**Philosophical reflections on the future of construction grammar**
**(or, Confessions of a radical construction grammarian)**

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*In memory of Henry Bacon (1957-2022), and our decades-long conversation about philosophy, music, art, and life*

## 1. Introduction

What is the future of construction grammar? I am honored to be invited to answer this question in this theme issue. To be sure, at this point in my life, I am more part of the past and present of construction grammar than the future. So my aim is primarily to persuade the reader to carry forward the ideas and suggestions found here.

The editors of this theme issue perceive a number of problems in the current state of construction grammar, although they do not mention the greatest problem by far, the continued dominance of Chomskyan generative grammar, particularly in Europe and North America. They have explored the problems in admirable detail, including a forthcoming paper (Boas, Leino and Lyngfelt, in prep.), an extensive online questionnaire, a roundtable discussion at ICCG-11 in Antwerp, and this theme issue. I will summarize the problems identified by the editors, and then offer my own approach to these problems in the remaining sections of this paper.

The two most important problems in the editors' minds are the framework problem and the meaning problem. They are the first two listed in their introduction, the first two set topics at the ICCG-11 discussion, and they are more or less the two questions we were asked to address:

> "Is Construction Grammar best considered a coherent theoretical framework or rather a flexible toolbox for linguistic analysis?"

> "What's in a construction? What kind(s) of information is, and is not, included in a construction, and in a proper description of a construction?"

The editors' introduction suggests that part of the framework issue is whether there should be a single formalism, or any formalism, for construction grammar. Although the second question is not specifically about the representation of meaning in construction grammar, the representation of meaning is probably the greatest challenge in the representation of constructions. I address these two questions in sections 3 and 4.

Other issues were raised by the editors and in the ICCG-11 discussion. These issues include: Can construction grammar's breadth include all of language (or at least, all of grammar)? What is the overall organization of the construction network? How are constructions combined in a sentence? How do we accommodate conversational

discourse and multimodality? What is the role of language use; what does "usage-based" mean? I will touch upon some of these issues. Mainly, though, I will focus on use, in section 2. From my corner of the construction grammar community, this issue is equally important, and guides my answer to the other two questions.

## 2. From usage-based to complex adaptive systems to the evolutionary framework

### 2.1. The usage-based model as a model of grammatical knowledge and processing

Some construction grammarians, but not all, are usage-based. Other construction grammarians are generative, in the formal language theory sense of that term, in the way that other formal theories of grammar such as Head-driven Phrase Structure Grammar (HPSG) are generative. The contrast is most clearly articulated in the chapters by Bybee and Kay in *The Oxford Handbook of Construction Grammar* (Bybee 2013, Kay 2013). Here I will describe what could be called different degrees of usage-based-ness.

In the narrowest sense, exemplified by Langacker's early paper (Langacker 1988), the usage-based model is a model of how linguistic knowledge is stored in the mind. Langacker contrasts the "maximalist", "non-reductionist" and "bottom-up" character of Cognitive Grammar to the "minimalist, "reductionist" and "top-down" character of generative grammar (Langacker 2000:1). The "minimalism" of generative grammar is the minimizing of stored grammatical knowledge, with the rest being the product of innate structures and rules. In contrast, "maximalism" argues that much grammatical knowledge has to be learned. The "reductionism" of generative grammar is primarily that if there is a more general rule (or for a construction grammarian, a more general schema), then more specific instantiations would not be stored. In contrast, "non-reductionism" allows for more specific as well as more general rules/schemas to be stored. Finally, the "top-down" approach of generative grammar focuses on the most general rules/schemas for the language, while the "bottom-up" approach of usage-based models doesn't ignore low-level, restricted patterns and idiosyncratic constructions, including of course idioms. The seminal article in Construction Grammar (Fillmore, Kay and O'Connor 1988) begins with a taxonomy of idiomatic constructions.

One consequence of even this narrow sense of the usage-based model is that there are an awful lot of stored constructions, of varying degrees of schematicity, that are assumed to be represented in the human mind. All usage-based models therefore propose that constructions are organized into a network (for a detailed explication, see Diessel 2019). Langacker represents the network such that nodes may represent more general or more specific constructions: both [SBJ VERB OBJ] and [*I love you*] are nodes in a taxonomic hierarchy (or more generally, a lattice). Bybee (1985), the seminal work on the usage-based model, represents only word forms (types) as nodes in the network. The word types are linked to other word types by similarity or identity both in phonological form—the individual phonemes, as in /walkt/—and in the components of meaning expressed by the word, as in [WALK + PAST]. Any more general construction is a pattern of similarity links among the words that instantiate that more general construction. Bybee's network representation makes even clearer the "bottom-up" nature of the usage-based model.

Bybee is also a pioneer in dynamicizing this usage-based model, situating it in a model of language processing and language change. In particular, Bybee and others made

the case for the role of both token and type frequency in dynamic processes associated with the storage of grammatical representations, including entrenchment, productivity, retrieval, and formal changes such as phonetic erosion of forms and analogical reformation.

The well-established role of token frequency leads logically to the question of how token frequency is to be represented. One approach gaining much interest is the representation of tokens directly, that is, exemplar models of linguistic representation. Exemplar models were first proposed in phonology, in part to accommodate the fact that productions of phonemes were highly variable phonetically, more or less within a region of phonetic space, e.g. the vowel space (Pierrehumbert 2003). Exemplar models allow for the representation of that variability directly as a network of instances, although there are other ways to represent variability, e.g. representing a phoneme as a probability distribution over a region of the phonetic space. Bybee (2010) proposes an exemplar model that applies to syntax as well as phonology.

### 2.2. The usage-based model as a model of grammar vis-à-vis language use

This represents roughly the current version of the usage-based model of grammatical knowledge and processing, taken down to the token level. Yet this is not the notion of "usage" that many linguists have in mind. Grammatical knowledge and processing are "in the head", that is, in the mind of the speaker. But usage also means using language, that is, language in social interaction. In this sense, usage is "out there" in the world, between the speaker and addressee. If construction grammar aims to be a theory of language, not just of syntax, then it must "break out" of a single mind and include the social dimension of language.

