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Simpler Syntax and the Mind: Reflections on Syntactic Theory and Cognitive Science¹

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1.1 Introduction

There are many fundamental and far-ranging questions about language that Ray Jackendoff has touched on in his work; see, for example, Jackendoff (2002) Foundations of Language. These questions are often raised in cognitive science but less often within linguistics itself: What is a rule? What is (a) grammar? What are syntactic constraints, and where do they come from? What is the difference between competence and performance? What is the difference between grammaticality and acceptability? Where do universals come from? What is the relationship between linguistic theory and language acquisition, language processing and language variation?²

In this paper I focus on a question that touches upon many of these topics: how is knowledge of language represented in the mind? An answer that Ray has offered over the years to this question is that “rules of grammar are taken to be pieces of structure stored in memory, which can be assembled online into larger structures” (Culicover and Jackendoff 2006, 415).³

I explore this idea here from the perspective of Simpler Syntax (SS, see Culicover and Jackendoff 2005), which assumes that grammars are composed of constructions. The structures posited by SS are motivated by the Simpler Syntax Hypothesis (SSH):

Simpler Syntax Hypothesis: Syntactic structure is only as complex as it needs to be to establish interpretation.

SS thus contrasts with mainstream approaches to syntactic theory in which a primary motivation for structure is the maximization of structural and derivational uniformity—see Culicover and Jackendoff (2005, chaps. 1–3) for discussion.
I suggest below a particular implementation of the idea of “pieces of structure stored in memory,” which I refer to in this paper as “memory structures.” It is an instantiation of Marr’s (1982) algorithmic level that carries out the computation of some cognitive function. The grammar, on this view, is a description of the function that the mind is computing, but not a description of the mental architecture itself. Competence is embodied in the device in the mind that computes correspondences between form and meaning, correspondences that are described in terms of constructions. This is one way of understanding Chomsky’s idea that linguistic competence is “incorporated” into a performance mechanism that produces and understands language (Chomsky 1965, 15).

This view raises a number of difficult questions. I can only hope to raise them here, and suggest where some solutions might lie. Section 1.2 sets the stage by briefly summarizing the constructional perspective of SS. Consideration of the acquisition of constructions by learners takes us in section 1.3 to the question of representation, in particular, what memory structures might look like. Crucially, I assume that constructions are represented in the mind as computational routines for mapping between strings and meanings. Section 1.4 considers how constructions might function in real time in the processing of sentences. Section 1.5 concludes with the question of where universals come from in a theory such as SS that makes minimal assumptions about the human language faculty, and in particular does not assume that generalizations such as island constraints are part of grammar.

1.2 The Constructional Perspective

On the constructional view, a native speaker’s knowledge of language consists of form-meaning correspondences and how to construct expressions that exemplify them. Following prior constructional theorizing (e.g., Goldberg 1995), I assume that each individual word, with its meaning, is acquired by learners as an individual correspondence, that some correspondences between strings of words that constitute phrases and their meanings are acquired by learners as suí generis, and that more general correspondences are formed through generalization over sets of these individual correspondences that share common properties of form and meaning.

This constructional perspective is central to Jackendoff’s Parallel Architecture and SS. The essence of the notion construction is that the grammar consists of correspondences between sound and meaning,
mediated by syntax, and stored in the (extended) lexicon. A sentence is well-formed if every part of its form and meaning is properly licensed by some construction. Instantiations of this view of well-formedness can be found in work in Construction Grammar (see Kay and Fillmore 1999; Kay 2002, 2005; Müller 2006; Sag 2012).

In the Parallel Architecture, a word is a correspondence between a phonological form and a meaning, mediated by syntactic information, such as category and formal features (gender, number, etc.). An individual phrase and a sentence composed of several phrases is also such a correspondence. Constructional approaches account for creativity by allowing for generalization based on sets of individual correspondences. While speakers may store exemplars of some individual expressions, they are able to go beyond their experience through generalization.

