented in this book satisfies all five desiderata for a theory of language change, and thus can be counted as a comprehensive framework of language change. However, it is only a framework; it is hoped that future work will be able to flesh out theories of specific types of changes in this framework. The last section of this chapter briefly outlines the framework.

1.3 An utterance-based selectional theory of language change

The framework for understanding language change to be presented here is based on a generalized theory of selection for all types of evolutionary phenomena, originally developed in biology and applied to the history of science by David Hull (Hull 1988; see Dawkins 1976). The generalized theory of selection, described in chapter 2, distinguishes variation (altered replication) from differential replication. It specifically provides a model of selection, which Hull argues is the mechanism for differential replication for most types of biological evolution and also conceptual evolution in the history of science. Hull also emphasizes that replication and selection involve historical entities (tokens), not types (except for very general types such as 'gene', 'species', 'population' and so on: see chapter 2). The generalized theory of selection thus satisfies the first three desiderata enumerated in §1.2.

The framework presented in chapter 2 can be used to interpret the major extant theories of language change; they are surveyed in chapter 3. However, in chapter 2, I also present the first of four major theses about the nature of language change set forth in this book. I propose that UTTERANCES, more precisely the replication of linguistic structures in utterances in language use, play a central role in the theory of language change. A widely held view treats language change as occurring in the process of 'replicating' a grammar in child language acquisition. There are however serious empirical problems with this view, discussed in §3.2. For this reason, the Theory of Utterance Selection, which is more or less compatible with most aspects of sociohistorical linguistics, grammaticalization theory and the invisible hand theory (see §3.3), is pursued here.

In the Theory of Utterance Selection, CONVENTION is placed at center stage. Normal replication is in essence conformity to convention in language use. Altered replication results from the violation of convention in language use. And selection is essentially the gradual establishment of a convention through language use.

Convention does not generally take center stage in linguistic theory, formalist or functionalist. The reason is that conventions are essentially arbitrary (see §4.2.4). Saussure considered arbitrariness to be central to the understanding of language: '[The arbitrary nature of the sign] dominates all the linguistics of language; its consequences are numberless' (Saussure 1916/1966:67–8). Yet neither formalists nor functionalists have shown much interest in arbitrariness per se. Functionalists are chiefly interested in the nonarbitrary, functionally motivated aspects of grammatical structure. Formalists find arbitrariness useful in criticizing functionalist analyses, but they are chiefly interested in general, formal universals that have an innate basis. But a central aspect of a speaker's use of language is convention. When I say *Who did you meet yesterday?*, I put the interrogative pronoun *Who* at the beginning of the sentence because that is the convention of my speech community, I know the conventions of my speech community, and my use of language will serve its purpose best most of the time if I conform to the conventions of my speech community. It may be that the initial position of *Who* is partly motivated by pragmatic universals of information structure, or partly specified by an innate Universal Grammar. In fact, one (or both) of those factors may be the motivation for the origin of the convention. But that is not why I have put it there in that utterance. As Saussure wrote: '[arbitrary conventions] are nonetheless fixed by rule; it is this rule and not the intrinsic value of the gestures that obliges one to use them' (Saussure 1916/1966:68). Convention – whether conforming to it, violating it, or establishing it – plays a key role in language use and in language change. (It also plays a key role in our knowledge of language; see Croft to appear b.)

Convention is a property of the mutual knowledge or COMMON GROUND of the speech community. Of course, common ground is found in the minds of speakers, albeit shared with other members of the speech community. Thus, there is an interplay between convention and individual speakers' knowledge, or COMPETENCE as it is usually called. There is also an interplay between conventional and nonconventional aspects of language use, which plays a critical role in the understanding of how replication of linguistic structures in utterances occurs. All of these concepts are discussed in some detail in chapter 4.

The second major thesis of this book pertains to the nature of grammatical (and lexical) change. The causal mechanisms for innovation involve the mapping from language structure or form to language function, that is, meaning in context (Croft 1995a; see §4.3 for some discussion of other senses of the word). This mapping occurs at two levels or interfaces. One is the mapping from phonological structure to phonetic reality (articulatory and auditory). The other is the mapping from grammatical (morphosyntactic) structure to its semantic/pragmatic/discourse function in context. Neither mapping has been found by linguists to be simple to represent. But nor is it simple for speakers to represent these two levels of mapping. In chapters 4–6, I argue that altered replication is essentially a result of speakers adjusting the mapping from language structure to external function. I focus chiefly on grammatical change, with a few references to sound change.

The mechanisms for innovation in language change involve both structure and function. The mechanisms for propagation, on the other hand, are essentially social, namely the various factors discussed by sociolinguists (see §3.4.3, §7.4.2). In other words, there are two distinct mechanisms operating in language change – this is my third major thesis (see also Croft 1995a:524; 1996a: 116–17). The mechanism for innovation is functional, that is, involves the form–function mapping. The mechanism for propagation is a selection mechanism, in the evolutionary sense (see §2.3), and it is social. Thus, the integration of structural, functional and social dimensions of language change is achieved largely by integrating the two distinct processes of change, innovation and propagation/selection.

The last major thesis about language change presented in this book pertains to the relationship between internal and external (contact-induced) sources of language change, which is more complex than is usually assumed. In chapter 4, I argue (following sociolinguistic theory) that a speech community is defined in terms of domains of use, not in terms of collections of speakers. All people in a society are members of multiple speech communities, whether those communities are conventionally described as representing a single language or multiple languages. In other words, all speakers command multiple varieties or codes, and thus some of the mechanisms for internal sources of change are the same as those for external sources of change. These mechanisms are discussed in chapters 6–7. The blurring of the line between internal and external changes also allows us to integrate the study of language contact and genetic linguistics. The naturalness of this view becomes more apparent when one recognizes that language 'speciation' is more like plant speciation than animal speciation. This view of language speciation is discussed in chapter 8.

Chapter 2

An evolutionary model of language change

> The formation of different languages and of distinct species, and the proof that both have been developed through a gradual process, are curiously parallel . . .
> Charles Darwin, *The descent of man*

2.1 Introduction

The relationship between language change and biological evolution has been debated since the emergence of linguistics as a science in the nineteenth century, at around the same time as the emergence of evolutionary theory. The debate has increased in recent times. One can identify three separate ways in which biological evolution has been connected to linguistic evolution in recent discussion.

First, interest has revived in the evolution of language, that is, the evolution of the human linguistic capacity (Pinker & Bloom 1990; Hurford, Studdert-Kennedy & Knight 1998; Kirby 1999). The evolution of human linguistic capacity is directly a biological process: some genetic change among ancestral primates led to the creation of a social and cognitive capacity for language or a language-like system for communication, and some process selected those primates with that capacity, leading to humans as a speaking species. This topic, while interesting, is also extremely speculative, and will not be surveyed in this book: this book is concerned with language change itself, not the evolution of a certain biological capacity of human beings.

Second, interest (and controversy) has arisen over the so-called genetic origin of contemporary human languages. Here the evolutionary connection is one of historical association. The internal structure of genetic families such as Austronesian are compared to the distribution of biological traits, such as alleles in mitochondrial DNA, or blood types (Bellwood 1991). It is assumed that, for the most part, transmission of biological traits through offspring is historically paralleled by transmission of language from parents to children, and hence family trees of human communities based on biological traits should roughly parallel family trees constructed on linguistic evidence.

Of course, all know that this parallelism in the history of languages and of human biological traits is not necessary. Languages are not transmitted via an individual's DNA; biological traits are. Rather, languages are transmitted to new speakers through exposure to their use. A group of people may abandon their language and adopt one of another group to whom they are not biologically closely related. For more recent families such as Austronesian, where the demographic history is better known, the relative contribution of language shift vs parent-to-child transmission can be more easily sorted out. In Austronesian, for example, it is clear that Melanesians are biologically closer to Papuans, and presumably have shifted to the Austronesian languages that they now speak (cf. Melton *et al.* 1995; Redd *et al.* 1995).

Relationships have also been observed between proposals for historically deeper linguistic families such as Amerind (Greenberg 1987) or even Proto-World (Bengtson & Ruhlen 1994) and proposals for historically parallel biological phylogenies (Greenberg, Turner & Zegura 1986; Cavalli-Sforza *et al.* 1988). These are much more controversial, chiefly because of challenges to the linguistic classification; the classification based on some biological traits (in particular mitochondrial DNA) is also questioned. Again, this relationship between biological evolution and language change will not be surveyed in this book: this book is concerned with the mechanisms of language change, not the origin and spread of specific families of languages.

The third connection between language change and biological evolution is found where the theory of biological evolution itself has been adopted, or adapted, in order to construct an evolutionary theory of language change (see e.g. Keller 1990/1994:141–52; McMahon 1994:314–40; Lass 1990, 1997 passim; Ritt 1995). Evolution is recognized as a process that occurs with certain types of entities. The process is probably best understood as it occurs with populations of biological organisms; that is evolutionary biology. The hypothesis is that language change is an example of the same process, or a similar process, occurring with a different type of entity, namely language. It is this hypothesis that forms the starting point of this book.

A number of approaches have been taken to an evolutionary model of language change. The first approach is literal: language is a genetic capacity, and hence obeys certain principles of biology. This approach is associated with Chomskyan linguistics, because Chomsky argues for the biological basis of quite specific linguistic properties (e.g. certain syntactic structures and constraints). The literal approach also makes developmental claims: for instance, the hypothesis that the human language capacity in all its detail emerges in maturation.

However, the main goal of the literal approach is to claim a biological basis for the universal properties of languages. The ways in which contemporary human languages are divergent, and have diverged or will diverge in history, cannot be accounted for in the literal approach. A literal approach to language diversity would amount to claiming that the differences among languages reflect genetic differences among their speakers. This is patently false, as can be seen from the aforementioned fact that a person can learn a second language, and learns whatever language is spoken in their surroundings. For this reason, the literal approach generally turns to questions of the evolution of the human linguistic capacity, that is, what gave us the genetic basis for the properties common to all languages, whatever those may be.

The second approach is essentially analogical: there are analogies between certain biological processes as described by evolutionary theory and certain processes of language change that call for description. Hence, linguists seeking better descriptions and analyses of those processes can borrow or adapt the descriptions and explanatory mechanisms that evolutionary biologists have proposed. However, no deeper claim is made about the relationship between the theory of evolution in biology and the theory of language change in linguistics. There are simply analogies or metaphors between a process in one domain of scientific study and a process in another domain; in particular, one should not push the analogy too far. In the analogical approach, the relationship between evolution and language is essentially opportunistic – an opportunity for linguists to utilize some already developed theoretical constructs.