The following paragraphs summarize language use as part of social interaction (based on Croft 2000 [ch. 4], 2009a and 2011). Language is not an isolated system. It serves a function in social interaction:

> Language is a (largely) conventional coordination device to solve the coordination problem of communication, which in turn is a coordination device to solve the coordination problem of successfully achieving any joint action that human beings wish to engage in (Croft 2009a:403)

This definition of the function of language needs unpacking, as it is couched in terms introduced by Lewis (1967), Bratman (1992) and Clark (1996). A joint action, the ultimate goal, occurs when two individuals cooperate in carrying out an action that is made up of the individual actions of the two (Bratman 1992; Clark 1996). This can happen only when each individual takes into consideration the other individual's beliefs, intentions and actions. This cooperation involves absence of coercion, mutual support, common ground (shared knowledge) and mutual responsiveness, and what Bratman calls 'meshing subplans'—each individual's actions and subactions must mesh with those of the other individual (Croft 2009a:398-99).

The successful accomplishment of a joint action requires coordination between the two individuals (Lewis 1967; Clark 1996). Coordination is a challenge because we cannot read each other's minds. Hence joint action gives rise to coordination problems. In

order to solve coordination problems, our intentions, plans and beliefs must somehow be made public, so that they can be shared and the joint action can be successful.

Coordination problems are solved by coordination devices. By far the most effective coordination device to carry out joint actions is communication: I communicate to you my beliefs and plans, you do the same for me. That makes it possible for each of us to do our individual actions as described above so that they mesh together to bring about the joint action.

But communication is itself a joint action that requires coordination. And again, this poses a coordination problem because we can't read each other's minds. Coordination devices are needed to solve the communication problem. Of course the communication must be rich enough in meaning that fine distinctions can be made to precisely convey beliefs, plans and so on. This is possible when conventional communication signals are adopted by a community. Language is a general purpose conventional signaling system. Convention is not the only coordination device found in communication; nonconventional devices are also necessary. However, we can set these aside for our purposes here.

There are conventions for many other things than communication. For instance, Britain has a convention of driving on the left side of the road. This convention serves the joint action of not killing each other accidentally. Lewis and Clark present a definition of convention that is therefore quite general, although they both primarily apply it to language. The definition given here is a composite one from both authors (see Croft 2000, 2009a, 2011), illustrated here with the English word *butterfly*:

a. A regularity in behavior (regularly producing the sounds represented by *butterfly*)
b. that is partly arbitrary (one could have equally chosen the sound string *mariposa,* as the Spanish did)
c. that is common ground in a community (using *butterfly* is shared knowledge among English speakers)
d. as a coordination device (members of the English speech community conform to it to a great degree)
e. for a recurrent coordination problem (English speakers have the recurrent problem of communicating about a butterfly)

Two aspects of the definition of convention are particularly important for this paper. First, conventions are associated with a speech community, not just an individual speaker. The knowledge of a convention is shared among the speech community, and in fact is a significant part of what defines the speech community as a community.

Second, the pairing of form in (a) and meaning in (e) is recurrent. What makes *butterfly* a convention is that this form-meaning pairing is regularly, repeatedly used by different speakers in different social interactions across the speech community.

How do we connect usage of language as a model of grammatical knowledge to language use as serving the social goal of joint actions? The two are linked by token frequency. At the social level, this is the repeated employment of the linguistic convention as a coordination device. At the psychological level, this is the foundation of an exemplar usage-based model of the storage and processing of linguistic knowledge—knowledge about one's language.

This linkage between social interaction and individual cognition is generally described as a complex adaptive system (CAS):

> Language as a CAS involves the following key features: The system consists of multiple agents (the speakers in the speech community) interacting with one another. The system is adaptive; that is, speakers' behavior is based on their past interactions, and current and past interactions together feed forward into future behavior. A speaker's behavior is the consequence of competing factors ranging from perceptual constraints to social motivations. The structures of language emerge from interrelated patterns of experience, social interaction, and cognitive mechanisms (Beckner et al. 2009:1-2)

In particular, the linkage provided by production of tokens and its effect on speakers is the adaptive component of a complex adaptive system. Occurrence of tokens of linguistic units—sounds, words and constructions—feeds back into the speaker's knowledge about their language and influences future language use.

### 2.3. An evolutionary framework: replication, lineages and populations

In Croft (2000), I used the approach to language use and knowledge about language in §2.2 to develop an evolutionary framework for language change, or more generally, for language. This framework is much too broad to describe here. Instead, I focus on just the part that manifests the usage-based/exemplar model, and its consequence for defining what is a construction.

The fundamental idea in Croft (2000) is that language change happens in language use. Language change is an instance of change by replication. Every time I open my mouth to talk to you, I replicate sounds, words and constructions that I or my interlocutors have previously used. This replication process is inherently variable. As noted above, the phonetic realization of each (phoneme) hits a slightly different point in the phonetic space. And each experience being verbalized is unique, so the replication of the words and constructions describe slightly different experiences than those for which they were used before.

Once there is variation in replication, there can be selection. I follow the philosopher of science David Hull's General Analysis of Selection (Hull 1988). Hull generalizes the theory of evolution, that is, change by replication, so that it abstracts away from particular structures and mechanisms in biology. Hull applies the General Analysis of Selection to conceptual change in science in his 1988 book. It is a relatively short step from there to apply it also to language change, as I did in my 2000 book.

Replication is a temporal process. Hence, linguistic categories have a temporal dimension. This observation is already implicit in exemplar models where the memory of tokens decays; such decay is usually a function of time since the token occurred. Since replication happens every time we speak, the temporal dimension of categories is at a small scale, well within the lifetime of a single speaker.

Replication also extends beyond the lifetime of a single speaker, since one can (and does) replicate sounds, words and constructions from someone else's utterance that they

heard or was addressed to them. This is possible because language use is public, not internal: it occurs in conversation, everyday talk.

Replication forms lineages, that is, a replication of a replication of a replication...In the evolutionary framework, replication lineages provide the relations between tokens. Replication lineages can branch when there is an innovation in form or in meaning. Replication lineages are known in historical linguistics under other names: a sound lineage is a sound change; a word lineage is an etymology; a construction lineage is a grammaticalization chain.

A construction in a particular language, such as the English Progressive construction, is a lineage, in particular one branch of a lineage that split when some replications of the source construction came to have a function that we call the meaning of the Progressive, and (usually somewhat later) a distinctive form that in hindsight a linguist calls the form of the Progressive construction.

The view that linguistic categories are lineages is mentioned briefly in Croft (2000:109), but I did not really draw out this conclusion until quite a bit later, in a series of lectures I did in Beijing in 2010, and were published in the West in 2021 (Croft 2021:284-85; see also Croft in press:223-26). Although it follows naturally, it represents such a radical break with the way semantics is normally done that it took a while for even me to accept it.

