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## LANGUAGE UNIVERSALS: A COLLABORATIVE PROJECT FOR THE LANGUAGE SCIENCES

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*Underlying the endless and fascinating idiosyncrasies of the world's languages there are uniformities of universal scope. Amid infinite diversity, all languages are, as it were, cut from the same pattern.*

—Memorandum to the 1961 Dobbs Ferry Conference on Language Universals  
(Greenberg, 1963/1966)

### 1.1. Language Universals: From Dobbs Ferry to the Present Time

Today, the idea that all languages are at least in part cut from the same pattern is perhaps not particularly controversial. In contrast, as is clear from the nature of the contributions to Greenberg (1963/1966), one of the main goals of the Dobbs Ferry Conference was to justify this thesis and articulate the uniformities that languages show. This is particularly clear in the appendix to Greenberg (1963/1966), “Memorandum Concerning Language Universals,” which was distributed to the participants of the conference. In this memorandum, various notions of universals are introduced and compared, and it is suggested that language universals constitute “the most general laws of a science of linguistics.”

Since the Dobbs Ferry Conference, the general perspective in the linguistic community on language universals has changed radically. The recent history of linguistics has been characterized by the intense search for these language universals, inspired in part by Greenberg’s (1963/1966) seminal paper, and in part by the publication in 1957 of Chomsky’s *Syntactic Structures*. These two publications have given rise to an explosion of work on language universals, ranging from work in formally

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oriented syntactic and semantic theories to the large number of typological studies inspired by Greenberg's 1963 paper. Although the origins of these two streams of thought are very different, the dividing line is becoming less clear. In an attempt to delineate possible parametric variation (and hence to isolate properties of universal grammar), generative work has become increasingly focused on a wide variety of typologically very different languages. The interpenetration and dialogue between these two streams of thought is one of the defining characteristics of the linguistics of the second half of the twentieth century and the beginning of the twenty-first century.

Therefore, at the present time, there is no need to justify the claim that language universals exist. All linguists (formally or functionally oriented) would recognize the search for the universal aspects of language as one of the most important areas of research in their field. As opposed to the state of affairs at the time of the 1961 Dobbs Ferry Conference, there are many well-articulated candidate universals that in some cases have been debated extensively. However, as evidenced by the broad spectrum of perspectives represented in this volume, opinions differ—sometimes strongly—over the exact nature of language universals, their origin, and how best to study them.

In putting together this volume, we wanted to construe the notion of language universal in the broadest sense possible, ranging from Hockett's (1960) design features (e.g., interchangeability, semanticity, arbitrariness, discreteness, displacement, openness, duality of patterning, etc.) to Greenberg's (1963/1966) implicational universals (e.g., "languages with dominant verb-subject-object (VSO) word order are always prepositional") to Chomsky's (1986) principles of Universal Grammar (UG) (e.g., recursion, structure dependence, subadjacency, etc.). As this book shows, this list is far from complete. Thus, this volume also includes discussions of possible universals deriving from diachronic and historical processes (Bybee; Hurford; Reali & Christiansen, Chapters 2, 3, 14), performance constraints (Hawkins; Bever; Reali & Christiansen, Chapters 4, 6, 14), principles of "good design" (Hornstein & Boeckx, Chapter 5), neural components adapted for language through natural selection (Pinker & Jackendoff, Chapter 7), model-theoretic semantics (Bach & Chao, Chapter 8), the semantics of action planning (Steedman, Chapter 9), formal language theory (Stabler, Chapter 10), and biology (Müller; Clark & Misyak; Finlay, Chapters 11–13).

This book brings together contributions by language scholars from a variety of fields, seeking to forge new insights into the universals of language. The chapters take the form of original position papers by major figures in a variety of scientific fields with a stake in the study of language, including linguistics, psychology, computational linguistics, cognitive neuroscience, philosophy, and computer science. As such, the volume is intended to provide a snapshot of the current state of research and theoretical perspectives on language universals.