An example of the analogical approach appears to be the use of the biological metaphor in creole studies, e.g. Whinnom (1971) and Mufwene (1996a, to appear). Whinnom suggests that the biological concept of hybridization can be applied to language contact 'provided that the analogies are properly applied' (Whinnom 1971:91). Mufwene compares languages to species and the factors that determine a language's survival or extinction as ecological factors, but states:

> I do not want to suggest that language evolution is in all, or most, respects like species evolution . . . There are, however, some similarities between the concepts of *language* and *species*, which I find informative and would like to use cautiously to shed light on the process of language evolution. (Mufwene to appear, fn. 1)

It appears that Lass's adoption of an important concept in recent evolutionary theory, exaptation (Lass 1990), and its application to historical linguistics, is another example of the analogical approach to the relation between biological evolution and language change (see §5.3 for further discussion). Lass writes: 'while claiming that the notion of exaptation seems useful in establishing a name and descriptive framework for a class of historical events, I remain fully aware (even insistent) that languages are not biological systems in any deep sense' (Lass 1990:96). He adds, for instance, that 'There is as far as I am aware no storage or coding mechanism for linguistic transmission equivalent to DNA' (ibid.).

However, Lass makes it clear in the following paragraph that he is not taking an analogical approach. It is not that languages ARE biological systems. It is that languages and biological systems are instances of a more general phenomenon: 'rather than extending a notion from biology to linguistics, I am suggesting that the two domains . . . have certain behaviors in common by virtue of evolving' (Lass 1990:96). In fact, Lass is taking a third, generalized approach. This approach proposes a generalized theory of evolutionary processes, which applies to the evolution of species and their traits in biology, to language change in linguistics, and to other domains as well: 'I am convinced . . . that there is such a thing as a theory of "historically evolved systems"' (Lass 1997:316). In the generalized approach, there is a profound relationship between biological evolution and language change, which is worth exploring in greater detail. The two are not identical by any means. But they both display salient properties that demonstrate that they are instantiations of the same generalized theory that crosses disciplinary boundaries.

Even in the generalized approach, the evolutionary biologists are again in the forefront. Lass cites Dawkins in support of this approach. Dawkins' popular book *The selfish gene* (Dawkins 1976), besides making specific proposals about the nature of biological evolution, suggests that his model can be applied to cultural evolution as well. He proposes the notion of a MEME to represent a sociocultural unit that can evolve via differential replication. David Hull, a biologist who became a philosopher of science but not without continuing to make contributions to systematics and evolutionary theory, develops a generalized theory of selection which subsumes both biological and conceptual evolution (Hull 1988, especially chapters 11–12). In this chapter, I will argue that Hull's model can be applied to language change, and allows us to construct the foundations of a theory of language change and the major mechanisms that bring it about.

If the generalized approach is to be taken seriously, then Lass's claim – that there is no equivalent of DNA in linguistic evolution – raises a difficult question. If Lass's claim is true, then are linguistic and biological evolution really instances of the same thing? Does DNA play an essential role in the theory of evolution developed by biologists – developed in far greater detail than the theory of language change in linguistics? If so, then the role in evolutionary theory that is played by DNA in biological systems must have a counterpart in linguistic systems. Lass argues against the literal approach, that is, that there is a genetic basis to the phenomena of linguistic evolution: language change does not occur through biological genetic mutation and selection. But that does not necessarily mean that there is no functional equivalent to DNA in linguistic evolution. Hull writes, 'People reject selection models in conceptual change out of hand because they have a simplistic understanding of biological evolution' (Hull 1988:402). The trick is making the right instantiation of the theoretical constructs of the generalized theory.

In this chapter, I will argue that there is an equivalent to DNA in linguistic evolution, and that it is the utterance. Both the existence of an equivalent to DNA and the entity I am proposing as the equivalent will at first strike the reader as surprising, perhaps even bizarre. But an essential role in the generalized theory of selection is assigned to a function most typically centered on DNA in biological evolution. I will argue that this function is most typically centered on the production and comprehension of utterances in language change. It should be clear from the wording of the preceding sentence that the DNA–utterance analogy is going to be rather indirect and not the one that Lass rightly rejects. In fact, what will emerge from the application of Hull's theory to language change is a theory that is thoroughly based on what happens to language in use, from the origin of an innovation to its adoption as a convention of the speech community, and which unifies internal and external causes of language change. The remainder of this book will explore some of the consequences of this theory. But first we must explicate the two most fundamental notions in the generalized theory, the population theory of species and the generalized theory of selection.

2.2 Populations and phylogenies

One of the major advances of the so-called evolutionary synthesis is the replacement of the essentialist theory of species by the population theory of species (Dobzhansky 1937, Mayr 1942, cited in Hull 1988:102; see also Mayr 1982). The population theory of species is sometimes traced back to Darwin, but Darwin was not entirely clear in his definition of species (Mayr 1982:265–69; Hull 1988:96, 213 fn. 2; see Mayr 1982:272 for other precursors). The population theory is also inextricably tied up with the question of systematics, that is, the taxonomic classification of organisms into varieties, species, genera, families and higher taxa. Here the contrast is between classification and phylogeny; we must discuss this question as well.

In the ESSENTIALIST view of a species, each species has immutable essential structural properties that identify it (Mayr 1982:256). That is, the essentialist view is that a species instantiates an abstract type. The essentialist view ran into problems due to various sorts of structural variation among species, including high degrees of structural variation among individuals in a population and also among different life-stages in an individual in a population (for example, a caterpillar and the butterfly it turns into, or a species that changes sex over its lifetime; Hull 1988:430). The essentialist view also ran into problems with populations which could not be distinguished by structural features but were distinct reproductive communities (Mayr 1982:271; see below). But the greatest problem for the essentialist view of a species is that a species evolves, and in so evolving, can lose 'essential' structural properties. Identifying this problem is one of the major contributions of Darwin to evolutionary biology.

The POPULATION theory of species is completely different from the essentialist theory (Mayr 1982:272). A species consists of a population of interbreeding individuals who are REPRODUCTIVELY ISOLATED from other populations. This property – interbreeding, and lack thereof between species – is the 'essential' property the individuals have in common. There is no essential species type. Individuals can vary in enormous ways in physical structure (and behavior), but as long as they form a population in the evolutionary sense, they are members of the same species. Conversely, individuals may be structurally extremely similar, but if they come from two distinct reproductively isolated populations, they are members of different species. This is a radically different view of the species as a conceptual category. The category definition is based on a specific set of individuals, and category membership is defined in terms of how the individuals interact with each other, not by any specific traits associated with all and only the individuals in the category.

Not every individual need breed with every other individual in order for the set of individuals to form a population; only reproductive isolation is necessary: 'extensive interbreeding with the population system is not an essential property of biological species; non-interbreeding with other population systems is' (Grant 1981:91). Although reproductive isolation is treated in theory as a sharp dividing line, it is not entirely so in fact (Hull 1988:102–3). There are cases in which populations which were separated and then brought into contact again developed a stable hybrid region in between the two distinct populations. Hull gives the example of the hooded crow and the carrion crow in Europe: separated by glaciers which then receded, the species populations remain distinct, but there is a stable band of hybrids in a zone not exceeding 75 to 100 kilometers in width (Hull 1988:103). Hence there is interbreeding where there is contact, but there is little gene flow between the two populations. Conversely, reproductively isolated populations of plants can merge: 'estimates of the proportion of plant species in general that are of hybrid origin run as high as 30 or 40 percent' (Hull 1988:103; cf. Grant 1981:203).

In the essentialist view of species, a species is a type, defined by a set of properties, that is not located in space or time but in an abstract domain of biological traits. In the population view, a species is a spatiotemporal individual, not an eternal essence. The population of organisms constituting a species is circumscribed by the region in time and space collectively occupied by the individual members of the species. The beginning of a species is defined by its branching off in a speciation process, and its end by either its extinction or its fission into two or more new species in speciation: 'Just as the name "Gargantua" [an individual gorilla] denotes a particular organism from conception to death, "*Gorilla gorilla*" denotes a particular segment of the phylogenetic tree' (Hull 1988:215).

A species, like an individual organism, is a historical entity in the population view. In the essentialist view, a species is not a spatiotemporal individual: it is a type or kind, whose instantiations may be particular individuals, but the kind is not spatiotemporally bounded itself. But species are not types; they cannot be types. The essentialist view treats a historical entity as if it were a type. In the population view, only entities as abstract as species (in general), and certain theoretically defined subpopulations of a species such as demes (in general) or geographical races (in general) are kinds. Any particular species, deme or geographical race is a spatiotemporal individual. In other words, a population is a fundamentally historical entity. This point is a very important one in understanding both the relationship between populations and classification and between populations and selection (see §2.4.1).

If the population theory of species is distinct from the essentialist theory of species, then one would expect to find cases where there are mismatches in the world between species defined in terms of reproductively isolated populations and species defined in terms of essential structural properties. In fact, this is the case (see e.g. Hull 1988:104). SIBLING SPECIES are two reproductively isolated species whose structural descriptions overlap to such an extent that on an essentialist definition, they would be the same species. For example, five different species of the flower *Gilia* in the Mojave Desert are so similar that they were once classified as a single species, but the five species are highly intersterile (Grant 1981:61–2). POLYTYPIC SPECIES, on the other hand, are species that are structurally so heterogeneous that an essentialist would be hard put to categorize them as a single species, yet they form an interbreeding population (in terms of gene flow; Mayr 1982:287–92).

A population may split into two or more parts, often through geographical isolation. The term VARIETY is generally used for a subpart of a species population. Varieties may cease to interbreed. In fact the two populations may diverge in structure and behavior such that they could no longer interbreed even if brought together again. At this point one would say that the original species has split into two daughter species. (I follow Hull 1988, and Hennigian systematics in general, by assuming the old species no longer exists after such a split, thereby avoiding the pseudoproblem of deciding which of the daughter species is 'really' the continuation of the parent species.) 'Varieties are merely incipient species. Not all varieties become species, but all species at one time were varieties' (Hull 1988:96).