Why is that so? What makes it so radical? It is because a linguistic category lineage—sound, word or construction—is not defined in terms of inherent, essential properties of form and meaning, but instead is defined as a historical entity. A historical entity is something that has a beginning in time and space—in this case, when the English Progressive emerged—and also an end—in this case, when the construction is abandoned, or itself splits into a family of new constructions. Of course, over the course of the construction's use, one can describe inherent properties of the construction's form and meaning. More precisely, one can describe the inherent properties of particular instances of the construction, because those properties vary in every use. This fact is apparent to those who look at not just a few invented examples but corpora of use, including variationist sociolinguists and historical linguists as well as corpus-based construction grammarians. This variation may be directed; in hindsight we call this a change in or evolution of the construction. But it is all the same construction because the construction category is defined as a lineage of replications.

The historical, spatiotemporally bounded nature of linguistic categories is a consequence of the fact that the categories are part of a phenomenon defined by replication: that is, language, and also the speech community that produces language. Replication creates populations, in the technical evolutionary sense of that term: a set of entities that are unified not by possessing a shared set of inherent properties, but by a relational property that holds the population together—or more precisely, a relational property whose absence between two individuals distinguishes one population from another. That property is replication.

The biological question that led to population thinking, one of the major insights of the neo-Darwinian synthesis (Mayr 1982:272), is the definition of a biological species. The older definition of a biological species is essentialist (also known as Aristotelian). A species such as a red-tailed hawk was defined in terms of inherent properties of the bird: its shape, size, physiology and so on. However, the essentialist definition suffers from a

number of serious problems. There are sibling species: two species that have similar inherent properties but do not interbreed. There are also polytypic species: a species that has a high degree of variation but whose members nevertheless interbreed. Many if not most species have a high degree of variation among inherent properties, making an essentialist definition impossible. Finally, species change over time, and their "inherent" properties that supposedly define them disappear.

A linguist will recognize that exactly the same problems occur with languages. There are many cases of sibling languages, including Czech and Slovak. Modern Chinese is a polytypic language; so is Modern Italian. All languages vary to the point that one cannot identify a set of essential properties (rules, constructions, words) that holds for all speakers of the language. And languages change over time, even when they do not split up into daughter languages.

Population thinking takes a completely different approach from essentialist thinking. A species is defined as a reproductively isolated population. Members of a species interbreed among themselves (although of course it is not necessary that every member breeds with every other member). More significantly, they do not interbreed with members of other species, for whatever reason: it is physiologically impossible, their ranges are fully separated, one species breeds in the spring and the other in the fall, and so on. The relational property that defines a population is reproduction (cf. Hull 1988:470). And reproduction, of course, is how replication occurs, creating new individuals in the population.

Of course, there are hybrid species, especially among plants. There are also chains of populations, where there is some interbreeding between neighboring populations but not between geographically distant populations. These are problematic cases in defining species in population terms. But the "problems" are phenomena that directly follow from the population definition of species. Sometimes reproductive isolation is not complete. Speciation happens: that is, populations split. But the speciation process, the loss of interbreeding, is a gradual process. Populations may also converge, as in hybridization. Hybridization is also a gradual process.

Population thinking can be applied to language, or more precisely, the speech community (Croft 2000:13-20). The speech community is a communicatively relatively isolated population of speakers. A speech community may split, as happened with Latin and its daughter Romance languages. The split is incipient in the case of Czech and Slovak. Communicative isolation is incomplete in many instances, perhaps more so than between biological populations. The emergence of new languages is gradual. In some cases it is due to the gradual process of the splitting of a speech community, leading to "sibling languages".

In other cases it is due to the gradual integration of a nation state, leading to "polytypic languages", that is, languages made up of distinct geographical varieties that have been unified under a new national identity. That is, there is also convergence or even merger of speech communities, just as there are with species; it leads to multilingualism, language contact phenomena and language shift with contributions from the lost language as with Norman French in English.

A further complexity that is found in human societies but not biological populations is that a society is not a homogeneous population; human individuals belong to multiple overlapping and nested speech communities in a society, based on social domain and

social categories (Clark 1998; Croft 2000:90-94, 166-73, 2009a:403-4; Höder 2018:43-47): 'There is no limit to the ways in which human beings league themselves together for self- identification, security, gain, amusement, worship, or any of the other purposes that are held in common; consequently there is no limit to the number and variety of speech communities that are to be found in society' (Bolinger 1975:333).

In the evolutionary framework, a language such as Italian or Czech has a distinct identity to the extent that the speakers of the language form a distinct speech community based on a relatively high degree of communicative isolation. It is not due to a fixed phonology, lexicon, or set of constructions. In the evolutionary framework, a language is not an infinite set of sentences, but an actual, finite population of utterances produced by the speech community—a corpus. Likewise, sounds, words and constructions are finite populations of forms actually produced by speakers, contained in the finite population of utterances that make up the language. They will vary in form and meaning, but their unity is a result of replication, not shared inherent features.

The population is finite but its terminal boundary may be in the future since the language is still being used. This is of course the case for any living language that we may study. Let us return to language use, and ask how this population is extended.

A speaker chooses to use, for instance, a word to describe some aspect of the experience she wishes to verbalize. Her knowledge about her language includes knowledge about previous uses of words and phrases in the language. She always has multiple choices, for example *butterfly, Monarch, bug, that thing, it, orange butterfly, big butterfly* and so on. In the exemplar model, these choices are available as previously heard (or produced) coordination devices associated with the particular experiences that were coordination problems for communication at the time. When the speaker chooses a particular word on this new occasion of use, say *butterfly,* she is construing her current experience as a recurrence of a prior experience or experiences for which the word *butterfly* was used as a solution for the coordination problem.

This is how a use of *butterfly* is a replication, and adds to the lineage of that linguistic category. Construal is an essential part of the replication process, because a coordination problem is recurrent only in the eyes of the speaker. But every experience is unique, and construal alters the language, if only subtly most of the time. Sometimes the new construal is more abrupt, such as a figurative use. The construal chosen by a speaker can be novel: not entirely predictable, certainly not by a deterministic rule, and not entirely by a probabilistic rule either.

## 3. Construction Grammar: a "framework", or a scientific community?

### 3.1. Construction grammar as a "framework"

The introduction to this theme issue indicates that the framework issue is a problem: 'The field of CxG is essentially lacking a coherent framework'. They note that there is quite a bit of variation among different so-called flavors of CxG in terms of formalisms and tools. They do not note that there is also quite a bit of variation among different flavors of CxG with respect to more foundational issues, such as the generative vs. usage-based approaches described at the beginning of §2.