For example, the word *pizza* is a construction, a correspondence between a phonological representation, here [pitsə], a syntactic representation N, and a meaning *PIZZA*. (I use boldface for the elements of conceptual structure representations.) The correspondence is shown in (1):

(1) \( \text{PHON} [\text{pits} \_ \theta], \text{SYN} N_1, \text{CS PIZZA}_1 \)

Similarly, the representation for the lexical item *eat* is given in (2). It takes two arguments, an AGENT and a PATIENT.

(2) \( \text{eat} \)
\( \text{PHON} [\text{it}], \text{SYN} V_1, \text{CS } \lambda y.\lambda x.\text{EAT}_1(\text{AGENT}:x, \text{PATIENT}:y) \)

For simplicity of exposition, I ignore the constructional details of inflection.

A correspondence for *eat the pizza* is given in (3). The first term is phonological, the second is syntactic, and the third is semantic. By definition, the phonological term incorporates information about temporal ordering, while the syntactic and semantic terms do not. The subscripts indicate correspondences between the constituents of each representation.

(3) \( \text{PHON} [\text{it}, \delta_2 \text{ pits} \_ \theta_3], \text{SYN} [\text{VP} V_1, [\text{NP} \text{ ART}_2, N_3]], \text{CS } \lambda x.\text{EAT}_1(\text{AGENT}:x, \text{PATIENT}:\text{PIZZA}_3[\text{DEF}_2]) \)

This correspondence says that in the linearized phonological representation, [it] corresponds to a V with the meaning \( \text{EAT}, [\delta \_ \theta \text{ pits} \_ \theta] \) corresponds
to an NP consisting of ART and N with the meaning of \textbf{PIZZA}[\textsc{def}], and this NP meaning is the \textsc{patient} argument of \textsc{eat}.

It is plausible that a learner that experiences many exemplars of individual correspondences that share certain properties will generalize over these exemplars and hypothesize a generalized construction. There is some evidence that children start generalizing quite early in the course of language acquisition (Naigles 2002; Naigles, Hoff, and Vea 2009; Gertner, Fisher, and Eisengart 2006), but the extent of such generalization remains a contentious issue. Tomasello (2003) has suggested that the grammar of a learner never reaches maximal generality, and that typical rules of grammar such as phrase structure rules are actually collections of more specific constructions.

Whatever the timing and extent of generalization might be, learners do acquire lexical items and more complex constructions. These are instances of memory structures. The question of generalization concerns the extent to which individual pieces of structure are ultimately subsumed by more general representations. But, even given very conservative assumptions about generalization, it appears that English speakers eventually arrive at the notion of a transitive VP. That is, given enough transitive verb phrases, learners eventually generalize the pattern exemplified by (3).

The pattern seen in (3) and other transitive VPs is as follows: the phonological form corresponding to the V precedes the phonological form corresponding to the NP, and the meaning corresponding to the NP is the argument of the meaning corresponding to the V. Using the notation of (3), this generalized construction may be represented as (4), where \( \phi \) is a variable, and V and NP are constituents of VP:

(4) Transitive VP
\[
\begin{align*}
\text{PHON} & : \phi_1, \phi_2 \\
\text{SYN} & : [\text{VP} V_1, \text{NP} 2] \\
\text{CS} & : V_1(\text{NP}_2)
\end{align*}
\]

This representation describes a piece of structure in memory. Since the meaning of \textsc{eat} is that in (2), \textsc{eat the pizza} in (3) is licensed by (4).

Idioms and constructions with idiomatic properties take a similar form, where again \textsc{phon} specifies the linear order of elements, \textsc{syn} describes the structure, and \textsc{cs} the corresponding interpretation. Representations for \textsc{kick the bucket}, \textsc{take a walk}, and \textsc{sell NP down the river} are given in (5), (6), and (7), respectively:
(5) kick the bucket
PHON [[kik]1[ðaikt]2].5
SYN [VP V1, [NP ART2, N3]4]3
CS λx.DIEd(EXPERIENCER:x)

(6) take a walk
PHON [[[tey]1[ɔ[wak]2].4
SYN [VP V1, [NP ART2, N3]4]3
CS λx.WALKd(AGENT:x)

(7) sell NP down the river
CS λy.λx.BETRAY1+6 (AGENT:x, PATIENT:y)(NP2)

Notice that in the last example, the NP2 in SYN is a variable. The description of the construction guarantees that the phonological form of this constituent is situated after that of sell and before that of down, and that its interpretation functions as the argument of the meaning BETRAY, which corresponds to the idiom sell, [down the river].