If one constructs a historical account of the splitting (and also merging) of populations of organisms, the result would be a PHYLOGENY. A phylogenetic classification is intended to reflect the history of the organisms being classified. A phylogenetic classification is not the same as a taxonomic classification, the familiar classification of species into genera, families and so on. A taxonomic classification is based on similarities and differences among traits. It is basically founded on an essentialist view of species. A phylogenetic classification is historical. Yet the two have often been confused, even by biological systematists (taxonomists). There are two reasons for this confusion. The first is the apparent similarity between a phylogenetic tree and a taxonomic tree: 'The relationship between a branching phylogenetic tree and the successive subdivisions of a hierarchical classification could not seem more patent. Yet, it is not' (Hull 1988:98).

The second is due to a practical problem in determining phylogenies. It is not always practically possible to discover patterns of gene flow in populations. In particular, it is impossible if the species is extinct and one must rely on fossil evidence. Instead, one examines traits, and uses the differences in traits among populations to hypothesize a historical scenario of the successive splitting (and merging) of populations. Since one is using traits to project a phylogeny, it is tempting to use a taxonomic classification to project the phylogeny. But a proper phylogeny requires the differentiation of traits based on their history. If two taxa share a trait, it could be a retained trait from the parent population (a SYMPLESIOMORPHY), or it could be a shared innovation of the two taxa (a SYNAPOMORPHY). Only a shared innovated trait can justify grouping the two taxa together phylogenetically. A shared retained trait simply indicates that the two taxa may be grouped together phylogenetically with other taxa at a greater time depth. And of course the shared traits may be shared accidentally, that is, the trait arose independently in each population, and hence they do not form a phylogenetic group (see Lass 1997:113–14 for a brief introduction to these terms and concepts in a historical linguistic context).

In sum, populations and phylogenies represent historical entities and evolution, while the essentialist view of species and taxonomic classification represent a view of species and groupings of species that is not historical or evolutionary, and at best provides indirect evidence for historical phenomena. In developing an evolutionary theory of language change, or of any historical process involving populations and their divergence (or merging), the concepts of populations defined by interaction of individuals (or lack thereof) and phylogenies are the relevant ones.

All of the phenomena described above are directly relevant to linguistics. A genetic linguistic classification, the family tree model, is intended to be a phylogeny of languages (although some linguists retain certain essentialist views; see §8.1). Shared innovations are crucial to establishing a genetic linguistic grouping; shared retentions represent at best some higher genetic grouping. There is of course the possibility that apparent shared cognates are accidental. Historical linguists have also adopted the convention of giving daughter languages different names from the parent language, and generally assume the daughter language is a 'new' language (compare the naming of daughter species in Hennigian systematics alluded to above).

The mismatches occurring between the essentialist and population definitions of species are also found in languages. These are the standard examples of the problem in defining language and dialect (see e.g. Chambers & Trudgill 1980, chapter 1).

SIBLING LANGUAGES are two linguistic varieties that are structurally so similar that they are considered to be 'dialects of the same language', yet are perceived by the speakers – or at least by one group of speakers – as distinct languages. Examples of sibling languages (of varying degrees of controversiality) include Macedonian and Bulgarian, Danish and Norwegian, Serbian and Croatian, Hindi and Urdu, and Malay and Indonesian. Dixon (1980:33–40) points out that many instances of neighboring languages in traditional, small, decentralized, nonliterate societies such as Australian aboriginal societies involve what I call sibling languages. In some cases the perception of the sibling languages as distinct is not reciprocal: many Bulgarians tend to see Macedonian as a dialect of Bulgarian, but the reverse does not hold. Of course, this reflects different perceptions about the social and political separateness of the communities that speak these linguistic varieties.

POLYTYPIC LANGUAGES, on the other hand, are linguistic varieties that are structurally so diverse that linguists would characterize them as different languages, yet their speakers perceive them as dialects of the same language. Examples of polytypic languages include the Chinese so-called dialects: they are mutually unintelligible (Li & Thompson 1981:2), but the writing system and political unity tends to imply identification as a single language (Norman 1988:1–3). Another example of polytypic languages is found in DIGLOSSIA (Ferguson 1959/1972), where there are two related but mutually unintelligible varieties, the L[ow] variety being a vernacular and the H[igh] variety a written standard, as in German-speaking Switzerland or the Arab countries. Speakers perceive H and L as a single language, L often being perceived as a substandard or imperfect version of the H variety. The same is true of postcreole continua, where the creole basilect and standard language acrolect are mutually unintelligible, as with Jamaican creole and Standard Jamaican English (DeCamp 1971:350). The structural diversity of traditional dialects of English, German, Italian and other western European languages may be instances of a lower degree of polytypy, depending on the degree to which their speakers identify themselves as speakers of English, German, etc., albeit nonstandard speakers.

Turning to the crux of the matter, the conflicting definitions of species, we find a parallel clash of definitions of a language. The linguistic or STRUCTURAL definition of a language – if two varieties share enough structure in common (phonology, grammar or morphosyntax, lexicon), then they should be classified as part of the same language – corresponds to the essentialist definition of a species. Comparison of linguistic varieties based purely on structural properties leads to assessments of language vs dialect based on essentialist criteria. The structural definition of a language possesses the same flaw as the essentialist definition of a species. As I argued in §1.1, the structural definition of a language makes a type out of a historical entity. As with species, languages evolve over time, undermining the structural definition; and sibling languages and polytypic languages demonstrate further problems with the structural/essentialist definition of a language.

What is the linguistic equivalent of the population definition of species? Chambers & Trudgill (1980) offer a social definition of language as an alternative to the structural definition (see also Haugen 1968/1972). They define an AUTONOMOUS VARIETY as one that is perceived by its speakers as a distinct language, no matter how similar it is structurally to some other variety. A HETERONOMOUS VARIETY, on the other hand, is perceived by its speakers as being the same language as that of an autonomous standard variety, no matter how structurally distinct those varieties are. We may apply Chambers & Trudgill's definition to the cases of sibling languages and polytypic languages. Serbian and Croatian are examples of sibling languages. Serbian is autonomous from Croatian because Serbian speakers perceive their language as distinct from Croatian and vice versa. Modern Arabic is an example of a polytypic language. The colloquial varieties of Modern Arabic are heteronomous, because speakers of the modern colloquial varieties perceive their colloquial variety as a version of Arabic.

Chambers & Trudgill's social definition of language closely corresponds to the population definition of species. However, their definition is based on speaker perceptions (and the existence of a standard variety). The genuine equivalent to the population theory of species for a language must be in terms of actual communicative interaction. This does not imply that every speaker of a socially defined language speaks with every other speaker of that language, any more than every organism of a species mates with every other organism of that species in its lifetime (see above). It merely implies that every speaker perceives every other speaker as someone he or she should be able to communicate with by using what they perceive as the same language.

The last remark illustrates a parallel with one of the qualifications of the population theory of species: not all members of a population must necessarily interbreed in order to be deemed members of the population. Not surprisingly, there are parallels with the phenomenon of different degrees of reproductive isolation (the European crow example described above). Chambers & Trudgill note that there is a 'hybrid' area in East Anglia between the Northern English vowel [ʊ] and the Southern English [ʌ], one of the most salient phonological markers of Northern vs Southern English (Chambers & Trudgill 1980:129–37). In the hybrid area, one finds MIXED and FUDGED varieties (lects in their terms; see §7.4.4). Mixed varieties possess [ʊ] in some words and [ʌ] in other words; fudged varieties use a phonetically intermediate vowel such as [ɤ] in some words. The mixed and fudged varieties form a transition zone between the Northern and Southern English varieties. Similar transition zones are found with bundles of ISOGLOSSES (geographical boundaries between one linguistic feature and another). For example, the boundary between French and Occitan is defined by a number of lexical and grammatical features. But the isoglosses for each feature do not match perfectly: there is a transitional zone across the middle of France where varieties possess some 'French' features and some 'Occitan' features (Chambers & Trudgill 1980:111, Map 7–6, after Jochnowitz 1973).

If we pursue an evolutionary theory of language following the lead of the evolutionary theory of biology, then we must take the population (social) definition of a language as the basic one. A structuralist linguist may feel uncomfortable about the social definition of a language. But the fact is that the social definition is the correct one from a historical perspective, in terms of causal mechanisms of language speciation. The social definition makes predictions of likely historical developments whereas the structural definition does not. Sibling species are likely to diverge morphologically as their reproductive isolation continues (see Hull 1988:66–7, discussing Mayr's theory of speciation). Likewise, sibling languages are likely to diverge structurally as their communicative isolation persists. A polytypic species may break up if the gene flow is interrupted, or possibly become more homogeneous or at least maintain itself as a single language. A polytypic language may break up if its social unity is broken – this appears to be what is happening in the distinct modern Arab nations. Or it may survive as a single language as in China, possibly becoming more homogeneous, as with the loss of the traditional dialects of western European languages. Social and communicative isolation leads to structural divergence; social and communicative intercourse leads to a maintenance of the status quo, or even convergence (which itself is a result of tighter social cohesion and mobility).

The last few paragraphs have surreptitiously introduced the linguistic equivalent to reproductive isolation: COMMUNICATIVE ISOLATION. Conversely, linguistic interbreeding is communication. The population definition of a language thus appears to be very similar to the notion of mutual intelligibility used to distinguish languages from dialects. However, mutual intelligibility tends to be defined in terms of potential communicative interaction, whether or not the speakers belong to the same speech community. Communicative interaction depends not only on the degree of structural similarity of the varieties spoken, but also on the social behavior of the speakers. Serbian and Croatian are mutually intelligible to a high degree, but many speakers do not communicate with the opposite community due to the recent political changes in former Yugoslavia.

One must distinguish the real potential of communicative interaction of two members of the same speech community who happen not yet to have conversed with each other, with the abstract potential of communicative interaction of members from different speech communities who would not normally talk with each other, except in a dialectologist's experimental situation. An analog to the latter situation in biological populations is, for example, plant species which could produce hybrids if they interbred, but do not interbreed because one species is pollinated by certain bees in the early morning and the other by other bees in the late afternoon (Grant 1981:113). Only the real potential of interbreeding/communication matters for the population definition of a species/language.

It is worth describing the two other sorts of biological populations mentioned earlier in this section in a little more detail. A SPECIES is a population of interbreeding individuals. A GEOGRAPHICAL RACE is a subpopulation of a species which is defined geographically, and often has structurally diverged to a slight extent, but presumably not so far as to prevent interbreeding. A DEME

> consists of organisms in sufficient proximity to each other that they all have equal probability of mating with each other and producing offspring, provided they are sexually mature, of the opposite sex, and equivalent with respect to sexual selection. To the extent that these conditions are met, the organisms belonging to a deme share in the same gene pool. Of course, in natural populations, some mating occurs between adjacent demes, and not all organisms within a single deme have precisely equal probability of mating, but the isolation between demes is met often enough and well enough for demes to play an important role in biological evolution. (Hull 1988:433)

These different types of populations are also relevant to the notions of language, dialect and speech community, defined in terms of communicative interaction and social identity rather than in the essentialist terms of linguistic structure. A language and its speakers should be defined in population terms just as species generally are. A geographical race is a traditional geographical dialect: defined geographically, slightly divergent structurally, but not enough presumably to prevent communication (i.e. intelligibility) or to provide a separate sociolinguistic identity, assuming we are not dealing with sibling languages.