Are there any core theoretical ideas that characterize a theory of grammar to be a construction grammar rather than something else? I suggested two in Alan Cruse's and my textbook on cognitive linguistics in a section called 'essentials of construction grammar theories' (Croft and Cruse 2004:257-65; cf. Croft 2001:18-29). The first is that linguistic forms are basically symbolic units, pairings of form and meaning, that differ only in degrees of complexity and schematicity. This contrasts with the Chomskyan generative approach that separates form and meaning into distinct modules. The second is that these symbolic units are organized into a network. This contrasts with the Chomskyan generative approach that minimizes stored units and assembles complex units by rules of various sorts.

The results of the questionnaire created by the editors did not refer to the first supposedly essential idea. This is perhaps because no less a construction grammarian than Chuck Fillmore argued that some constructions consisted of form without meaning (Fillmore 1999; for somewhat different alternative analyses, see Goldberg 2006, Croft 2009b). The second supposedly essential idea, the network organization of symbolic units, was strongly supported in the questionnaire. However, even network representation will be questioned in §4.3.

If there is no single set of essential ideas behind the theory of construction grammar, then who is a construction grammarian? There are some linguists whose theories share many ideas with construction grammar. Is Ray Jackendoff a construction grammarian? I suspect that many construction grammarians would not call Jackendoff a construction grammarian.

Another interesting case is Cognitive Grammar. Surveys of flavors of construction grammar such as those in Croft & Cruse (2004) and Hoffmann & Trousdale (2013) include Cognitive Grammar as one of the flavors. But Cognitive Grammar developed simultaneously with and in parallel to Berkeley Construction Grammar, and has its own technical terminology and formal representations. Is Cognitive Grammar a construction grammar? At one point, Langacker described Cognitive Grammar as 'a constructional approach' (Langacker 2009:225). But he did not change the name of his theory. In fact, he earlier wrote that 'It appears…that anything statable in construction grammar has a direct analog in cognitive grammar' (Langacker 1991:8), suggesting that at the very least Cognitive Grammar was there first.[1]

And what about linguists who proposed similar ideas, but before Berkeley Construction Grammar came in to the world, such as the brilliant and prescient Dwight Bolinger (1976), but also Anna Wierzbicka (1982), Ellen Prince (1978) and particularly Joseph D. Becker (1975)? Are they construction grammarians? Proto-construction-grammarians? Or just fellow travelers? There was certainly the feeling that constructions were "in the air" in the late 1970s and early 1980s, for those of us who were there.

### 3.2. Construction grammar as a historical entity

The astute reader will have noticed that this discussion is basically the same as the one about biological species, languages and linguistic categories in §2.3. There is a great deal of variation within construction grammars and among construction grammarians. It is

[1] I am grateful to the editors for bringing this passage to my attention.

hard to pinpoint even a single "essential" property of construction grammar. There are linguists whose theories of grammar share some "essential" properties of construction grammar, but who are not usually considered construction grammarians.

The solution I suggest here is the same as the one proposed at the end of §2. Construction grammar, and the community of construction grammarians, are historical entities, the former produced by the latter (cf. Hull 2006). The ideas are important, but they are variable and they evolve—for example, the evolution of what it means to be "usage-based" described in §2. What matters is that construction grammarians share their ideas with each other, and debate competing ideas with each other, as well as sharing the same empirical phenomena as critical for evaluating the success and persistence of those ideas—the replicators of construction grammar.

This is exactly what Hull's General Analysis of Selection was developed for: how science proceeds. His 1988 book is subtitled *An Evolutionary Account of the Social and Conceptual Development of Science.* Hull argues that the differential replication of scientific ideas happens in the conversations of scientists as well as in the confronting of those ideas with empirical reality (Hull 1988:7). Of course, the conversations of scientists—in class lectures, in talks at conferences, and in research publications—are subject to selection pressures as well: success in academic employment; institutional support for graduate students and one's research activities; attendance at conferences, workshops and summerschools; and success in academic publication and in invitations to conferences. In other words, attitudes of one's fellow scientists, not to mention academic politics and economics, as well as the facts of empirical evidence, apply selection pressures to the replication of scientific ideas.

Hull argues that fairly small groups of scientists, which he calls 'research groups' (Hull 1988:22-23), are the primary communities. A research group is usually based at a single university, at least until the graduate students finish and radiate to other universities, and consists of scientists who interact intensively with each other, debate ideas and test them against empirical data, and cite each others' work in their own. Hull also considers the existence of larger "demes" of scientists (Hull 1988:353), and the importance of competing research groups (see especially chapter 5)—his case study is the competition between the pheneticists and the cladists in biological systematics. Hull also observes that research groups are relatively ephemeral (Hull 1988:23).

I think it is fair to say that the Berkeley linguistics department from the late 1970s to the early 1990s, particularly the group centered around Chuck Fillmore (not to mention Paul Kay and George Lakoff, both of whose presence was also critical) was a highly successful research group in Hull's sense. It led to the emergence of construction grammar, Frame Semantics and indeed, cognitive linguistics more broadly. The research group at UC San Diego around Ron Langacker was also quite successful: another major source of cognitive linguistics and more specifically the source of Cognitive Grammar.

One can trace the lineages of the flavors of construction grammar from the emergence of these two research groups. Cognitive Construction Grammar and Embodied Construction Grammar were developed by scientists who received their doctorates at Berkeley. Berkeley Construction Grammar evolved into Sign-Based Construction Grammar, converging with Ivan Sag's variant of Head-driven Phrase Structure Grammar from Stanford. Cognitive Grammar was a slightly divergent lineage, originating in San Diego, and continues, not having branched into different flavors.

I followed these developments closely at the time from across the bay at Stanford, where I was part of the tail end of another important research group, the typologists around Joe Greenberg (a large group during the Stanford Project on Language Universals from 1967-76, with a last flowering in the early 1980s before Greenberg's retirement). Radical Construction Grammar represents a convergence of typology and construction grammar: the subtitle of Croft (2001) is *Syntactic Theory in Typological Perspective.* Luc Steels also joined his work to the construction grammar research community, calling it Fluid Construction Grammar. Mike Tomasello wrote a pioneering study of syntactic acquisition that is similar to construction grammar (Tomasello 1992), and later adopted construction grammar as seen in the title of his 2003 book, *Constructing a Language: A Usage-based Theory of Language Acquisition.*

Words matter. Neither Luc, Mike nor I studied at Berkeley, but by describing our approaches to syntax as 'construction grammar' (independently of each other), we each construed our work as descended from, or at least merging with, the lineage of the Berkeley research group.