Because SS is a constructional theory, it strongly favors minimal syntactic structures to account for correspondence with interpretation. For instance, given the sequence V-NP, if the corresponding interpretation is V(NP), it is simpler to state this directly in terms of the structure [VP V NP] rather than posit a more abstract syntactic structure such as [VP V1 NP1 [VP t1 t2 ] ] or something even more complex. In other words, SS does not rule out complex structures with filler-gap chains, but such structures would have to be strongly motivated by the linguistic facts. So SS does assume a filler-gap chain in A’ constructions, for example, but only because doing so explains properties of the interpretation, simplifies the grammatical description, accounts for reconstruction effects, and so on.

A constructional theory is also well-suited to account for semi-regularities, idiosyncrasies, and exceptions, locating these phenomena in the degree of specificity of the terms of the syntactic description. In a more categorical theory (e.g., Principles and Parameters Theory) that makes a sharp distinction between “core” and “periphery,” such phenomena are typically ruled out of consideration because they do not fall within the range of the descriptive devices (Culicover 2011).
1.3 Representations

A fundamental characteristic of constructions, that is, memory structures, is that they include knowledge of temporal ordering of forms, represented by the ordered subscripted components of $\text{phon}$ in our descriptions. This is a point that Jackendoff has made often, and quite clearly in Jackendoff (2002), but it is important enough to bear repeating and restating. A speaker knows that stringing one form after the other in time in a particular way corresponds to a particular meaning, and that in order to express a meaning, one orders certain forms one after the other in time. This view contrasts with the familiar (and conventional) idea that knowledge of a language (“I-language”) consists of knowledge of the well-formed structures, and linear order and interpretation are merely the consequence of processes applying “at the interfaces” (Chomsky 1986).

In this section I summarize a characterization of memory structures in terms of the metaphor of trajectories in a linguistic space. The linguistic space is the memory; the individual pieces of structure are the primitive trajectories. Each point on a trajectory is a correspondence embodied in a linguistic element, that is, a phoneme, a word, or a morpheme. The ordering of the points on the trajectory represents the linear ordering of expressions in the language; constraints on what trajectories are possible in a language represent knowledge of grammatical structure. The linguist’s grammar is a description of the configuration of this space, of how the trajectories are arranged and how they relate to one another, to some level of precision.

Consider the acquisition by a learner of a specific correspondence, one that might in principle be an idiom (but ultimately turns out not to be), for example, pet the kitty. The learner learns that there is a correspondence between the phonological form and the meaning, along the lines outlined in the preceding section, and learns that to express the meaning, one produces the words in the specified order.

Crucially, learning how to produce the form that conveys this meaning is not something that follows the identification, abstraction, and generalization of the syntactic structure, but precedes it. In other words, what is acquired first is the individual correspondence, including the particular actions that one must perform in order to express (or understand) the expression (Tomasello 2003). Generalization to a construction specified in terms of lexical and phrasal categories (i.e., forming a “rule”) abstracts over the syntactic and semantic categories of the elements, and preserves the linearization information, along the lines of the constructions in (4) and (7).
Culicover (1998) and Culicover and Nowak (2003) characterize language acquisition in terms of gradually filling the linguistic space with trajectories representing individual sound-meaning correspondences. Acquisition is a process of gradually abstracting and generalizing over the properties of related trajectories. Culicover and Nowak (2003) assume that each individual construct is a point in the linguistic space, and the individual constructions are trajectories connecting points.

Each point corresponds to a distinct word, and words that are similar in meaning are assumed to be near one another in the space. In the acquisition of generalized constructions, individual trajectories are engraved in this space on the basis of experience with individual correspondences. A syntactic category is a connected region of the space, and the structure of an expression is a description of the path that the trajectory takes through the regions of this space. For example, the correspondence in (3) says that in order to express the given meaning, follow the trajectory denoted by PHON, passing through the corresponding regions of the linguistic space.