A deme is related to one definition of the complex notion of a speech community. In fact, the term speech community as it is broadly used is the proper linguistic equivalent of a biological population (see §4.2.3). A speech community can be defined as broadly as all of English no matter where it is spoken, at an intermediate level such as Hiberno-English, or as narrowly as a particular fairly cohesive social network such as the ones analyzed by the Milroys in Belfast (Milroy 1987). A SOCIAL NETWORK corresponds most closely to a deme: a group of people who are most likely to communicate with each other, and not so much with those outside the network. One can describe the results of the Milroys' research in Belfast rather well by paraphrasing the Hull quotation and making the appropriate substitutions of sociolinguistic terms for biological ones (see chapter 7):

> a social network consists of speakers in sufficient proximity to each other that they all have equal probability of communicating with each other, if they have some reason to linguistically interact. To the extent that these conditions are met, the speakers belonging to a social network share in the same language. Of course, in natural speech communities, some communication occurs between adjacent social networks, and not all individuals within a single social network have precisely equal probability of communicating with each other, but the isolation between social networks is met often enough and well enough for social networks to play an important role in language change.

Species are formed only when a population reproduces sexually. Asexual organisms do not form species: each asexual organism is reproductively isolated (Grant 1981:64; Hull 1988:215). Communicative interaction is 'sexual': language is produced when a speaker communicates with a hearer. Even writers presuppose an audience. Hence, languages and their speakers form populations in the biological sense.

The metaphor found in the word 'intercourse' (sexual or linguistic) is not an accident. This parallel should make the DNA–utterance equivalence to be introduced in §2.4.1 a little more plausible. But first we must review certain recent developments in the theory of selection in biology.

2.3 The generalized theory of selection

The theory of selection provided by the neo-Darwinian synthesis has been the subject of criticism and modification in recent decades. The neo-Darwinian theory of selection is basically that organisms that are better adapted to the ecological conditions of the environment will have a greater likelihood of survival and reproduction – i.e. are selected. One criticism directed towards the neo-Darwinian theory of selection is the role of adaptation in selecting individuals in the population. Other mechanisms for selection besides the standard adaptive one have been proposed. One such mechanism is exaptation: some trait which evolved for one purpose, or evolved for no apparent purpose at all, is exapted to serve some other function which bestows a competitive advantage on its possessor (Lass 1990; see §5.3). This particular application of evolutionary theory to historical linguistics seems quite appropriate, and Lass takes it to be a strong argument for the position that each instantiates a generalized theory of evolution.

We will concern ourselves here with another, perhaps more profound, critique of the theory of selection, that concerning the unit of selection. In the standard view found in the neo-Darwinian synthesis of evolutionary theory in biology, it is the organism that is the unit of selection. Selective processes, of whatever sort, operate on the level of the fitness of the organism. Although it is genetic material that is ultimately replicated and then generates a new organism in reproduction, it is the organism which is ultimately selected in the evolutionary process, by virtue of its (successful or unsuccessful) interaction with its environment.

This view, the organism selectionist view, was challenged by (among others) Dawkins (1982a, 1982b). Dawkins argues that the gene, not the organism, is the unit of selection. Selection can be described only in terms of favoring or disfavoring gene frequencies in populations: 'According to Dawkins, in sexually reproducing organisms only short segments of the genetic material have what it takes to be selected. Organisms are simply survival machines constructed by genes to aid them in their single-minded quest for replication' (Hull 1988:211).

However, the complications in biological selection do not end there. Others have argued that selection may occur at other levels as well. It has been argued that selection might occur at the species level, or even at higher taxonomic levels. For example, it has been suggested that a species may possess a population structure that favors its evolutionary survival (Hull 1988:420–1, citing Vrba 1984). It has also been suggested that the geographical range of a higher taxon makes it more likely to survive a mass extinction, no matter how many species are contained in the taxon (Hull 1988:220, citing Jablonski 1986, 1987).

Still worse complications ensue when we abandon our zoöcentric view of evolution and ask ourselves at what level of organization does natural selection operate for cloned groups of plants and single-celled organisms:

> botanists distinguish between tillers and tussocks, ramets and genets. For example, many sorts of grass grow in tufts (tussocks) composed of numerous sprouts (tillers) growing from the same root system. Which is the 'organism,' each tiller or the entire tussock? More generally, botanists term each physiological unit a ramet, all the ramets that result from a single zygote, a genet. Sometimes all the ramets that compose a single genet stay attached to each other; sometimes not. (Hull 1988:417)

The basic problem is that the divisions between the levels of organization for organisms is not at all clear, once we go beyond animals: 'The hierarchical boundary between organisms and groups of organisms is no sharper than that between genes and organisms, in fact much less so' (Hull 1988:418). Hence, one should not base a theory of selection on a particular alleged level of biological organization.

But there is another way to look at selection. Hull argues that there has been a convergence in the two approaches in the gene vs organism selectionist debate as they have refined their positions. Hull quotes an organism selectionist, Mayr, and then a gene selectionist, Dawkins:

> as Mayr (1978:52) has emphasized tirelessly, 'Evolution through natural selection is (I repeat!) a two-step process' . . . According to the terminology that Dawkins (1982a, 1982b) now prefers, evolution is an interplay between replicator survival and vehicle selection. (Hull 1988:217; see also pp. 412–18)

The two steps involve two processes, replication of individuals and selection of individuals through interaction with their environment. However, in the paradigm case, these two individuals are not the same: it is genes that are replicated and organisms that are selected – which ensures the survival of their genes.

Hull argues that the debate between gene selectionists and organism selectionists is largely a matter of emphasis as to which process is more important. But both processes are necessary, and it appears that prominent advocates on both sides of the debate accept this: 'Since the . . . dispute over the units of selection broke out, all sides have come to accept the distinction between replicators and interactors, albeit not necessarily in the terms I am urging' (Hull 1988:413). And, in fact, this is the crucial conceptual advance in understanding the nature of evolution.

Hull himself has contributed to this debate. He borrows the term REPLICATOR from Dawkins and chooses a different term, INTERACTOR, from Dawkins' term 'vehicle' (which Hull believes renders the role of the interactor more passive than it actually is, and is a consequence of Dawkins' gene selectionist bias; see Hull 1988:413). From this, Hull constructs a general analysis of selection processes. The basic components of Hull's theory of selection are quoted below (Hull 1988:408–9; emphasis original):

(1) 'REPLICATOR – an entity that passes on its structure largely intact in successive replications'
(2) 'INTERACTOR – an entity that interacts as a cohesive whole with its environment in such a way that this interaction CAUSES replication to be differential'
(3) 'SELECTION – a process in which the differential extinction and proliferation of interactors CAUSES the differential perpetuation of the relevant replicators'
(4) 'LINEAGE – an entity that persists indefinitely through time either in the same or an altered state as a result of replication'

There are a number of important consequences of Hull's theory that will be described here. The first is that a replicator must not simply replicate its structure. The replicated structure must also be able to replicate its own structure: 'If all a gene did was to serve as a template for producing copy after copy of itself without these copies in turn producing additional copies, it could not function as a replicator' (Hull 1988:409). That is, one must be able to have a replication of a replication of a replication . . . This leads to the creation of lineages of indefinite age.

Replication also allows for an indefinite sequence of differences in replication that can eventually lead to very different structures from the original replicator. Replication must preserve structure largely intact, otherwise we would not call it replication; but it can involve alterations to that structure. Once the structure is altered in replication, that alteration can be further replicated. The result can be a replicator that is quite different from the original replicator. 'The important principle is that in a chain of replicators errors [alterations – WAC] are cumulative' (Dawkins 1982b:85).

The second feature is equally important. Hull emphasizes that causality is involved in the selection process. In fact, there are two different causal mechanisms. The first mechanism, implicit in (1) and not discussed in any detail by Hull, causes replication, both identical (NORMAL) and ALTERED REPLICATION. The paradigm example of the mechanism of normal replication in biology is the process of copying genes in reproduction, with mutation and recombination being mechanisms for altered replication.

The possibility of altered replication gives rise to variation, by creating new replicators with a different structure from the original. The second mechanism, referred to in (2) and (3), causes differential replication, that is, perpetuation of (different) replicators: this mechanism propagates some variants at the expense of others.[1] Differential replication is hypothesized to result from the interaction of interactors as a group with their environment, specifically, the survival of some interactors (and hence their replicators) and the extinction of others. The paradigm example of differential replication is the increase in frequencies of certain genes due to the favored survival and reproduction of the individual organisms possessing those genes in their ecological environment.

Hull makes a third important proposal in his theory: that his general analysis of selection processes applies not just to the gene-organism level in biological evolution, but may apply to other levels as well: 'Just as genes are not the only replicators, organisms are not the only interactors. Just as variable chunks of the genetic material function as replicators, entities at different levels of the organizational hierarchy can function as interactors' (Hull 1988:417). If the population structure of a species can be heritable, then species might be able to function as replicators. Genes may be interactors as well as replicators, since they interact with their cellular environment at the molecular level. Although Hull expresses some doubts as to whether organisms and species can function as replicators, he suggests that it is possible, and cannot be ruled out absolutely (for organisms, see Hull 1988:409, 415; for species, see ibid. 219 and 419). Hull's main point, though, is that a generalized model of selection must be cut loose from the hierarchy of levels of biological organization.

On the other hand, change can occur without selection, and selection need not result in change:

> Once the distinction between replication and interaction is made, one can distinguish four possibilities: changes in replication frequencies due to interaction (directional selection), no change in replicator frequencies because the effects of the relevant variations happen, by chance, to balance each other out (balancing selection), changes in relative frequencies that are not due to any environmental interactions (drift), and replication sequences in which there are neither changes in replicator frequencies nor significant environmental interactions (stasis). (Hull 1988:443)

This classification of selective and nonselective changes will be relevant for understanding the mechanisms of language change (see §3.3.2).