Ontologies also matter. If construction grammar is a historical entity, produced by a group of linguists who interact with each other professionally, not unlike a biological species or more relevantly, a speech community, then uniformity is not to be expected, nor do I believe it is desirable. It is true that the sort of evolutionary historical usage-based approach described at the end of §2 is very different and in a number of ways incompatible with the generative formal model of Sign-based Construction Grammar (see §3.3). But I would not exclude either of these approaches from the construction grammar community. It is important to debate with scientists who disagree with you. Much of construction grammar developed as a reaction against another research group which has radiated from MIT to almost all linguistics departments in the US and very many across the world, namely Chomskyan generative grammar. Yet internal debates are equally important.

### 3.3. Formalisms and construction grammar

An important part of the framework question, for linguists, is the formalism used to represent syntactic structures. The questionnaire revealed major differences of view about the value of 'an exact formalism to represent [CxG's] findings'. The introduction to this theme issue notes differences in the formalism used in different 'flavors' of construction grammar. It is worth looking into this question more deeply.

What exactly is a formalism? The simplest yet perhaps most useful type of formalism is a visualization of the linguistic analysis of a sentence. (Construction grammar is primarily concerned with syntax, or more generally morphosyntax, so I will focus on this type of grammatical structure.) Trees, bracketing, boxes, graphs (in the mathematical sense) and abstract symbols for schematic elements of a construction are commonly used to visualize an analysis of a sentence or of a family of constructions that a sentence belongs to.

Visualization is helpful to the reader, but some linguists want more from their formalism. One approach is based on formal language theory, which is a branch of mathematics. This is exemplified by a generative grammar, which includes some flavors of construction grammars. In these models, the analysis of a sentence's syntactic structure

or its meaning is like a derivation in logic: it follows from "first principles", such as a set of symbol-manipulating rules. More specifically, a generative grammar sanctions all and only the sentences of the language; the set of sentences defined by a generative grammar is infinite, but not all sentences are grammatical from the point of view of the generative grammar.

The advent of computers has allowed for the development of computational models of language. Such models allow for the implementation of hypotheses about how speakers store grammatical knowledge and process sentences of a language, such as parsing and semantic analyses of sentences, or more challenging, production of sentences. More ambitious models include agent-based models of language in social interaction. Luc Steels' models are by far the most ambitious: robots that interact with each other through an emerging language.

I have no issue with formalism per se. I have worked with statistical physicists to develop formal computational models of the evolutionary framework described in §2.3 (we are not so far along to model complex constructions, unfortunately). But the value of the formalism depends on what you think of the theory that is presupposed by the formalism.

For example, Radical Construction Grammar argues, based on both cross-linguistic and language-internal evidence, that constructions are the basic units of (morpho)syntax. That is, syntactic categories such as Noun or Subject are not the basic units of syntax, used to build up constructions of different kinds. This follows not just from empirical facts but also from the fundamental method of syntactic analysis, distributional analysis (Croft 2001, chapter 1).

Distributional analysis defines syntactic categories by the occurrence of their members in constructions. But then the constructions that defined the syntactic categories are defined as combinations of those syntactic categories, e.g. [Det Adj Noun] or [Sbj Verb Obj]. This is circular reasoning. It might be acceptable if constructions consistently defined the same syntactic categories in their distribution. But they do not: not across languages, and not within languages either, as was noted by the American structuralists (and more recently, e.g. by Gross 1979).

The usual solution is to arbitrarily choose a construction to define a syntactic category. This is what I called methodological opportunism (Croft 2001:30-32, 41-44). The empirically best solution is to accept the facts of variation in distribution across and within languages. The result is that constructions are recognized as the basic units, and syntactic categories are both language-specific and construction-specific.

Many formalisms do not take this approach. They assume that the basic units of syntactic structure are categories that exist independently of constructions, both within languages and across languages. I call the cross-linguistic assumption the skeleton model of language universals—all languages have, or partake of, a set of universal categories and structures (Croft, in press). I call the language-internal assumption the building block, or reductionist, model of syntax: complex syntactic structures are defined as a combination of smaller syntactic units that exist independently of constructions.

Hence any formalism that presupposes the skeleton model of language universals and the building block model of syntax presupposes a theory that is incompatible with at least one flavor of construction grammar, namely Radical Construction Grammar. These assumptions are not necessary conditions for a formalism. Fluid Construction Grammar is

a formal computational model that does not make these theoretical assumptions and is compatible with Radical Construction Grammar. But there will not be a single formalism that is satisfactory for all flavors of construction grammar in the construction grammar research community.

Likewise, a formalism that does not model degrees of similarity in network links, or degrees of strength of nodes or network links corresponding to type frequency and token frequency, isn't capturing what the usage-based approaches described in §2.1 consider to be crucial elements of the nature of grammar and language. A formalism that doesn't also model social interaction and constructions as conventions of a speech community is at least not useful to, if not theoretically incompatible with, the social-interactional theories of syntax in language use described in §2.2. Finally, a formalism that models a language as an infinite set of abstract sentences rather than a finite set of utterances bounded in space and time, and defines sounds, words and constructions as essentialist entities rather than as historical entities defined by their replication lineages, would be incompatible with the evolutionary usage-based model described in §2.3.

Formalisms and computational models can be useful. But my guess is that there won't be a single formalism for construction grammar taken as a whole. This is true for syntax. But it is even more true for semantics, which may challenge the validity of the most basic assumption of grammar formalisms, namely that they are modeling mental representations of knowledge.

## 4. Meaning, function, and phenomenology

The second question posed to the contributors to this issue was broader: "What's in a construction? What kind(s) of information is, and is not, included in a construction, and in a proper description of a construction?" While the answer to this question with respect to form is vexing enough, as seen in §2 and §3.2, the function side of a construction is where the really tough questions arise. In this section, I will briefly explore where my research has taken me with regard to this question.

### 4.1. Semantic content and information packaging

Radical Construction Grammar basically emerged from the realization that my analysis of universals of major syntactic categories or parts of speech in my doctoral dissertation (revised as Croft 1991) should be expanded to all of grammar. In that work, I argued that cross-linguistic and language-internal variation in the morphosyntactic behavior of parts of speech could be explained by recognizing two dimensions of function: the semantic class of lexical concepts—traditional "meaning"—and the propositional acts that they performed in discourse: reference, predication and modification.