## 1.2. Varieties of Language Universals

The search for universals of language has been, and still remains, one of the central explanatory goals of the various disciplines involved in the study of language. By approaching the notion of language universals from an interdisciplinary perspective, we hope that the volume will allow the language sciences to make progress on the following questions: What are the possible sources of language universals? What are the most productive directions for future research into the problem of universals? And most importantly, how can communication be increased between linguistics and the other disciplines that participate in research on language universals?

In Chapter 2, Joan Bybee approaches linguistic universals from the viewpoint of the usage-based theory of language. She argues that from this perspective there are very few synchronic universals in the sense of features that can be found in all languages. The only synchronic universal that she reports having found in her work on morphology is that all languages have at least some minimal derivational morphology. More generally, Bybee argues that language change has to be taken into account in order to understand language universals. Factors relating to language use—such as frequency of usage—lead to grammaticalization, which tends to follow specific developmental paths. For example, she notes that discourse adverbs develop first from verb modifiers to clause modifiers, from a narrow scope to covering the whole clause, from concrete senses to more abstract ones, and from denoting specific content to indicating the speaker's attitude at the discourse level. Bybee suggests that language universals may be best viewed in terms of such unidirectional paths of linguistic change, driven by constraints arising from domain-general processes rather than ones that are specific to language.

James Hurford agrees that diachronic change is important to understanding language universals. In Chapter 3, he draws the reader's attention to two properties of languages that are, as he notes, not usually billed as universals: the ubiquitous irregularities and, what he considers to be the most striking universal of all, the tremendous expressivity of language. Hurford then proceeds to sketch an account of the former in terms of the latter. For that, he claims, it is necessary to widen the scope of the inquiry into universals from acquisition to production and to the diachronic or historical processes that link the two. By considering the life cycle of languages as well as their evolution and change, Hurford builds a case for diachronic explanation in the study of language universals, and illustrates its application to several of Greenberg's original examples. These ideas resonate in interesting and potentially productive ways both with classical and with new thinking about language. In noting that "language is like an ancient city, with buildings dating from different historical periods, but all still functioning," Hurford echoes Wittgenstein's (1953) remark in *Philosophical Investigations* (para. 18). At the same time, his hypothesis

concerning the formative role of the “performance > competence > performance > competence” cycle in language change (cf. Christiansen & Chater, 2008) is likely to assume a key explanatory role in the study of language universals.

Whereas both Bybee and Hurford explore the possible diachronic causes of existing language universals (in Chapters 2 and 3, respectively), John Hawkins examines synchronic cross-linguistic patterns in grammars and language use. He proposes in Chapter 4 that “variation-defining” universals delimit the scope of possible variation across languages. Examples of such universals include the Greenbergian implicational universals and the parameters in the Government-Binding tradition. Hawkins argues that variation-defining universals are to be understood in terms of performance principles. For example, Hawkins explains the fact that verb-initial languages tend to be prepositional by showing that under certain assumptions a prepositional language where the verb precedes its object yields structures that are more efficiently parsed. Furthermore, he suggests that these same performance principles govern variation of structures within languages, dictating that following a verb, short prepositional phrases should precede long prepositional phrases.

In contrast to the performance-based universals discussed by Hawkins, the focus of Chapter 5 by Norbert Hornstein and Cedric Boeckx is on linguistic universals embodied in Universal Grammar (UG), a characterization of the innate properties of the language faculty. Approaching language universals from a minimalist perspective, they start out by contrasting I-universals (innate properties of UG) with E-universals (universals in the Greenbergian tradition). They point out that even if every language displayed some property P, it would not imply that P is an I-universal, whereas P would be considered an E-universal. Most of their chapter is devoted to considering UG and I-universals in light of recent minimalist syntactic theory. In particular, they make the point that I-universals will have to be rethought in light of Darwin’s problem, or the logical problem of language evolution (see also Christiansen & Chater, 2008). Following Chomsky (2005), Hornstein and Boeckx raise the question of the relative importance of the following three factors in accounting for I-universals: (a) genetic endowment, (b) experience, and (c) language-independent principles. They conclude that the minimalist perspective suggests that I-universals—the key properties of UG—may not be genetically encoded but instead may derive from language-independent principles of good design.