![Figure 1.1](attachment:image.png)

Figure 1.1
Development of flow between regions at times (a), (b), and (c)

When several trajectories go from one region to another region, a flow develops. A simple illustration is given in figure 1.1. On this metaphor, generalization is a matter of filling in the entire set of trajectories between two regions when a sufficient number of individual trajectories between them have been established.

The description of an individual construction is the trajectory that is followed in processing this expression (Culicover 1998). For example, (3) says to traverse the VP region by going first to the word *eat* in the V region, and then to the NP region, where first *the* in the ART region is processed, and then *pizza* in the N region is processed. Our linguistic description of a very general construction abstracts away from individual lexical items and specifies trajectories simply in terms of the regions, that is, the categories. Other constructions, such as the one embodying *sell down the river*, are a mix of individual lexical items and categories.
On this view, call it the Spatial Implementation, the syntactic structure of an expression is simply a description of the trajectory: what regions of the space it visits, in what order, and what interpretations it is linked to along the way. Syntactic structure is essential to generalization beyond individual exemplars. If the syntactic description were simply linearized V, ART, and N, it would say “visit a V, then an ART, and then an N,” which would yield the correct sequence. But if the syntactic description is \([vp, [np \text{ ART N}]]\), then the syntax says that the sequence corresponds to an interpretation in which ART-N itself has a meaning, this meaning is an argument of V, and the entire sequence corresponds to a meaning. In effect, syntactic structure is the link between linear order and structured meaning.

I suggest that the Spatial Implementation is a useful way to understand “pieces of structure stored in memory.” Memory is not static but dynamic. That is, it contains a sequence of instructions for processing the sentence in production and comprehension. The radical speculation here is that the knowledge that underlies this capacity is represented in the processor and not in some other mental component. In other words, there is no architectural distinction between competence and performance. What exists is performance, and competence is embodied in how this device is organized. Taking this position has a number of implications and raises a number of fundamental questions, which I take up in the next section.

1.4 Processing Constructions

Consider what happens when we take the representations in section 1.3 to be memory structures. The processing of a sentence proceeds from the beginning of the sentence by projecting possible continuations of the string, as reflections of projected structure. These possible continuations are alternative paths that can be followed in the linguistic space. Since at many points in a sentence there is typically more than one possible continuation, a plausible theory of sentence processing takes a probabilistic, parallel perspective. The set of possible trajectories may be expressed as a probabilistic phrase structure grammar, where the probability of each construction at any point in the processing of the string is determined by its relative frequency in the corpus on which the learner has been trained (Hale 2001). In computational linguistics, such a learner is a parser for the language (Nguyen, Van Schijndel, and Schuler 2012). Computational parsers are trained on annotated corpora such as those...
in the Penn Treebank. The human parser is trained on the corpus of the learner’s experience.

A probabilistic phrase structure grammar has rules of the form in (8), where A, B, C . . . are categories and p is the probability of the particular expansion.

(8) \[p\]A \(\rightarrow\) B C . . .

When the parser encounters an instance of B, it projects the structure \([A B C . . .]\) with probability \(p\). The probability is determined by the frequency of the full structure initiated by B in the corpus that the parser is trained on. These probabilities correspond in our physical description of processing in a linguistic space to the width and density of trajectories.

My experiments using a parser trained on a tagged corpus have shown that configurations that are locally well-formed but globally non-existent in the corpus cannot be correctly parsed. To take just one example, it is well-known that extraction from a sentential subject in English, as in (9), is unacceptable (Ross 1967):

(9) *These are the shares which \([S\) that the president sold \(t\] has surprised the market.

This sentence is locally well-formed, in that a sentence may be a subject in English, the wh-phrase is where a wh-phrase may be, and the gap is where a gap may be.