I started expanding this two-dimensional analysis of function in order to find an organization of the meanings that are expressed in language (Croft 1990). This is an audacious task because language is a general purpose communication system (see §2.2). I then rediscovered the model of the verbalization of experience of another great linguist who was at Berkeley in the 1970s and early 1980s, Wally Chafe (Chafe 1977). I elaborated his model to integrate the two-dimensional analysis I had previously developed (Croft 2007). This project is relevant to another topic raised by the editors, the

aim of construction grammar to cover all grammatical constructions. But how does one decide what all of the grammatical constructions of a language are, given its general-purpose scope? The editors also identify what they call the "core problem": how does construction grammar cover the 'more general structures' of a language? The more basic problem is: what are the core structures of a language?

The only answer to this question that can be offered, especially if one wants an answer that applies to all languages, is in terms of function. I realized that the second dimension of function, which I came to call 'information packaging' (following Chafe 1976), was a better place to start to lay out the skeleton of language as a general-purpose communication system than a semantic classification of all of experience. In the terms used in §2, information packaging is the construal of experience for communication, and ultimately joint action. Syntactic structures follow information packaging more closely than what is traditionally called "meaning." The skeleton of information packaging allows us to get an overview of how to cover "all of the constructions" of a language, at least schematically. Or even more ambitiously, all of the constructions of all languages.

This is the aim of *Morphosyntax: Constructions of the World's Languages* (Croft 2022a). It uses the functional framework of Croft (2007) to lay out the major types of constructions in terms of information packaging, and major semantic classes that are most relevant to those constructions, ranging from minimal referring phrases (pronouns) to complex sentences (conventionalized patterns of discourse relations between clauses). It then surveys the major morphosyntactic strategies found across the world's languages to express those constructional functions, drawing on six decades of typological research. Of course, such a vast enterprise cannot be accomplished in a single book, even if it is over 800 pages long (including the online glossary). But I hope it is a useful start.

### 4.2. Semantic maps, multidimensional scaling, and the continuous nature of conceptual space

The problem of parts of speech from a cross-linguistic perspective is their variability: constructions used to define "noun", "verb" and "adjective" do not cover the same range of concepts in different languages. (They don't do so even in the same language; see §3.3.) Typologists use the semantic map model to account for cross-linguistic variation. The semantic map model represents functions as points or nodes in a network (graph structure). For example, each lexical concept is a node. A construction's distribution is the set of nodes—e.g. lexical concepts—that occur in the construction. The distribution of constructions is not arbitrary: nodes representing concepts that occur in the same construction are semantically related. (This is not always true, for historical or accidental reasons; one must account for noise in the empirical data of syntactic distribution; see Croft 2022b:3-4.) If you look at the distribution patterns of enough constructions, you can construct a network representing semantic relations between concepts that are manifested in syntactic, morphological or lexical distributions. Many typologists use the term 'semantic map' for both the conceptual network, and the mapping of a construction's distribution onto the conceptual network. I distinguish the two, using 'conceptual space' for the former and 'semantic map' only for the latter.

The simplest and one of the earliest examples of the semantic map model was developed to characterize ergativity (Comrie 1978). In ergative languages, some

constructions group together transitive object and intransitive subject. In accusative languages, including most European languages, constructions usually group together transitive subject and intransitive subject (hence the traditional terms 'subject' and 'object'). Typologists accommodated both patterns in a single representation. First, function was split: transitive subject (A), transitive object (P), and intransitive subject (S). Accusative languages groups A and S against P; ergative languages group A against S and P. The relations between A, S and P are captured in the graph structure in Figure 1. The circles indicate the categories found in ergative languages (dashed) and accusative languages (solid).

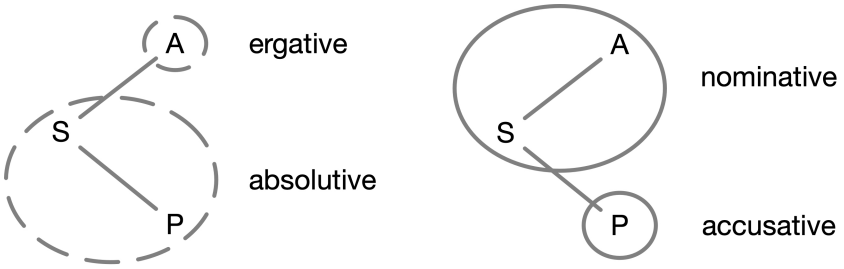


*Figure 1. Semantic maps of ergative and accusative systems in the same conceptual space.*

Typologists started using semantic maps to account for variation in categories across syntactic, lexical and morphological categories. In *Radical Construction Grammar,* they are used as the replacement for universal essentialist building-block categories such as "noun", "verb" and "adjective", "subject" and "object" and so on. The principle linking universal semantic relations among concepts to constructions is the Semantic Map Connectivity Hypothesis: a construction's distribution must cover a connected subgraph of the conceptual space (Croft 2001:96).

However, it was difficult to apply the semantic map model to a large number of concepts and/or a large number of languages. There is so much variation in construction distributions across languages, especially when there are a large number of concepts, that it is impossible to produce a coherent graph structure representation of the conceptual space manually.[2] Some linguists, including Steve Levinson and his research group (Levinson et al. 2003) and, independently, myself (Croft and Poole 2008; Croft 2022b), began to use multidimensional scaling to automatically generate Euclidean conceptual spaces from large and complex datasets of cross-linguistic variation in the mapping from constructional form to meaning. These new methods revealed a new perspective on the relation between form and meaning.[3]

Multidimensional scaling (MDS) represents a conceptual space as a Euclidean geometrical space, that is, a continuous space, not a graph structure of discrete nodes as

[2] There is now an algorithm to do it computationally [Regier et al. 2013], but a large conceptual graph structure is nevertheless difficult to visualize easily.

[3] MDS is one of several multivariate methods that are used outside linguistics and within; see Croft and Poole (2008:7-10) for a brief discussion of the former and Baayen (2008, ch. 5) and Croft (2022b) on the latter.

in Figure 1. A piece of data is a point on the space. Conceptual relations between points in the same space are represented directly as Euclidean distance. MDS reduces all the variability of the data to a fixed number of dimensions; the most useful number of dimensions is determined by fitness statistics. Thus patterns in complex variation in distributions are easy to visualize.

The use of MDS allows the researcher to plot points representing a much larger number of much more fine-grained situation types than a small number of crude semantic categories like 'property' and 'action' or 'transitive agent' and 'transitive patient'. Examples include the Bowerman-Pederson set of 73 spatial relations pictures, or Dahl's tense-aspect questionnaire with 250 sentence contexts. For example, Figure 2 represents an MDS spatial model of the conceptual relations among the Bowerman-Pederson spatial relations pictures.