Tom Bever adopts a minimalist approach to language, similar to Hornstein and Boeckx, but also seeks to incorporate elements from functional linguistics. Thus, in Chapter 6, he argues that linguistic universals need to be understood in terms of a model of language that incorporates both learned statistical patterns (“habits”) and derivations (“rules”). In his Analysis by Synthesis model, sentences are initially given a basic semantic interpretation based on canonical statistical patterns

of syntax, but sentences are also at the same time assigned a separate derivation, reflecting the syntactic relationship between constituents. This model leads Bever to differentiate between two types of language universals: (a) structural universals that relate to the minimalist core of the language faculty and manifest themselves in the existence of derivations, and (b) psychological universals that relate to how language is acquired and used (including performance-based constraints, such as those also discussed by Hawkins, Chapter 4). He also proposes a universal constraint on language that is necessary for his model to link statistical patterns with syntactic derivations. This constraint—the “canonical form constraint”—requires that all languages must have a set of statistically dominant structural patterns indicating the mapping between syntactic constructions and their meanings. Moreover, it should be possible to approximate the meaning of complex derivations in terms of such canonical patterns without recourse to a full derivational analysis. More generally, Bever sees his approach as complementary to the Minimalist program in that it seeks to determine what is minimally required to explain language acquisition and use.

In Chapter 7, Steven Pinker and Ray Jackendoff characterize language universals in terms of specific brain components that are available universally for the acquisition of language. Because each of these brain-related linguistic devices may not be utilized in every human language, linguistic patterns common to all languages do not necessarily follow from this approach. Pinker and Jackendoff suggest that evolution has endowed modern humans with a suite of adaptations that are specific to language (or for which language provided a strong selectional pressure). These adaptations for language include human specializations for both speech perception and production, as well as, more broadly, the duality of patterning (Hockett, 1960) evident in phonology as the combination of meaningless discrete sounds (phonemes) into meaningful units (morphemes). As examples of universal features of language that hold across all languages, Pinker and Jackendoff highlight the existence of words, construed as organized links between phonological, conceptual, and morpho-syntactic information, as well as the notion that all languages are designed to express conceptual structure. On the syntax side, they argue that the brain makes available a number of different syntactic devices that are reflected in human languages to a greater or lesser degree, including hierarchically organized phrase structure, word order, agreement between various constituents, and case marking. Thus, from the viewpoint of Pinker and Jackendoff, language universals arise primarily as a consequence of brain-related capacities that have evolved through natural selection and that are unique to humans and unique to language.

Although Pinker and Jackendoff note the importance of conceptual structure as a source of universal constraints on language, their chapter focuses primarily on linguistic devices outside of semantics. In contrast, Emmon Bach and Wynn

Chao, in Chapter 8, focus on semantic universals from the viewpoint of formal model-theoretic semantics. They start by outlining some general properties of semantic theory, including the notion of a “model structure” (the system of possible denotations), types of denotations, types of functions, and compositionality. On the basis of this general theory, the authors investigate the following questions: (a) Are the basic elements of the model structure universal? (b) Are the relations between syntactic categories and semantic interpretations universal? (c) Are there typological patternings related to either (a) or (b)? Whereas Bach and Chao hypothesize that the general model structure is the same for all languages, they outline research on a number of different “semantic typologies” where different semantic and syntactic properties seem to cluster together.