Interestingly, the filler-gap configuration exemplified here does not occur in the corpus. The reason may be that (9) is ungrammatical in the traditional sense, or it may be nonexistent in the corpus for reasons other than grammar per se. In any case, the parser is not trained on sentences like (9), and hence does not handle such a sentence properly, as shown in figure 1.2. The feature –g (for “gap”) should appear on the circled node RP-IM, but actually is passed down through VS-gNS-II. This is an error, since the extraction is from the subject, not the matrix VP.

The traditional explanation for the unacceptability of sentences such as (9) is that it violates a grammatical constraint. However, there is an alternative possibility: that such cases reflect processing complexity (Hofmeister, Casasanto, and Sag 2013). On this view, more complex configurations, like genuine cases of ungrammaticality, are rare in the experience of the learner. This rarity gives rise to high “surprisal,” reflecting the low or zero probability of the configuration (Hale 2001, 2003; Levy 2005, 2008). High surprisal in turn correlates with the subjective experience of unacceptability (Crocker and Keller 2006).
The idea that extraction from subjects introduces complexity was proposed by Kluender (1992, 1998, 2004). Similar arguments have been made for other island constraints in the recent literature (see, e.g., Hofmeister 2011; Hofmeister and Sag 2010; Hofmeister et al. 2007; Hofmeister et al. 2013; Hofmeister, Culicover, and Winkler, forthcoming; Sag, Hofmeister, and Snider 2007). While a fully explicit processing account of these constraints in terms of complexity is yet to be formulated, SS points in this direction, on the assumption that grammatical knowledge consists only of constructions. The task of the processor is to take these constructions, that is, memory structures in the performance mechanism, and fit them together in order to compute representations for more complex expressions. On this view, any judgment that cannot be tied directly to the well-formedness conditions imposed by constructions must have an extra-grammatical explanation.

1.5 Where Do Universals Come From?

The preceding sections suggest that no matter what the linguistic experience of the learner is, it will be incorporated into linguistic competence in the language processing mechanism in the form of a construction. Such a view does not explain where the linguistic experience comes from, or what if anything constrains its properties. But it does appear that
languages share certain properties and lack others, and that some properties, at least, are good candidates for universals. So we come to what is probably the most fundamental issue in syntactic theory, which is that of universals: how are they represented in the mind, and where do they come from?

Regarding the first question, we propose in SS that Universal Grammar, that is, the human language faculty, is a “toolkit” that learners draw upon in construction grammars of their languages; this is an idea that has been prominent in Jackendoff’s work (see e.g., Jackendoff 2002, chap. 4). Something that is in the toolkit need not be in every grammar, but it must be universally available. The toolkit assumed in SS is very restricted, compared with more traditional grammatical theories (Culicover and Jackendoff 2005, chap. 1).

Regarding the second question, in Culicover (1999) and Culicover (2013), I suggest that universals are in part reflections of economy in the formulation of SYN-CS correspondences. The notion of economy is of course familiar from the Minimalist Program, where it is envisioned in terms of computational “perfection” (Chomsky 1995). I take economy to be a matter of the actual complexity of the form-meaning correspondence.

Let us begin with the plausible assumption that what is evolutionarily prior to language is essentially human CS, as articulated by Jackendoff (1972, 1983, 1990, 1997, 2002). In particular, assume that it represents reference to objects, relations between objects and properties of objects, and events and states, that is, representations of the form $\lambda x.F(\theta:x)$. Kirby (1997, 2002) and his colleagues (Kirby, Smith, and Brighton 2007) have conducted computational experiments to model the evolution of language. These experiments show how groups of agents, that is, learners, in a generation can settle on increasingly more general grammatical hypotheses about the correspondences between strings and meanings produced by the preceding generation. Once a group of agents hits upon the idea of using sounds to refer to and distinguish objects and their properties, syntactic representations may evolve that are as complex as the CS representations, and in fact closely mirror the structure of these representations.

A key advance in the evolution of such representations is the formation of categories based on similarity of properties and distribution. So it is reasonable to assume that three key universals are the following:

(i) CS is structured and recursive.
(ii) Sound corresponds to CS.
(iii) Form categories.
Universal (ii) is, of course, the notion of a construction—essentially Jackendoff’s (2002, sec. 8.3) “use of symbols”—, and adding (iii) gives us syntax.