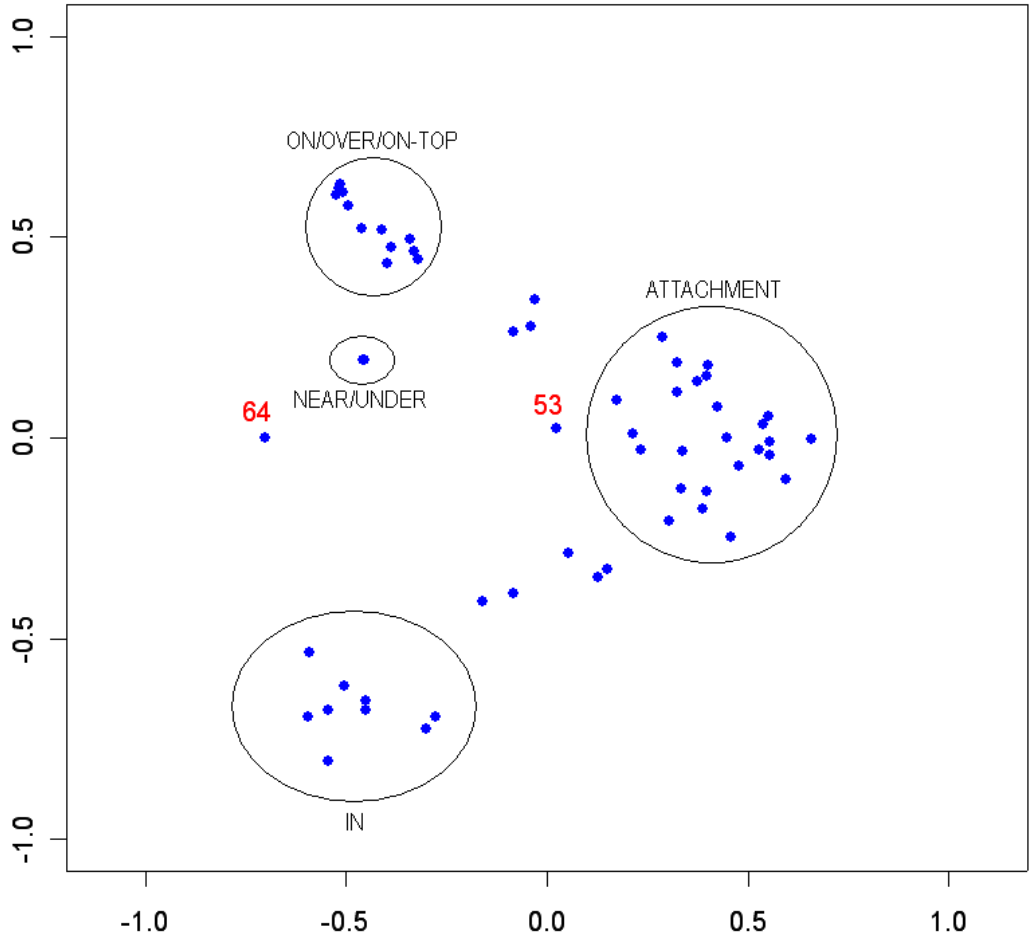


*Figure 2. Spatial model of Bowerman-Pederson adposition meanings. Data from Levinson et al. (2003); analysis from Croft (2010a).*

When data on the cross-linguistic expression of these large sets of fine-grained situation types is plotted by MDS, there is an important and striking result. If semantic classes were discretely conceptualized in language use, one would expect points representing instances of those classes to clump together in tight clusters. But that is not what is found (Croft 2010a). The only example of a tight cluster in Figure 2 are the four spatial relations labeled NEAR-UNDER, all superimposed on one point in the spatial model.

Instead, the common pattern is that points are distributed across broad areas of conceptual space. Although Figure 2 gives suggestive names for regions of the conceptual space (ON/OVER/ON-TOP; ATTACHMENT; IN), this is an oversimplification. The "clusters" are spread out in semantically significant ways, and there are spatial relations found between the "clusters". Some spatial relations are more or less on their own (pictures 53 and 64 in Figure 2). These patterns represented in Euclidean space reflect cross-linguistic variation in semantic categorization of spatial relations.

These patterns indicate that speakers are sensitive to fine-grained situation types such as the Bowerman-Pederson spatial relation pictures, and can make grammatical distinctions in their language throughout the conceptual space. Moreover, the conceptual space really is continuous: the dimensions of the space are straightforwardly interpretable. For example, the 'IN' part of the conceptual space of spatial relations, based on data from nine languages in Levinson et al. (2003), is a continuum based on degree of enclosure of the figure by the ground (Croft 2010a:12-13).

In other words, there are no universal discrete conceptual categories such as 'containment' (for 'IN') or 'surface contact' (for 'ON'), just as there are no universal discrete morphosyntactic categories. This conclusion is confirmed by an analysis of the morphosyntactic expression of scenes from the Pear Stories film in the English Pear Stories narratives (Croft 2010b; data from Chafe 1980). When one looks at verbalization in a controlled setting, it is obvious that there is immense variation in verbalization: no one describes the same scene in exactly the same way. An analysis of that variation reveals that alternative morphosyntactic constructions used by speakers are potential incipient sources of grammaticalization and lexical semantic change (Croft 2010b).

Moreover, a close comparison of the Pear Stories scenes shows that subtle differences in scenes are systematically represented by frequency differences in the use of variant forms (Croft 2021, chapter 9). For example, in scenes where an event that is not intended by a human participant is verbalized, events that are more likely to be under the control of the person are more likely to verbalize the person as subject in the argument structure construction, while events less likely to be under the control of the person are more likely to verbalize them with another participant as the subject, in a gradient scale (Croft 2021:264-65).

This evidence indicates that very fine-grained distinctions between situations being verbalized are grammatically relevant, determining both variation and change in the frequency of use of different constructions for subtly different scenes. That is, a speaker's grammatical knowledge must include knowledge of a very fine-grained set of situation types, ranged along continuous dimensions of conceptual variation. The mapping between form and meaning for a speaker is a probability distribution of constructions

across conceptual space (Croft 2021:271). These probability distributions are inferred from the frequency distributions of alternative forms—by the speaker learning and using language, not just by the linguist analyzing the patterns after the fact. Finally, language change involves a gradual shift of these probability distributions over time, even over the speaker's lifetime.

### 4.3. From Frame Semantics to radical embodiment (existential phenomenology)

The description of the semantics of constructions in the preceding section implies that detailed knowledge of fine-grained differences between situation types is part of our knowledge about our language. In other words, our knowledge about these fine-grained situation types is very rich, albeit structured by multiple dimensions of continuous variation, depending on the nature of our experience.