In Chapter 9, Mark Steedman takes a different approach to the notion of semantic universals. He opens his chapter by distinguishing those linguistic universals that are conditional and statistical (as in Greenberg’s original list) from those that are absolute. The latter are further subdivided into substantive (e.g., the existence of nouns or of transitive verbs), functional (e.g., the existence of case, tense, etc.), and formal (e.g., the universal constraint noted by Ross (1967) that relates “gapping,” or deletion of the verb under coordination, to base constituent order in the language). He then sets out to explain absolute universals in terms of the semantics of action planning—arguably, the driving force behind the emergence of language, construed as a means for communicating meaning as it is situated in the world. Steedman’s formal approach to planning is based on a calculus of affordances (which, he notes, can be implemented in associative memory), such as those that are transparently encoded in the Navajo noun system, or in the Latin case system. The primitive operations in this calculus are function composition and type raising (the operation of turning an object of a given type into a function over those functions that apply to objects of that type). By resorting to the framework of Combinatory Categorical Grammar, Steedman reduces universals to functional application, composition, and type-raising rules. This allows him to develop a unified account for a wide range of formal universals, such as the fact that all natural languages are mildly context-sensitive, and the gapping direction in coordination.

Edward Stabler, too, adopts a formal approach to language universals but from the point of view of formal language theory and the theory of learnability, a point of view that was completely absent from the original 1961 meeting on language universals. In Chapter 10, he reports on research showing that it may be a universal structural property of human languages that they fall into a class of languages defined by mildly context-sensitive grammars. Stabler also investigates the issue of whether there are properties of language that are needed to guarantee that it is learnable. He suggests that languages are learnable if they have a finite Vapnik-Chervonenkis (VC) dimension (where VC dimension provides a

combinatorial measure of complexity for a set of languages). Informally, a finite VC dimension requires that there be restrictions on the set of languages to be learned such that they do not differ from one another in arbitrary ways. These restrictions can be construed as universals that are required for language to be learnable (given formal language learnability theory). Stabler concludes by pointing out that formalizations of the semantic contribution (e.g., compositionality) to language learning might yield further insight into language universals.

In Chapter 11, Ralph-Axel Müller asks how the kind of language universals discussed in the previous chapters might be instantiated in human brains. He distinguishes between “shallow” and “deep” universals in cognition, the former being due to abstract computational properties, and the latter to properties of the neural architecture that supports the function in question, such as language. He proposes that shallow universals that are a matter of consensus in the linguistic community should be studied from a neurodevelopmental standpoint to seek their deep (i.e., biologically meaningful) counterparts. To examine the likelihood of there being deep universals that are specific to language, Müller conducts an extensive survey of genetic, anatomical, and imaging data, while advocating caution in their interpretation: both genes and input during development determine the function of the areas where language is traditionally assumed to reside. According to the explanatory synthesis he offers, the specific architecture of local brain areas (such as Broca’s area) is not genetically predetermined but instead emerges as a result of its role and activity, given its particular location in functional networks. In conclusion, Müller suggests that a neurodevelopmental account of putative language universals is most likely to be based on organization and interaction of nonlinguistic “ingredient processes.”

Using Müller’s chapter as a point of departure, Andy Clark and Jennifer Misyak offer a critical perspective on the notion of innate universals. In Chapter 12, they describe their stance as “minimal nativism,” according to which a brain area should be seen as embodying a kind of language universal if it is genetically predisposed toward fulfilling a certain sufficiently general linguistic function, for example by virtue of its strategic connectivity. On this view, Broca’s area could still count as the brain locus of a linguistic universal, even if it supports other functions beside language. Having thus questioned one of the premises of Müller’s argument, Clark and Misyak point out that its conclusion may still hold, if the “real story” of language involves languages adapting to humans (as hinted, e.g., by Hurford, Chapter 3—see also Christiansen & Chater, 2008).