The fourth, and most important, aspect of Hull's general theory is that selection operates only on spatiotemporally bounded individuals: 'only an individual has what it takes to be selected' (Hull 1988:215). Spatiotemporally bounded individuals are actual individuals, by definition, and so selection operates only over actual individuals: 'In selection processes of all sorts, selection takes place among actual, not possible, alternatives' (Hull 1988:473). 'Individual' is taken in the broad sense here, so that spatially discontinuous entities (such as populations) are individuals as well, as long as the collection of entities is spatiotemporally bounded. Thus, taking the population view of species, a particular species is an individual: it has a beginning and an end temporally and it is also bounded spatially. Particular organisms and genes are also individuals; so is a collection of plants growing from a single root stock; so are other population-based entities such as demes.

Hull's purpose in devising a generalized theory of selection is not merely to sort out certain controversies in evolutionary biology. Hull wishes to apply the generalized theory of selection to sociocultural evolution. He suggests that a misinterpretation of biological evolution has impeded application of evolutionary models to sociocultural evolution:

> If biological evolution were the neat process of genes mutating, organisms being selected, and species evolving, then sociocultural change is nothing so simple. One purpose of this chapter has been to show that biological evolution is not so simple either. In this chapter I have shown how general the characterization of selection processes must be if they are to apply to biological evolution. (Hull 1988:430)

Hull then applies his generalized theory of selection to conceptual change in the history of science. The first step is to discard an essentialist theory of concepts. In order to understand how scientific theories evolve, concepts must be treated as spatiotemporal individuals, in fact, lineages of ideas replicated from one scientist to another. For the understanding of conceptual change, what matters is the history of the concept, not its content. Two similar concepts with distinct lineages are distinct concepts, even if they seem alike from an essentialist point of view. The 'same' concept as 'discovered' by another scientist without knowledge of the conceptual lineage of the first scientist is, in Hull's view, a different concept, belonging to a different conceptual lineage. The phenomenon of 'reinventing the wheel' in science is not really reinvention, if the second scientist came up with the idea independently. The concept of the phoneme was invented several times, but only once did it catch on and was replicated in subsequent linguists' research and publications.

Conversely, two concepts that are of a different type are the same concept from a historical point of view if one is a later replication of the other and thus in the same lineage. As with organisms, ideas can change with each replication from scientist to scientist, even though they form a single lineage, since replication is not always identical. For example, the Prague school notion of markedness and Greenberg's notion of markedness in typology are quite different on essentialist grounds (Croft 1996b); but they are one historical concept in Hull's theory because Greenberg's notion was intellectually derived from the Prague school notion, as Greenberg acknowledges in his work (Greenberg 1966:11, 13). This view of concepts is radically different from the traditional essentialist one, where concepts have an immutable, eternal identity.

As my examples have indicated, Hull argues that it is the concept as a spatiotemporally bounded individual that is the replicator, that is, the equivalent to the gene in the classic biological gene-organism selection process (Hull 1988:441). The scientists are the interactors. The environment that scientists interact with is their empirical observations and their fellow scientists. Their interaction with their environment causes the replication of concepts (new or modified ideas), and their differential propagation (the amount of attention those ideas enjoy among scientists) causes the differential perpetuation of the relevant replicators (the ideas embodied in scientists' theories). It is possible that conceptual lineages may converge if the two scientists criticize each other and refine their ideas in response to those criticisms. Again this is parallel to biological evolution; it occurs frequently among plants and other organisms (see chapter 8).

This is Hull's theory of conceptual evolution – scientific change – in a nutshell. It applies the generalized theory of selection to conceptual evolution in a novel way, redefining concepts as historical individuals and treating concepts rather than scientists as the basic components of scientific change. In fact, Hull's theory of conceptual evolution can be seen as an instance of the theory of language change to be argued for in the next section: it can be considered a theory of semantic change in a certain specialized register, scientific language. We now turn to the more general theory of language change.

2.4 The generalized theory of selection applied to language change

2.4.1 *The paradigm instantiation of selection in language change*

We begin by presenting some definitions that closely resemble the definitions of these terms used in nonformal linguistic theories, formal linguistic theories and philosophical theories of language, but differ from them in certain critical respects.

An UTTERANCE is a particular, actual occurrence of the product of human behavior in communicative interaction (i.e. a string of sounds), as it is pronounced, grammatically structured, and semantically and pragmatically interpreted in its context. This definition more or less conforms to the standard philosopher's definition of utterance-token with the additional specification of its phonological and morphosyntactic peculiarities. An utterance is differentiated from a sentence, as the latter term is understood by philosophers, formal language theorists and syntacticians. A sentence is defined in essentialist terms; it is not a spatiotemporally bounded individual. An utterance as defined here is a spatiotemporally bounded individual. Thus, unlike sentences, only actually occurring tokens count as utterances in our sense. It is critical to the theory of language change that utterances be actually occurring language; recall that selection operates only over actual, not possible, alternatives. Since an utterance is an actually existing entity, all levels of its structure are included, in particular its specific pronunciation and meaning in context as intended by the speaker and interpreted by the hearer (see §4.3.2).

A LANGUAGE is the population of utterances in a speech community. This definition appears to be quite deviant from the structuralist notion of a language as a system of contrasts of signs. However, the structuralist notion of a language as a system of signs is the embodiment of essentialist thinking (see §1.1, §2.2), and a population approach is necessary for attacking the problem of the nature of language change (and, for that matter, language itself; see §1.1). Thus, our definition of a language actually more closely resembles the formal language theory definition of a language as a set of sentences. But it differs from the formal language theory definition in two important respects. First, a language is a population of utterances, not sentences (see the preceding paragraph). Second, our definition does not denote the set of all and only the sentences or utterance types that are generated (in the technical sense of that term) by a formal grammar. It is only the set of actual utterances produced and comprehended in a particular speech community. Again, this restriction conforms with the biological definition of a population: it is a spatiotemporally bounded set of actual individuals, not a set of 'possible' individuals – whatever that would mean.

A GRAMMAR is the cognitive structure in a speaker's mind that contains her[2] knowledge about her language, and is the structure that is used in producing and comprehending utterances (the nature of this knowledge will be discussed further below). The grammar of each speaker is acquired on the basis of the subpopulation of the language that she is exposed to.[3] Thus, each speaker will have a slightly different grammar. This definition is also based on the formal language notion of grammar but deviates from it just as our definition of language does. First, the grammar is not generative in the technical sense of 'generate' as characterizing a set of admissible sentences. This is because the grammar does not generate the language as described in the preceding paragraph in the formal language theory sense of 'generate'. It cannot do so, because the language is not all possible sentences or even all possible utterances (whatever that would mean). On the other hand, the grammar (in our definition) does generate the language in the informal sense of 'generate': it is what a speaker uses in producing (some of) the utterances of a language.

Second, the grammar consists of all our mental capacity in the use of language. Some theorists, notably generative linguists, argue that the processing mechanisms involved in producing and comprehending utterances are separate from the repository of grammatical knowledge (competence) in the mind. Others, notably cognitive linguists, argue that a single, more or less integrated cognitive structure both 'contains our knowledge of the language' and is used for actually producing and comprehending utterances of the language. For our purposes, it does not matter whether the two are separated or not: what matters is that the whole mental apparatus is included in our definition of grammar. Hence, our definition of grammar does not correspond to only the competence module postulated by formal syntacticians; it must include any processing modules as well. Whatever one's linguistic theory is, however, it must be clear that our definition of a grammar is a real, individual, psychological entity, not an abstraction that does not have a psychological (or physical) existence. In other words, a grammar as defined here is also a spatiotemporally bounded individual.

Now we may apply the generalized theory of selection to language. Recall that Hull argues that one should not expect interactors and replicators to be found at only one level in the organization of life. Nor should we expect the same in language. In fact, though, Hull points out that the paradigm case of an interactor is the organism, and the paradigm case of a replicator is the gene, which is found in DNA. Likewise, we will begin with the paradigm cases of interactor and replicator in linguistic selection.

It seems fairly uncontroversial that the paradigm case of a linguistic interactor is the speaker, including of course the speaker's grammar as we have defined it. The speaker interacts as a cohesive whole with her environment. The speaker is a cohesive whole as a member of a speech community, communicatively interacting with other members of the speech community. The ENVIRONMENT is thus the other members of the speech community, the social context of the speech event, and the goals of the speech event itself (see §3.4 and chapter 4). The grammar used by the speaker is a real existing mental structure: it must be able to interact with a real physical/mental/social environment. The speaker interacts as a cohesive whole in that the appropriate level of description of social interaction and communication is that of individual humans as social/cognitive beings, not any smaller unit.

What is the paradigm replicator? Recall that in the basic level in biological selection, the replicator is a GENE, and genes are found in DNA, which is replicated in sexual reproduction in sexual organisms. In Hull's theory of conceptual change, the replicator is a concept, which is replicated whenever a scientist uses the concept, in particular in interaction with students and other scientists. However, identifying a gene in DNA is not a simple task, nor is identifying a concept. Hull writes, 'If ever anyone thought that genes are like beads on a string, recent advances in molecular biology have laid that metaphor to rest' (Hull 1988:218; see Hull 1988:442; Mayr 1982:794–807; Dawkins 1982b:85–6 for more details), and 'in both biological and conceptual evolution, replicators exist in nested systems of increasingly more inclusive units. There are no unit genes or unit ideas' (Hull 1988:449).

Here we arrive at the proposal made in §2.1. The entity corresponding to DNA, over which the replicators are defined, is the utterance. The replicators themselves – parallel to genes – are embodied linguistic structures, anything from a phoneme to a morpheme to a word to a syntactic construction, and also their conventional semantic/discourse-functional (information-structural) values. The replicator is the particular linguistic structure as embodied in a specific utterance. An utterance, or more precisely some aspect of the utterance, embodies a linguistic structure: a passive clause, say, or a closed syllable, or a particular encoding of a predicate–argument relation. The linguistic structures as embodied in utterances are not beads on a string either. They exist in nested systems of more inclusive units, and with further complications (overlapping, discontinuity, intersection, etc.) that are well known to students of linguistic structure (see §2.4.3).