That is to say, the meaning side of the form-function pairing opens out to all our knowledge about our world. (I use the word 'about' rather than 'of' to emphasize that our knowledge is always incomplete, and always differs from the incomplete knowledge of other members of our speech community.) The function end of a construction encompasses all of our knowledge.

In addition, function also involves not just our knowledge about our world but also the packaging of it for communication. That is, it also involves knowing how to construe that knowledge for the specific purposes at hand, namely the joint actions we are aiming to achieve. It is legitimate to ask the question: how do we represent all of this knowledge in our mind, as part of our mental grammar of our language?

But that is not all. Fillmore, in addition to being the seminal figure in construction grammar, is also the seminal figure for a major theoretical concept in cognitive semantics, namely the semantic frame. Fillmore describes a semantic frame thus:

> A 'frame'…is a system of categories structured in accordance with some motivating context…The motivating context is some body of understandings, some pattern of practices, or some history of social institutions, against which we find intelligible the creation of a particular category in the history of the language community. (Fillmore 1982:119)

That is, a particular concept (category in Fillmore's terms) can only be understood against a background context of understanding, practice and social history in a particular community at a particular time. This view of meaning is holistic and nonreductionist, like the Radical Construction Grammar notion of syntactic categories described in §3.2. A concept is defined ('profiled' in Langacker's [1987] terms) with respect to the frame, not the other way around. This view of meaning also conceives of meaning as a historical entity, as described in §2.3. The semantic frame is bounded in space and time by the practices and understandings of a community of people at a particular period of time (see, e.g., Law 2019:69-70).

But again, it is legitimate to ask, how do we represent patterns of practices, understandings, and social history in our mind? Not just as part of our mental grammar of our language, but as our way of engaging with our world, linguistically or otherwise?

The mental representation model of human knowledge, perception and action is the classic model of cognitive science. However, there are those that have questioned this model. Cowley contrasts the mental representation model with what he calls 'radical embodiment', whose 'hallmark lies in replacing the view that brains depend on representations…with the methodological premise that cognition must derive from agent-environment relations' (Cowley 2016:411).

This is not a new idea. Hopper's emergent grammar (Hopper 1987) makes the same point. Bert Dreyfus, a philosopher at Berkeley from the 1970s onward, and a member of the cognitive science program there along with Fillmore, Lakoff, Talmy, Kay and Searle, argued against the mental representation model of human behavior all his professional life (e.g., Dreyfus 1992). And Dreyfus drew his critique from the existential phenomenologists of the early 20th century, particularly Martin Heidegger (Dreyfus 2007) and Maurice Merleau-Ponty (Dreyfus 2000, 2002).[4] In fact, Dreyfus argues that the history of the cognitive science paradigm of mental representations followed by its radical embodiment critique repeats the history of Husserl's phenomenology followed by Heidegger's and Merleau-Ponty's existential critique (Dreyfus 1982, 1993, 2000).

It would take me too far afield to try to explicate the existential phenomenological critique of mental representations, but I strongly encourage construction grammarians and cognitive linguists to examine the arguments. The direction that some construction grammarians have gone in terms of constructions as part of language as a historical, situated, embodied behavior, including Fillmore's definition of Frame Semantics, leads far down the road to a phenomenology of constructions.

(Full disclosure: while in high school, I read the works of Merleau-Ponty translated into English at the time, and studied phenomenology and hermeneutics as an undergraduate. I can't really say I understood Merleau-Ponty back then. But I can say for myself what Henry Bacon wrote me thirty years ago: 'I realized how much phenomenology has influenced the way I see life. I hadn't forgotten about it, rather it had become such an integral part of my thinking that for some time I hadn't been able to fully distinguish it from my attempts at forming at least a moderately coherent view of life on the whole' [personal letter, 20 October 1992].)

Of course, embodiment has been a rallying cry for some cognitive linguists and some flavors of construction grammar, particularly Embodied Construction Grammar (Bergen and Chang 2013). But their computational model makes use of mental representations of constructions and motor activity. Lakoff and Johnson's *Philosophy in the Flesh* intends to ground thought in embodiment. However, Ulric Neisser in his review of Lakoff and Johnson (1999) criticizes them for not really carrying through this aim:

> Metaphor in their hands becomes just another computational function, divorced from the meaningful activities of animals in their environment. Despite the allusion to Merleau-Ponty's notion of 'flesh' in the title, the version of embodiment which they propound stands contrary to any hermeneutic or phenomenological analysis. (Neisser 2001:167)

[4] Both Heidegger and Merleau-Ponty wrote their major works early in their careers (*Being and Time* [Heidegger 1927/1962]; *The Phenomenology of Perception* [Merleau-Ponty 1945/2012]), but also wrote many other important works. Dreyfus (1991) interprets Division I of *Being and Time*. Hass (2008) is an excellent overview of Merleau-Ponty's philosophy.

But I too use representations of constructions and meaning in my own publications. Are we all hypocrites? Not necessarily. We are trying to analyze what language is and how it is used. We observe people producing utterances and responding to them. We see this human behavior as if utterances—which are not mental representations—have linguistic structure and meaning. We trace the role of language structure and meaning in joint action, and their evolution over time. This does not necessarily commit us to mental representations and symbol manipulation in the mind. We must recognize that just as it is said that all models are wrong, but some are useful, it is also true that all formalisms/representations are wrong, but some are useful. We must accept that scientific linguistic analysis can shed light on embodied language use, but that it should not be mistaken for it.

## 5. Conclusion: the future of construction grammar

The purpose of this theme issue is to put a finger on the pulses of a few construction grammarians about the future of construction grammar. The editors are concerned about the future of construction grammar. I share their concern, but not all of the reasons for their concern. I find the breadth of views in construction grammar welcoming. The fact that the construction grammar community goes on after the passing of Fillmore, and the fact that other linguists such as myself have allied themselves with construction grammar, suggests that construction grammar is still a living research group.

I end with some words from David Hull. Hull embedded himself in the research groups he used for his case study of the evolutionary process of science, namely the pheneticists and the cladists in biological systematics (see §3.1). The cladists invited Hull to speak at the banquet for the first meeting of their professional society in October 1980. In the question-and-answer session after Hull's banquet address, which was titled "Games Scientists Play", a member of the audience asked Hull if he 'had any advice for the cladists to insure their success' (Hull 1988:191). Hull's response, which I pass on to construction grammarians, was this:

> "Stay socially cohesive, terminologically rigid, conceptually open, and make room for the next generation."

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