Taking on a broad biological perspective, Barbara Finlay notes in Chapter 13 that the existence of universals in language would only be surprising if the rest of cognition, as well as the world at large, were unstructured. Given that the world is in some sense and to some extent predictable, universals should be sought in the

structure of information it presents to the language system. A productive approach to the study of language universals could follow the lead of biology, where looking at the interplay of evolution and development is proving particularly effective.

The volume concludes with Chapter 14, in which Florencia Reali and Morten Christiansen note that natural languages share common features known as *linguistic universals* but that the nature and origin of these features remain controversial. Generative approaches propose that linguistic universals are defined by a set of innately specified linguistic constraints in UG. The UG hypothesis is primarily supported by Poverty of Stimulus (POS) arguments that posit that the structure of language cannot be learned from exposure to the linguistic environment. This chapter reviews recent computational and empirical research in statistical learning that raises serious questions about the basic assumptions of POS arguments. More generally, these results question the validity of UG as the basis for linguistic universals. As an alternative, Reali and Christiansen propose that linguistic universals should be viewed as functional features of language, emerging from constraints on statistical learning mechanisms themselves and from general functional and pragmatic properties of communicative interactions. The cognitive mechanisms underlying language acquisition and processing are proposed not to be qualitatively different from those underlying other aspects of cognition. Thus, this perspective calls for an interdisciplinary approach to the study of linguistic universals, where a full understanding of the language system would only be possible through the combined efforts of all subdisciplines in cognitive science.

### 1.3. The Importance of Interdisciplinary Research

It should be clear from the various chapters in this volume that language universals may derive from several different interacting sources: for example, a genetically specified UG, the interfaces between the language faculty (assuming UG) and other components of the brain, neural mechanisms and plasticity, processing constraints on language use, computational constraints on language learning and representation, factors related to the role of language as a medium of communication, and evolutionary dynamics of populations of language users. An intended contribution of this volume is to show that it is important to determine which of these various sources is at play and how the various sources interact. For example, some researchers may agree that some property, such as recursion, should be explained in terms of genetically specified neural structure, because it meets certain criteria for such an explanation, without necessarily agreeing that the structure is specifically “linguistic” (see Chapters 6, 7, 11, and 12 by Bever, Pinker & Jackendoff, Müller, and Clark & Misyak, respectively). Such a research strategy would force the linguist

to state the property of recursion in a simple and clear form in order to enable the neuroscientist to isolate the mechanisms involved.

The full benefits of an interdisciplinary approach can only be reaped if we realize that such an approach opens entirely new avenues of research into universals. In the various disciplines concerned with language, the past half-century has seen, over and above regular progress, a few major conceptual revolutions (such as the ascendancy of cognitive psychology), and even the emergence of new fields (such as computational linguistics, formal semantics, and cognitive science). The new disciplines that together with linguistics form the contemporary field of brain/mind science offer both new twists on the issue of language universals and, more importantly, a glimpse of the possible place of universals in the grand scheme of things in cognition. Indeed, the quest for universals in linguistics is mirrored by very familiar-looking concerns in those other disciplines. Let us consider two examples, one structure related, and the other focusing on function.

Insofar as structure is concerned, a surprisingly fresh-sounding perspective on cognitive universals<sup>2</sup> is provided by a 1951 paper by Karl Lashley, *The problem of serial order in behavior*. Lashley writes:

Temporal integration is not found exclusively in language; the coordination of leg movements in insects, the song of birds, the control of trotting and pacing in a gaited horse, the rat running the maze, the architect designing a house, and the carpenter sawing a board present a problem of sequences of action which cannot be explained in terms of successions of external stimuli.

(1951, p. 113)

Although contemporary readers hardly need to be convinced that stimulus-response associations cannot explain cognition, it is worth pointing out that some of Lashley's examples, such as bird song or multijointed limb coordination, necessitate *hierarchically structured*, not merely properly sequenced, representations. Indeed, possible computational underpinnings of hierarchically structured representations are being intensely studied, for example, in vision, specifically in object and scene processing (e.g., Mozer, 1999). We note that although much more is known about vision and its neurocomputational basis than about language (not the least because of the ready availability there of animal models), the general characteristics of hierarchical visual representations are yet to be worked out, which suggests that intellectual cross-fertilization with linguistics could be especially effective here.