I hypothesize that these universals provide a way to get a linguistic system under way without assuming universals formulated in terms specific to linguistic structure.

Next, we must assume a notion of economy—the SSH:

(iv) SSH: Syntactic structure is only as complex as it needs to be to establish interpretation.

Beyond this, processing considerations suggest that dependent elements are as close to one another in time as possible, and that logical scope is reflected in linear order (see Culicover and Nowak 2002; Culicover 2013; Hawkins 1994, 2004).

In Culicover (2013) I also argue, following early ideas about markedness in generative grammar (Chomsky 1965), that maximal generality consistent with the evidence also follows from economy. This is principle (v):

(v) Generalize maximally, consistent with the evidence.

There are two ways in which such generalization might simplify constructions. The first is the identification of a particular phonological form with a particular CS function. An example of such an innovation would be the introduction of case to represent the correspondence between a phrase and its thematic role. The second is the identification of a particular linear order with a particular CS function. An example would be the introduction of grammatical functions defined in terms of structural positions, again to represent the correspondence between a phrase and its thematic role.

Suppose that grammatical devices such as inflection and grammatical functions are not biologically evolved, that is, that they are not part of the human language faculty. But if they are not biologically evolved, how do we account for their ubiquity, if not universality? By appealing to the role of economy in language change and language contact, we can make some sense of the fact that there are certain tools that are universally available without appealing to biological evolution (Briscoe 2000, 2002; Brighton, Smith, and Kirby 2005; Kirby, Smith, and Brighton 2007; Chater and Christiansen 2010).

Assuming (i)–(v), we can understand the introduction of devices such as case and grammatical functions into the toolbox as a consequence of linguistic evolution. A language is far from a perfect system; it may
incorporate non-optimal ways of computing the form-meaning correspondence, a point that Jackendoff has often made.

Suppose now that a particular grammatical device is discovered that reduces the cost of computing some aspect of the form-meaning correspondence. Once such a grammatical device is invented, it will compete successfully with less effective devices (Culicover 2013). Further generalization of a device might result in syntactic autonomy, where the device becomes a condition on constructional well-formedness in a language. For example, English has a requirement that there must be a grammatical subject in a finite sentence. The result is that when there is no θ-role linked to the subject position, there is an expletive subject, as in extraposition (It is obvious that S), raising verbs (it seems that S), and there-sentences (there is a fly in my soup; there suddenly entered the room a rowdy bunch of drunken partygoers). Similarly, English constructions that require an auxiliary verb show expletive do when no such verb is available, as in inversion (Did you call?), sentential negation (I did not call), and so on.

On this view, part of the toolbox is transmitted through language itself as the learner acquires the constructs, and then, through generalization, the constructions that embody these grammatical devices. In other words, the grammar itself, and UG, are embodied in the set of correspondences in the linguistic experience of the language learner and in the constructions that the learner formulates on the basis of this experience.

To sum up, I have proposed here an interpretation and implementation of Jackendoff’s idea that knowledge of language is represented in the mind as “pieces of structure stored in memory” (Culicover and Jackendoff 2006, 415). These memory structures are constructions. This idea fits well with Simpler Syntax, which holds that much of what has been assumed to be in the language faculty is in fact not part of it. Some (more or less) universal aspects of language are cultural artifacts that are transmitted to learners and speakers through language acquisition and language contact. Others follow from processing complexity, which leads to non-representation in learners’ experience and corresponding judgments of unacceptability by speakers.

Naturally, considerable future research will be required to determine the extent to which these ideas are on the right track and to fill in the myriad details.

References


distinction. In *Grammatical Constructions: Back to the Roots*, edited by Mirjam

Kay, Paul, and Charles J. Fillmore. 1999. Grammatical constructions and
1–33.

Kirby, Simon. 1997. Competing motivations and emergence: Explaining implica-

In *Linguistic Evolution through Language Acquisition: Formal and Compu-
University Press.