Most important of all, the replicator is a spatiotemporally bounded individual, i.e. a token. It HAS structure – '[i]n order to function as a replicator, an entity must have structure' (Hull 1988:409) – but it should not be identified with the structure as an abstract essence (type). The formal structure of e.g. the passive construction, or its semantic/discourse function, or the phonetic expression of a phoneme, can change in replication. In order to clearly distinguish the embodied replicator from the structure that it possesses, we must give it a name. Following a suggestion by Martin Haspelmath, I propose that the paradigm linguistic replicator be called a LINGUEME, on analogy with Dawkins' meme. Thus, the paradigm replicator in language is the lingueme, parallel to the gene as the basic replicator in biology; an utterance is made up of linguemes, and linguemes possess linguistic structure.[4]

The genes found in one organism are organized into chromosomes. Biological genes occur at different LOCI in the chromosomes. The alternative forms of a gene that can occur at a single locus on a chromosome are called ALLELES. The total set of genes in a population of organisms, including all alleles that occur in the same locus in different organisms, is the GENE POOL of the population. The equivalent concepts in language play an important role in the evolutionary framework for language change. The equivalent to alleles of genes are VARIANTS of a lingueme, that is, alternative structures used for a particular structural element, such as alternative phonetic realizations of a phoneme, alternative words for the same meaning, or alternative constructions used to express a complex semantic structure such as comparison. The locus for a set of variants is essentially the VARIABLE in the sociolinguistic sense of that term, that is, 'two ways of saying the "same thing"' (Weinreich, Labov & Herzog 1968:162; see §3.3.1, §6.2). Just as only one allele is found in a given locus in a piece of DNA, only one variant can occur in the appropriate structural position in an utterance. The total set of linguemes in a population of utterances (the language), and hence in the grammars of the speakers taken as a whole, is the LINGUEME POOL.

The term 'lingueme pool' may suggest that there is no organization or structure to the inventory of linguemes in a language. But the term 'gene pool' in biology does not deny the fact that genes are organized in chromosomes in a very complex and highly structured fashion. Although it is true that the evolutionary framework for language change implies a looser organization of a language system than the structuralist and generative models do (see §8.1), a lingueme pool does have a high degree of structural organization (see §2.4.3).

The grammar – the speaker's knowledge about the language – is acquired through hearing other utterances embodying these linguistic structures. Knowledge of language is essentially the ability to replicate linguemes in the appropriate social-communicative contexts.[5] A speaker may not know all of the linguemes in the language's lingueme pool, of course, so her grammar may not be able to replicate every lingueme.

When a speaker produces an utterance, she replicates a linguistic structure – actually, a large number of linguistic structures. In fact, the production of an utterance involves an extremely complex recombination of elements from a great range of utterance parents, far more complex than the two-parent recombination of DNA in the reproduction of sexual organisms in biology. When another speaker hears that utterance and produces another one, the structures are replicated again – recall that 'in order to function as a replicator, an entity must have structure and be able to pass on this structure in a sequence of replications' (Hull 1988:409).

The act of replicating the appropriate linguemes in social-communicative contexts – saying what you want to say to your addressee, in the way you want to say it – represents the use of the conventions of the speech community. Conforming to a convention is a regularity in linguistic behavior in a particular speech community (see §4.2.4). The regularity is of course the structure that is passed on in lingueme replication. The set of linguistic conventions represented by the replicable structures of the linguemes in the lingueme pool of a language is the evolutionary equivalent to the language system (see §1.1). But the evolutionary concept of a language system is not essentialist. The conventions vary and change as a result of altered replication and selection. And conventions are defined by the speech community: an identical lingueme structure in another language is not the same convention in the evolutionary framework (cf. Rohde, Stefanowitsch & Kemmer 1999).

By this point, the idea that an utterance is the linguistic equivalent to DNA should not sound as bizarre as it may have sounded in §2.1. It seems counterintuitive; at first glance, a more appropriate analogy appears to be between the grammar as the genotype and the utterance as the phenotype (but see §2.5). But the proposal here is also parallel to Hull's application of the theory of selection to conceptual change, where the concept rather than the scientist is the replicator. In fact, Hull hints at this proposal in a remark on the tokens of scientific terms in their use in scientific discourse: 'Term-tokens themselves change in replication sequences, e.g. sequences of allelomorph-allelomorph-allelomorph gave way to allele-allele-allele. This sort of transition is the subject matter of historical linguists' (Hull 1988:505; see also Keller 1990/1994:147; Mufwene 1996a:85).

One might object that utterance replication is not really replication, since the utterance does not replicate itself; it must be replicated by a speaker, using the knowledge of her language embedded in her mind. This is not all that different from replication of genes in biology, however, particularly in sexual reproduction. Replication of the genome in biological reproduction is fundamentally a cell-level process, and it is mediated by among other things RNA molecules. In sexual reproduction, however, replication of the genome is also a population-level process, mediated by the behavior leading to and including the mating of two organisms. If an organism does not mate and produce offspring, its genome will not be replicated. Likewise, replication of linguemes in utterances is fundamentally a cognitive process, mediated by activation of some mental structure and articulatory motor routine. (This mental structure / motor routine is of course acquired from exposure to prior occurrences of the linguemes in language use.) And replication of linguemes is equally fundamentally a social process, mediated by the speaker in conversational interaction. If a speaker doesn't speak, she will not replicate any linguemes.

I will call this theory of selection in language change the Theory of UTTERANCE SELECTION for language change. I conclude this section with three important observations about the claims made by the Theory of Utterance Selection.

First, the Theory of Utterance Selection does not preclude the existence of selection processes in language change at other levels of the language, the individual and society. The Theory of Utterance Selection does however assume that utterance selection is the primary locus of language change, and hence that most language changes can be accounted for in terms of utterance selection. Selection processes at other levels of organization will be discussed in appropriate places in this book (see §3.2, §8.6).

Second, the hypothesis that utterance selection occurs does not entail a particular set of causal mechanisms for replication or selection of linguemes in utterances. Of course, a proper utterance selection theory of language change will propose certain causal mechanisms for replication and selection, and attempt to account for observed facts of language change with those mechanisms. Some causal mechanisms will be sketched in the next section, and most of chapters 5–7 will be devoted to presenting the case for those mechanisms.

Third, the Theory of Utterance Selection for language change puts linguistic convention at center stage (see §1.3). Normal (i.e. identical) replication of linguemes in utterances is conforming to the linguistic conventions of the speech community. Altered replication of linguemes in utterances – the creation of variants – is a causal consequence of not conforming to the linguistic conventions of the speech community. The reasons for nonconformity are the causal mechanisms of altered replication. And the selection of linguemes is equivalent to the establishment of a linguistic convention in a speech community. The reasons for selection of a lingueme are the causal mechanisms of selection.

2.4.2 The causal mechanisms of evolution in language change

As Hull and others have pointed out, evolution is a two-step process: altered replication of the replicators, and selection of interactors. Language change is also a two-step process, as was pointed out in §1.3: innovation and propagation. The core of any substantive theory of language change is the causal mechanisms proposed by the theory for both steps in the process. Chapter 3 will survey and discuss various approaches to this problem. In this section, I will outline the proposals for the model of language change advocated here; they will be presented in detail in the remainder of this book.

As mentioned above, convention plays a critical role in the Theory of Utterance Selection. Normal replication is simply conformity to linguistic convention. Altered replication is the result of not conforming to linguistic convention. However, a wide range of mechanisms may lead to a speaker not conforming to linguistic convention in an utterance. These mechanisms may be social or interactional, that is, be the causal consequence of interlocutors attempting to achieve certain goals in language use. They may also be psychological, involving purely internal psychological processes (including perceptual-motor processes) and not (directly) involving social interaction.

I will argue in §3.4 that there is not as sharp a line distinguishing these classes of mechanisms as various adherents claim; in particular, all of them take conformity to convention as a baseline for analyzing altered replication. In chapters 4–6, I will argue for mechanisms of altered replication that make crucial reference to the relationship between forms and their conventional meanings or functions. In this sense, the mechanisms for altered replication are functional; but they are not functional in the sense of being teleological, and not necessarily in the sense of being the means towards an interactional goal (see §3.4).

Altered replication leads to the existence of variants descended from a single lingueme. These variants usually begin as variants of a single linguistic variable, that is, different ways of saying the same thing, different at the phonological, lexical or grammatical (morphosyntactic) levels. Once variant linguemes occur, then they may be differentially replicated, leading to propagation or elimination. In the generalized theory of selection, differential perpetuation of replicators is a causal consequence of the differential extinction and proliferation of interactors and the differential perpetuation of the relevant replicators. This process is selection, and we must seek the causal mechanisms of selection of linguistic structures.

What exactly is selection in language? Clearly, it is not (just) the differential extinction and proliferation of speakers themselves that lead to the differential perpetuation of the linguistic structures found in utterances. Linguistic forms, and languages themselves, can die without their speakers having to die. Instead, the speakers give up their language and shift to another; or gradually stop using one form and favor another. Thus, it is something about the grammars that leads to the differential perpetuation of utterance structures, that is, of the variants in a linguistic variable.

In this book I will argue, following sociohistorical linguistics, that the selection process is essentially a social one, and not a functional one in the sense of (external) function that I use to characterize innovation (see §1.3, §3.3.1 and chapter 7). The variants in a linguistic variable have social values associated with them. Speakers select variants to use – that is, to replicate – in particular utterances on the basis of their social values: overt or covert prestige, the social relation of the speaker to the interlocutor, etc. (the mechanisms that have been proposed by sociolinguists will be discussed in chapter 7). This causes the differential perpetuation of the relevant replicators, that is, the differential survival/extinction of linguistic structures in utterances. In other words, it is social factors, not functional factors, that play the same role in selection that ecological factors do in biology.

How is it that the differential extinction and proliferation of interactors causes the differential perpetuation of replicators? The perpetuation of a particular linguistic structure in utterances is directly dependent on the survival of the cognitive structures in a grammar that are used by the speaker in producing utterances of that structure. The survival of cognitive structures is their ENTRENCHMENT in the mind (see Langacker 1987:59; see §3.4.2). I suggest that the interactive activation model used by cognitive grammar and by Bybee (1985) offers us a cognitively plausible model of linguistic variables, and provides a mechanism by which cognitive structures can 'survive' – become entrenched in the mind – or 'become extinct' – decay. The shift in proportions of the variants of a linguistic variable in usage is brought about by shifts in degrees of entrenchment of those variants in the grammars of speakers.[6] This shift is a result of the social value of those variants for individual speakers, but the global effect is an adjustment of their activation value, or a shift in their entrenchment, in a speaker's grammar.