Turning from representations to the related issue of function, processes, and mechanisms, we observe that in vision, researchers have long been interested in identifying a core set of universal information-processing operations, or computational universals. The phenomena that need to be explained in vision range from so-called low-level perception (of color, texture, motion, surface shape, etc.), through

mid-level perceptual organization and grouping, to high-level object and scene understanding. Echoing the minimalist hypothesis, suggesting that the complexity of language is mostly apparent (Chomsky, 2004), one may wonder whether the vast panoply of functions found in the arsenal of human vision can be reduced to a small set of computational primitives. In linguistics, the notion of a computational universal is exemplified by Merge and Move (Chomsky, 2004); it is not the place here to discuss candidates for similarly universal functional mechanisms in vision—suffice it to say that the possibility that such universals exist is being considered (e.g., Barlow, 1990; Edelman, 2008).

A possible methodological framework for facilitating comprehensive, cross-disciplinary studies of cognition had been proposed by Marr and Poggio (1977), who pointed out that cognition, as any other information-processing phenomenon, can only be fully understood if addressed simultaneously on a number of conceptual levels. These range from the most abstract computational level (what is the nature of the task, and what needs to be computed), through the algorithmic (what are the input and output representations, and how are the former to be mapped into the latter), to the implementational (what mechanisms can support the necessary computation, and what is their place in the brain).

Since its introduction, the Marr-Poggio approach has proven effective in various cognitive domains. Particularly instructive examples of the effectiveness of this approach can be found in the quest for computational universals, which are necessarily the farthest removed from behavioral and neurobiological data, and therefore the most difficult to substantiate. One such example is the interchangeability of space and time in cognitive representations—a possible computational universal identified by Pitts and McCulloch in a paper dealing with vision and audition, and titled, for reasons unrelated to the present book, *How we know universals* (1947). The idea that temporal quantities can be represented in the brain by spatial means has been supported by recent studies of auditory processing, which integrate behavioral and neurobiological data-gathering with computational analysis and modeling (reviewed in Shamma, 2001).

The recognition that universals will have different interacting sources suggests that a direction for future research will be the close collaboration of researchers from different disciplines with a stake in language, including linguistics, psychology, animal cognition, psycholinguistics, cognitive neuroscience, philosophy, computational linguistics, computer science as well as behavioral and molecular genetics. Given the ever increasing amount of research output in each of these disciplines, no single person can expect to cover all the bases. Thus, a complete understanding of the nature of language universals will by necessity require researchers to venture outside their home disciplines and invite collaborations with others.<sup>3</sup>

## 1.4. Toward an Integrated Understanding of Language Universals

In a multidisciplinary approach, it is not expected that there will be one answer to the question, “What are language universals?,” nor have we tried to engineer one in this introduction. For this reason, we find that the study of language universals (perhaps along with the study of language acquisition and evolution) may provide one of the most fruitful areas of language research for cross-disciplinary collaborations. Unlike descriptive studies of particular languages, or cross-linguistic studies of particular syntactic or semantic phenomena, language universals often have a level of generality that make them well suited for collaboration between linguists and nonlinguists. We suggest that it is time to start a series of conferences on language universals, which would take place every other year at a different university in the world. The conference could be modeled on the highly successful biennial language evolution conference that has been continuously growing in size and interdisciplinary breadth over the past 12 years. The proposed conference on language universals would force linguists to formulate their results in a way comprehensible to nonlinguists, would induce nonlinguists to take an interest in working with linguistics, and would provide a forum where such collaborative efforts could be presented. We hope that this volume will provide part of the inspiration and impetus to establish such a conference series.