Kirby, Simon, Kenny Smith, and Henry Brighton. 2007. From UG to universals:
Linguistic adaptation through iterated learning. In *What Counts as Evidence in
Linguistics: The Case of Innateness*, edited by Martina Penke and Anette Rosen-

Kluender, Robert. 1992. Deriving island constraints from principles of predica-
tion. In *Island Constraints: Theory, Acquisition and Processing*, edited by Helen

Kluender, Robert. 1998. On the distinction between strong and weak islands: A
processing perspective. In *The Limits of Syntax*, edited by Peter W. Culicover and

Kluender, Robert. 2004. Are subject islands subject to a processing account?
In *WCCFL 23: Proceedings of the 23rd West Coast Conference on Formal
Linguistics*, edited by Vineeta Chand, Ann Kelleher, Angelo J. Rodriguez,
babel.ucsc.edu/~wagers/islands/readings/Kluender_WCCFL04.pdf.

Levy, Roger. 2005. Probabilistic Models of Word Order and Syntactic Discontinu-


Müller, Stefan. 2006. Phrasal or lexical constructions? *Language* 82 (4):
850–883.

Naigles, Letitia R. 2002. Form is easy, meaning is hard: Resolving a paradox in

Naigles, Letitia R., Erika Hoff, and Donna Vea. 2009. *Flexibility in Early Verb
Use: Evidence From a Multiple-n Diary Study*. Boston: Wiley-Blackwell.

Nguyen, Luan, Marten van Schijndel, and William Schuler. 2012. Accurate
unbounded dependency recovery using generalized categorial grammars. In *Pro-
anthology/C/C12/C12-1130.pdf.


Notes

1 I have to confess that I (deviously) got Ray to comment on another piece that I was working on at the same time as this one that dealt with some of the same issues. As always, his comments have been very much to the point, and have led to substantial improvements. He is of course not responsible for any errors. More generally, I am pleased to once again have the opportunity to thank him for his friendship, his kindness, his patience, and his generosity, to acknowledge the enormous influence he has had on me and my work, and to thank him for affording me the privilege of collaborating with him for (wait for it!) . . . over FORTY fabulous years.

For very helpful comments on this piece in its present form, I thank Dan Siddiqi and an anonymous reviewer. I am also grateful to Richard Samuel for stimulating discussions about many issues, including the competence-performance distinction. Naturally, none of them are responsible for any errors, either.

2 Of course, linguistics is a branch of cognitive science, since language is a creation of the human mind. But much of linguistic research is not explicitly concerned with the mental representation of language, while mental representation is the central concern of cognitive science.

3 This particular quotation is from a joint article, but it has been Jackendoff’s idea for some time; see, e.g., Jackendoff (2002, chap. 6).

4 We argue in SS that the grammatical functions Subj and Obj must also be represented in correspondences. I leave these out here in part to simplify the exposition, and in part because in simple correspondences the grammatical functions are redundant. They appear to play a role, however, in capturing relationships between constructions such as active-passive.

5 I include the phonetic form of these expressions for explicitness, although it is inherited from the forms of the individual words and the normal syntactic structure of the English VP.

6 Treating the elements as points is of course a simplification, since they too have temporal characteristics.

7 Since the syntactic part of the space is not structured prior to experience, categories will vary across languages, as suggested by Culicover (1999) and Croft
(2001, 2005), among others. However, since the semantic part of the space is universal, it will constrain the types of categories that form, under reasonable assumptions about economy and generalization. See section 1.5 for further discussion.

8 The traversal of a trajectory is neutral with respect to speaker and hearer. A speaker starts with the CS representation, producing the sounds while going through the corresponding syntactic representation and from that to the phonological form. A hearer is driven through the trajectory by the phonological form, which corresponds to the syntactic structure, which in turn corresponds to the interpretation. In fact, in the course of real time processing, the hearer is likely to entertain multiple alternative structures, a point that I return to in section 1.4.

9 The experiments use the parsing environment described in Nguyen et al. (2012), and were carried out in collaboration with William Schuler and Marten van Schijndel.