2.4.3 Linguistic lineages and utterance structure

In the model of linguistic selection given in §§2.4.1–2.4.2, a lineage is the spatiotemporally bounded individual resulting from replication of a lingueme. The first linguistic lineage that probably comes to the reader's mind is a word ETYMOLOGY. A word etymology is a summary of all the replications of the word, which usually is replicated in an altered state over a long enough period of time – sound change, semantic change, syntactic change, etc. Recall that Hull points out that a lineage can go on indefinitely, in principle at least, although the species which contains it may terminate through its breakup into daughter species. Likewise, a word etymology extends indefinitely, even though it may be traced back through different languages – Old English, Proto-Germanic, Proto-Indo-European, and further back. Likewise, the lineage can be traced forward even to a creole such as Torres Strait Creole English (see §8.5). A grossly simplified example of such a lineage is Proto-Indo-European *bhlē̆* 'blow' > Proto-Germanic *blē-w* 'blow' > Old English *blā̆wan* 'blow' > Middle English *blowen* 'blow, smoke, carry by wind, play a wind instrument, etc.' > Modern English *blow* 'blow, smoke, carry by wind, play a wind instrument, cause to explode, etc.' > Torres Strait Creole *blo* 'blow, puff, pant' (*American Heritage Dictionary New College Edition*; *Oxford English Dictionary*; Shnukal 1988:117).

A word etymology is probably the prototypical case of a linguistic lineage; but sounds and grammatical constructions form lineages as well. The phoneme /f/ is a lingueme that has been replicated in utterances millions of times over in the history of English and even further in the past (cf. Heringer 1988, cited in Keller 1990/1994:158–59; Ritt 1995). This replication can be differential: /f/ can change from [f] to [h] for instance. Historical linguists would notate this change as *f* > *h*; what this means is that there is a lineage of replications of a sound in which altered replication has occurred.

A type of lineage that has become of great interest in recent historical linguistics and diachronic typology are the lineages that result from grammaticalization of a word or construction, called GRAMMATICALIZATION CHAINS (Heine, Claudi & Hünnemeyer 1991:221–2). Grammaticalization chains are actually lineages for whole syntactic constructions, not just individual lexemes or morphemes (Bybee, Perkins & Pagliuca 1994:11; Traugott 2000). For example, the construction *[X is going to VERB]* has been replicated millions of times in the history of English. The replication has been altered over time in that, semantically, it has changed from motion + purpose to future meaning, and, phonologically, it has changed from . . . *going to* . . . to . . . *gonna* . . . Nevertheless, it still represents a single lineage replicated by many different speakers on many more different occasions of use over several centuries.

All of this may sound like a return to the prestructuralist view held by many dialectologists that every word has its history, a view attacked by structuralist linguistics, which argued that the linguistic system functions as a whole. However, both the 19th-century view and the structuralist view have an element of truth in them (§8.1, chapter 9). Lineages of different kinds of linguemes can be remarkably independent of each other. But they must all interact in order to form utterances, and that interaction implies the existence of a system.

The production of an utterance involves replication of phonemes, morphemes, words and syntactic constructions (and their semantic content). But utterances are themselves very complex, and the production of an utterance implies a complex organization of the grammar even in the Theory of Utterance Selection for language change. Replication of those various linguemes must be coordinated carefully in order to produce an acceptable utterance. In particular, replication of a syntactic construction requires replication of its component lexical items; replication of lexical items requires replication of their component morphemes; and replication of morphemes requires replication of their component phonemes. As Hull writes (see §2.4.1), 'in both biological and conceptual evolution, replicators exist in nested systems of increasingly more inclusive units' (Hull 1988:449).

It should not come as news to linguists that phonology, morphology, lexicon and syntax are independent levels in a hierarchy of greater inclusiveness;

indeed, these facts about lineages in linguistic evolution reveal that this basic structure of grammatical organization still holds in the evolutionary model of language change advocated here.[7] However, the linguistic picture is more complicated than this. The building-block model of linguistic organization I have suggested implies that the higher (more inclusive) levels of linguemes do not specify any information occurring at lower (less inclusive) levels in the structure that they replicate. But in fact they often – perhaps usually – do. As Hull writes in the continuation of the above quotation, 'There are no unit genes or unit ideas' (ibid.). That is, linguemes at higher levels of inclusiveness are more independent as replicators from their less inclusive levels than one might imagine. I will briefly survey a few examples from English, with reference to the more general class of phenomena they illustrate, to show how common this is.

2.4.3.1 Phonological and lexical patterns

Old English had a phonological process by which intervocalic fricatives were voiced; voiced fricatives were not separate phonemes, but allophones of the voiceless fricatives between voiced segments (Hogg 1992:92). The voicing distinction in fricatives became phonologized as a result of the loss of the gemination distinction between [sː]/[z], [fː]/[v], etc. (Lass 1992:59–60), and so the *f/v* alternation was no longer allophonic. Yet the *f/v* alternation was retained for example in *life/lives*, *knife/knives*, *wife/wives*, etc. after the loss of the allophonic rule in general. What has happened here is that the plural form of these nouns has been identically replicated even though the replication of intervocalic fricatives at the phonological level was altered (and also the conditioning environment was lost with the loss of the following vowel). These examples demonstrate that these lexical items, in particular the plural forms, have a degree of integrity in replication that prevented the loss of the allophonic alternation when the phonological system of English changed. In other words, lexical replication can be almost completely independent of phonological replication, to the point of specifying phonological patterns independent of the lineages of the individual phonemes themselves.

Of course, for those speakers who say *roofs* rather than *rooves*, altered replication of the phoneme in this lexical item has led to altered replication of this particular lexical item (due to paradigm leveling; see §6.2.1). This example demonstrates the unremarkable fact that phonological replication can be independent of lexical replication, to the point of specifying the phonological content of lexical items. This fact is unremarkable because it follows from our reductionist structuralist assumptions that the properties specified by the lower levels of linguistic organization completely determine those properties at higher levels of organization.

The more remarkable examples of *life/lives*, etc. demonstrate that higher levels sometimes specify information at lower levels. This fact simply shows that linguemes are not organized as beads on a string, or as building blocks, easily dividable into units. But neither are genes, as units of selection. There is nothing problematic about this approach, in biology, conceptual change, or language change:

> As in the case of Williams's (1966) definition of a evolutionary gene and Dawkins's (1976) parallel definition of a replicator, the 'size' of a conceptual replicator is determined by the selection processes in which it is functioning. From the point of view of replication alone, units are not needed. Entities can pass on their structure largely intact even if this structure is not subdivided into smaller units. (Hull 1988:443)

If the proper representation of *lives* required it to be subdivided into smaller units, then it would be pronounced *lifes*, at the time that the phonological rule was lost or afterwards. (The instantiation of the voiced allophone of the Old English /f/ phoneme is now presumably merged with the lineage for /v/ independent of /f/.) Instead, at least at the time of the loss of the voicing alternation, *lives* was a single unit lingueme including specification of the voicing of the fricative.

2.4.3.2 Phonological and morphological patterns

The same sort of phenomenon demonstrates that morphological patterns are independent of phonology. This can be shown by phonological alternations affecting only specific morphological forms. An example of this is the phonological alternation between [s], [z] and [ɪz] found in the English plural suffix (*books*, *rods*, *boxes*) and also in the 3rd person singular present suffix (*looks*, *flies*, *misses*). The widespread existence of so-called morphophonological rules (phonological patterns that are restricted to specific morphological or lexical classes) demonstrates that lexical items and morphemes quite frequently specify phonological properties as part of the structure that they replicate, rather than leaving it to the phonological level to specify.

Linguists have generally accepted the existence of morphophonological rules, although in fact the analysis of morphophonological rules has always called for extra theoretical constructs of dubious value (abstract underlying segments in generative phonology, multiple-level lexicons in lexical phonology, and so on). The most neutral representation of this sort of cross-level specification in structural analyses is to describe a phonological rule as referring to a morphological class or a morphological boundary. We may call this analysis UPWARD SPECIFICATION: the phenomenon is described at the lowest level (in this case a phonological process), but the rule in addition specifies properties of higher levels (morphological class). The representation entailed by the description of linguemes is DOWNWARD SPECIFICATION: a morpheme or class of morphemes specifies some of its phonological properties. Downward specification is the proper description of the locus of replication of the properties of the lingueme because the lingueme is an entity existing at the higher, more inclusive, level. We will see that downward specification is useful for syntactic representations as well (see also Croft to appear b).

2.4.3.3 Phonological and syntactic patterns

There are also cases where particular syntactic constructions possess special phonological patterns unique to them. English possesses phonologically special contracted forms of the English auxiliaries and *not* as in *I'm going* and *He won't go*. These contractions are not manifestations of general (i.e. exceptionless) phonological patterns. Moreover, they can only be described at a syntactic level, since they violate the phonological integrity of individual words and also violate syntactic boundaries such as that between subject noun phrase and predicate phrase in *I'm going*. Less dramatic but far more common examples of phonological properties specified by syntactic constructions are sandhi phenomena and any phonological processes that cross word boundaries. These examples demonstrate that syntactic constructions are replicators which may specify phonological structure as well, rather than simply inheriting the phonological properties from lower levels of organization.

2.4.3.4 Lexical and morphological patterns

Lexical items can function as units specifying morphological properties rather than simply being built up from morphemes. For example, alongside the plural *brothers*, which involves the independent replication of the stem and the plural suffix, there also exists *brethren*, in which the lexical item has survived with an otherwise relic plural (cf. *children*) and also was replicated with a specialization to one meaning of *brother* (see §7.3). Another example is *shadow*, which formerly was an oblique case form of *shade*, but has been independently replicated from *shade*, with a distinct meaning and no specialized case function (*Oxford English Dictionary*). A more complex example is *hole/hollow* [n.], which may have resulted from a split of alternative inflectional forms of the Old English noun *holh* 'hollow' (ibid.). Less dramatic but far more widespread examples are the sorts of semantic variation found in the meaning of derivational affixes: compare the meaning of the *-er* suffix in *runner* (a person who runs on a regular basis), *walker* (the object used by people who have difficulty walking), *broiler* (a chicken that one broils), *fiver* (a five-pound note, in Britain), and so on. In these cases, the lexical item as a whole specifies the role whose referent is picked out by the *-er* derivational suffix.

2.4.3.5 Lexical and syntactic patterns

Syntactic constructions can also be replicated with the specification of properties of their component lexical items independent of the replication sequence of the lexical item itself. Idioms such as *tell time* specify the meaning of the verb *tell* as 'count', even though the verb *tell* as a word lineage no longer occurs with that meaning. Many, in fact most, idioms are what Nunberg, Sag & Wasow (1994) call 'idiomatically combining expressions', where the meaning of the lexical items involved is specified as part of the structure replicated by the construction. And such idioms are very common (ibid.).