As another example of collaboration between linguists and nonlinguists, debate on language universals could take place in the context of co-taught courses at universities (which can be either at the graduate or undergraduate levels). Students and professors from different fields and very different theoretical backgrounds can benefit from such programmed interactions. Both undergraduates and graduates often find this kind of course rewarding, and college administrators normally look favorably upon this kind of interdisciplinary co-teaching.

Because of the wealth of findings and theories offered by the different disciplines, it is now more important than ever to actively seek an integrated understanding of the nature of human language universals, the cognitive and neural mechanisms behind them, and their manifestation among different languages. We see the book as a first step in this direction, providing contributions from scholars of language who work in a variety of fields, in an effort to stimulate insights from a variety of points of view.

### Key Further Readings

To get some idea of the scope of the problem confronting any language researcher interested in language universals, one can take a quick look at the number of

languages in the world, and their genetic affiliations and geographical distribution in the *Ethnologue* (Gordon, 2005; an online version available at: <http://www.ethnologue.com/>). This source provides a listing of all the languages found on earth. It does not give much structural information, but can serve as a useful starting point for anyone interested in typological patterns. For a searchable database of the structures of the world's languages, see *The World Atlas of Language Structures* (Haspelmath, Dryer, Gil, & Comrie, 2005), which is the latest development of the Greenbergian tradition of typological linguistics.

The point of departure for a historical perspective on language universals would be the report that was published following the first Conference on Language Universals, convened at Dobbs Ferry, New York, in 1961 (Greenberg, 1963/1966). Also of historical significance is Greenberg's short volume on language universals, which was recently published in a new edition (Greenberg, 1966/2005), and his article in *Science* (Greenberg, 1969) pointing to the study of language universals as a new frontier for research. Additionally, Hockett's (1960) paper in *Scientific American* on the universal features of human language as well as Chomsky's (1965) discussion of linguistic universals and UG provide insights into the early study of universal patterns of language.

As background literature for the present volume, Baker (2001) provides a nontechnical introduction to the generative grammar approach to language and the role of language universals in this framework. For an alternative approach to grammar and universals, as seen from the viewpoint of construction grammar, see Goldberg (2006). Culicover and Jackendoff (2005) seek to provide a bridge between generative and construction grammar approaches to syntax and linguistic universals.

More generally, the nature of language universals and their possible origins is a key question for current research on language evolution. Christiansen and Kirby (2003) contain a selection of papers on the evolution of language, providing insights into universals from many different theoretical and disciplinary perspectives.

Finally, each chapter in this volume contains a list of *Key Further Readings*, listing background literature relating to language universals as approached from a variety of viewpoints, including those of usage-based, evolutionary, typological, minimalist, psycholinguistic, semantic, and computational linguistics, as well as biology, neurobiology, and cognitive science.

#### Notes

- 1 The authors' names are in alphabetical order.
- 2 By "universal" in the expression "cognitive universals," we mean to refer to properties holding across humans and cognitive domains.

3 As a case in point, one of us—Chris Collins—has joined forces with Richard Kayne (NYU) and computer scientist Dennis Shasha (NYU) to develop an open database aiming to provide a comprehensive picture of syntactic, semantic, and morphological variation across human languages. In a similar vein, another of us, Morten Christiansen, has embarked on a major project to create a quantitative modeling framework for understanding universal patterns of language change, through interdisciplinary collaborations with typological linguist William Croft (UMN), phonetician Ian Maddieson (UC Berkeley), mathematical biologist Jon Wilkins (SFI), a physicist specializing in molecular phylogenetics, Tanmoy Bhattacharya (LANL), cultural anthropologist Daniel Hruschka (SFI), statistical physicist Eric Smith (SFI), theoretical evolutionary biologist Mark Pagel (Reading), and molecular anthropologist Mark Stoneking (MPI-EVA).

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