2.4.3.6 Morphological and syntactic patterns

Finally, syntactic constructions can be replicated with the specification of properties for specific morphemes such as their semantics, position or form. English lacks much morphology, but one example of a morpheme whose meaning is specified in the construction is the passive participle in the perfect construction *[SBJ have VERB-en (OBJ)]*. The passive participle morpheme in this construction does not have the passive voice meaning that it otherwise has (as in *the boys were **taken** home*; *the window is **broken***; *a word **borrowed** from Italian*). Its perfect meaning in combination with the auxiliary *have* is specified by the construction and is a result of the independent replication of this construction, including its morphological affixes, from the morphological units that appear to make it up.

In sum: more inclusive linguemes as replicators often specify the structure of less inclusive linguemes that they contain. This fact demonstrates that the distinctions between these allegedly hierarchical levels are not always clear. We find evidence for this fact any time we observe the reduction from an independent word to a bound morpheme, the fusion of two morphemes, the morphologization of an exceptionless phonological rule, or the semantic specialization of words in idioms or morphemes in particular words and constructions.

This fact has also occasionally been used to argue against the independence of these linguistic levels. But this fact does not invalidate the independence of these levels in replication in many other cases, that is, where phonological, morphological, lexical, syntactic and semantic changes occur in a wide range of utterance contexts. As Hull writes, 'Yes, conceptual evolution can occur at a variety of levels, and, no, the levels are not sharply distinguishable. But by now it should be clear that exactly the same state of affairs exists in biological systems' (Hull 1988:424). There is no incompatibility in the hierarchical organization of phonology, morphology, lexicon and syntax, and recognizing that linguemes can specify replicable structure at multiple levels in the hierarchy. (Of course, a theory of grammatical representation must allow for this possibility, preferably as transparently as possible; see Croft to appear b.)

2.5 A unified model of linguistic variation and change

Hull's general analysis of selection processes presupposes a fundamental distinction between replication and selection, with selection causing differential perpetuation of the relevant replicators. Hull's model provides a theoretical grounding to the distinction between the innovation and the propagation of a language change. The Theory of Utterance Selection for language change applies Hull's general analysis of selection processes to language change, hypothesizing that utterances play the central role. The paradigm instantiations of the generalized theory of selection in biology and language are given in (5).

(5)

Generalized theory of selection	***Paradigm instantiation of selection in biology***	***Paradigm instantion of selection in language***
replicator	gene	lingueme
replicators in a population	gene pool	lingueme pool
structured set of replicators	string of DNA	utterance
normal replication	reproduction by e.g. interbreeding	utterance production in communication
altered replication	recombination, mutation of genes	mechanisms for innovation (chs. 5, 6)
alternative replicators	alleles	variants
locus for alternative replication	gene locus	linguistic variable
interactor	organism	speaker (including grammar)
environment	ecological environment	social-communicative context
selection	survival and reproduction of organisms	entrenchment of convention by speakers and its propagation in communication

Hull's model also implies, or at least suggests, that there are two distinct sets of causal mechanisms in evolutionary change, one for replication and one for selection. One of the central theses of this book is that there are distinct causal mechanisms that bring about the innovation and the propagation of language change (see §1.3). Functional factors – the phonetic and conceptual factors appealed to by functionalist linguists – are responsible only for innovation, and social factors provide a selection mechanism for propagation.

In gene-based biological selection, perpetuation of the replicators – genes – is achieved by reproduction by the interactor – the organism. But reproduction is possible only if the interactor – the organism – survives in the environment long enough to reproduce, and in sufficient numbers that its offspring will in turn reproduce. And reproduction may result in altered replication of the gene. In utterance selection, perpetuation of the replicators – linguemes – is achieved by production of utterances by the interactor – the speaker. But production is possible only if the interactor – the speaker – survives long enough to produce utterances with that lingueme, and in sufficient numbers that knowledge of the lingueme will become entrenched in another speaker's mind and she in turn produces utterances with that lingueme. And production may result in altered replication of the lingueme.

There are two significant disanalogies between biological and linguistic evolution, both hinted at in the last two paragraphs. These disanalogies might be taken as evidence against the applicability of Hull's generalized theory of selection to language change. However, both disanalogies are irrelevant to the generalized theory of selection, and hence to the theory of language change that follows from it.

Many biologists have assumed that functional adaptation is one of the primary determinants of biological selection at the organism level (see Hull 1988:221, 300, 426 for defense of this view against recent critics). Altered replication of genes, on the other hand, is a more or less random process involving (rarely) mutation and (much more commonly, in sexual species) recombination of DNA (gene selectionists would also argue for adaptive selection at the gene level). In linguistic evolution, under the hypothesis proposed in Croft (1995a), external functional motivation that is presumably adaptive for the purpose of communication (see chapter 4) is the cause of altered replication, not selection. This position is contrary to that taken by many linguists seeking functional explanations in language, who assume that functional explanations in linguistics are analogous to adaptive explanations in evolutionary biology (see e.g. Kirby 1997; Nettle 1999; Haspelmath 1999). However, the empirical evidence indicates that linguistic selection is governed largely if not exclusively by social forces that have little or nothing to do with functional adaptiveness for communication.

The disanalogy in the role of adaptive mechanisms in biological evolution and language change is not relevant to the generalized theory of selection. Any generalized theory of selection that is applicable to evolutionary phenomena in a wide range of domains of experience must abstract away from the causal mechanisms involved in selection in any particular domain: 'The specific mechanisms involved in biological and conceptual evolution are quite different. Conceptual change does not depend on DNA, competition for mates, and what have you' (Hull 1988:431). Thus, we should not expect a specific mechanism like adaptation, even broadly construed, to be a causal mechanism in evolution in another domain, let alone the causal mechanism for the same step in the process.

The second significant disanalogy between biological and linguistic evolution has to do with the relationship between the replicator and the interactor, other than the causal relationship leading to altered replication of the replicator. In biology, an organism is described as having a phenotype – the physical and behavioral properties of the organism – which is expressed, i.e. at least partially determined, by its genotype – the genes in its DNA. In linguistics, we say that a grammar generates an utterance, or that a speaker expresses an utterance of the language. That is, it appears that in some sense, the genotype – the replicator – 'produces' the phenotype – the interactor – in biology; but the grammar – the interactor – 'produces' the utterance – the replicator – in linguistics (cf. Keller 1990/1994:148). This disanalogy has probably contributed to the notion that language change occurs through speakers' grammars (child language acquisition) rather than through language use (see chapter 3).

There is a good reason why this is a false analogy between biology and linguistics. The generalized theory of selection does not apply only to the levels of the gene and the organism in biology. It is independent of the levels of organization of biological entities: 'The fact that all three processes – replication, interaction, and evolution – occur at a variety of levels in the traditional organizational hierarchy is one very good reason to abandon this hierarchy for the purposes of capturing evolutionary regularities' (Hull 1988:428). Thus, the fact that the genotype is expressed in the phenotype, but a grammar generates an utterance, has no bearing on the mechanisms or processes involved in replication, interaction and evolution. In fact, selection might occur at higher levels of linguistic organization as well, and so the specific relationship between grammar and utterance is not a necessary part of the evolutionary mechanisms of language change.

These disanalogies do not weaken the generalized theory of selection and evolution proposed by Hull. Hull's theory does not predict the spurious 'analogies'. All it specifies are certain causal relationships between replicator, interactor and environment. It does not specify what kind of causal mechanisms are involved, nor does it specify other sorts of causal relationships that may hold between the three entities involved in selection. Other cross-disciplinary theories will be necessary to account for these differences in causal relationships and mechanisms between biology and language.

Hull is not making random, convenient or opportunistic analogies between biology and conceptual change, and nor am I doing so in applying his generalized theory of selection to language change. Hull's generalized theory of selection stands above disciplinary boundaries. Hull illustrates its instantiation in biological evolution and applies it to conceptual evolution, thereby producing a theory of conceptual change in science. I am applying the same theory to language change, thereby producing the Theory of Utterance Selection for language change.

Notes

1 In Croft 1996a, I misinterpreted Hull's concept of differential replication as referring to the creation of different replicators in replication. Although one passage (Hull 1988:409) suggests this interpretation, other passages now make clear to me that differential replication refers to selection only. Dawkins (1982b:85) uses the term 'differential replicator survival' as the effect of adaptation, that is, selection. The consequence of this reinterpretation is that the mechanisms for altered replication (the creation of variants) need not involve interaction with the environment in the generalized theory of selection, although in fact they might do so (see §3.4.4).

2 Throughout this book, I will conform to the convention of using *she* to refer to the speaker and *he* to refer to the hearer.

3 So-called ungrammatical utterances have only a heuristic status in this theory, as one of several methods used by linguists to find out the structure of a speaker's grammar.

4 The term 'gene' has an unfortunate ambiguity between token and type. A phrase such as 'gene frequencies' refers to frequencies of gene tokens. However, a phrase such as 'the gene for hemoglobin', refers to the type: many different individuals have 'the gene for hemoglobin'. I am, unfortunately, going to continue this practice with 'lingueme'. In virtually all uses in this book, 'lingueme' will refer to tokens; if I am referring to a lingueme type, I will use the phrase 'lingueme type'.

5 We may remain fairly neutral as to what sort of mental representations of linguistic structures and their relationships is required by the ability to replicate linguemes; all that matters is the ability to replicate linguemes. For more specific proposals for mental representations conforming with the evolutionary framework, see §2.4.3, §8.1, chapter 9 and Croft (to appear b).

6 Tabor (1993) and Hare & Elman (1995) apply interactive activation models to problems of language change, within somewhat different theoretical frameworks than the one described in this book.

7 Construction grammarians may object to the syntax/lexicon distinction I am making here. Langacker (1987) argues for a syntax–lexicon continuum. However, I am casting the syntax/lexicon distinction in this passage as the distinction between a complex whole and its component parts. When Langacker and other construction grammarians argue for a syntax–lexicon continuum, they are arguing that syntactic knowledge should be represented as constructions which consist of pairings of syntactic form and semantic-discourse function, and which can occur at varying degrees of schematicity (e.g. *[V NP]* and *[kick [the bucket]]*). In this view, lexical items are merely simplex, maximally specific constructions; but constructions are organized in a network like the lexicon. The construction grammar model of grammatical knowledge as complex form–meaning pairings in fact fits well with the philosophical definition of linguistic convention described in §4.2.4.