Generativity, Comparative Grammar, and the Syntax vs. the Lexicon Debates

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Abstract

Within linguistic theory, the division of labour between syntax and the lexicon has been a central issue for debate among different architectures of grammar, roughly corresponding to the distinction between memorization and rule governed aspects of language competence. In this article, I give some historical context for these debates, concluding that differences in architectural assumptions are only resolvable ultimately if we are willing to allow these implementational decisions to have consequences for (and make predictions concerning) human behaviours or mental processes. I proceed then to assess the psycholinguistic evidence concerning the lexicon and processing from the cognitive science literature, and offer a reassessment of what this means for the linguistic debates that have dominated discussions of the lexicon to this date. My conclusion will be that some of the comfortable dichotomies often relied on in these discussions are untenable and that some of the classical positions need to be reevaluated.

1.   Memory vs. Generative Combinatorics

Theories of grammar often make use of a lexical module in distinction to a syntactic module, and the nature of those two components and their interaction have been part of many ideological debates. In this article, I propose to re-evaluate the question of the syntax vs. the lexicon divide from first principles, while bringing in certain facts concerning what we have discovered about these components of grammar from recent psycholinguistic and neurolinguistic research. What will emerge from the discussion is that while the *intuitive* distinction remains as clear as ever, we have progressed rather little in our actual understanding of how this is to be implemented either computationally or in real human minds. While this is an area that clearly cries out for a close collaboration between linguists and psychologists, genuine synergistic collaboration has remained elusive. I would argue that, if anything, recent debates within Chomsky inspired theories of grammar have obscured rather than contributed to, progress in this area. During the course of this short article, the overarching goal will not be to argue for one particular view of the lexicon in linguistic theory over another, but to present the big unresolved questions against the background of our current state of the art knowledge in both linguistics and psychology.

Theoretical debates notwithstanding, we must start off by acknowledging that all theories of language must distinguish between discrete symbols that are stored in memory as a part of the knowledge of a particular language, and the knowledge of how to *combine* those primitives in generative and open ended ways.

The relationship of 'the lexicon' in this sense and 'the syntax' is the question of what the primitives of those respective aspects of natural language are. In the case of the memory system, one should ask whether the units that are memorized are internally structured, and whether human minds encode relationships among them within memory. With respect to 'the syntax', we want to know what the combinatoric primitives are, and to what extent the systems so described for a particular language are unique to that particular language or whether there are commonalities across languages. In other words, are there emergent universals in either of the two domains (declarative memory for symbolic representations and combinatorics)?

1.1.   Words vs. Rules: A discredited dichotomy

What needs to be memorized and how are those units individuated and encoded within a functioning linguistic system? The traditional answer that generative linguistics has given is that the Lexicon (the memorized,

or listed, component) is the repository of all idiosyncratic and non derivable information in the grammar, an idea that goes back at least to Bloomfield (Bloomfield 1933).

Further, the idea that the combinatoric engine is a special and unique innovation has led to the default assumption that it is a single unified thing, and is essentially definitional of what we have classically called 'syntax'. Therefore, the thought goes that the minimal, most parsimonious, and most efficient grammatical organization separates the combinatoric system from the memorized repository of idiosyncratic listed information (Bruening 2018).

However, the dichotomy of 'words vs. rules' (Pinker 1998), turns out not to be as clean and simple as was once imagined. Pinker's position in the book *Words and Rules* is that regular inflection is part of a creative rule system whereby the past tense form is derived by rule, while irregulars are memorized associations. The Dual-Route model builds on this intuition but sees access to the output form as the outcome of a 'race' between two strategies. In general, with a frequent form, the memory route is faster, but in the case of low frequency words, or gappy input, the rule based route wins. In fact, as we will see in section 4, there is a lot of evidence that even regular forms are actually stored in memory, and conversely, that sub patterns within irregulars can give rise to limited productivity, e.g. with nonce or low frequency words. The bottom line seems to be that memorization is ubiquitous, and saves time, even for highly regular morphological forms. This might even be true for certain stretches within phrases that tend to be repeated often. The existence of a combinatoric generative system underlying language productions does not seem to preclude storage in declarative memory. Conversely, there is also a lot of evidence for speakers being sensitive to decompositional structure within the word, even when the internal morphemes in question are not in any sense productive.

So does this simply dissolve the declarative memory vs. procedural distinction when it comes to language? I will argue that it does not, but it does undermine many of the traditional architectures of the lexical vs. syntactic distinction.

The structure of this paper is as follows. First, I lay out briefly the ways in which the Lexicon has functioned as a battleground for many of the debates within modern generative grammar, broadly construed. Next, I focus on the comparative linguistic question to discuss the ways in which the Lexicon has been central to the question of how and where languages may differ from each other. In section four, I briefly summarize certain recent advances within psycho/neuro linguistics on the division of labour between the lexicon and syntax. In the final section, I briefly reassess the linguistic questions in the light of these cross disciplinary results, and sketch a way forward.

2. The Lexicon as Battleground in Linguistic Theory

Chomsky's (1970) 'Remarks on Nominalization' opened a discussion about the division of labour between the Lexicon and what was then known as 'the transformational component' that has been extremely influential in the field for a number of decades now. The argument in the original Chomsky article was that there were certain phenomena, certain patterns, that could only be captured in the transformational component by increasing the nature and power of those rules beyond what seemed reasonable. The solution was to farm out some patterns to the Lexicon in the form of redundancy rules (as in Jackendoff's 1972 implementation). The framework of Lexical Functional Grammar (LFG) emerged around this time and gathered momentum in the wake of a renewed interest in partitioning information between the Lexicon and the Syntax proper, with a view to building a more efficient and modular grammar (Bresnan 1978), and challenging the architectural choices of the official Government and Binding (GB) orthodoxy. Although both theories at the time operated with both a syntax and a lexicon, they differed systematically in where to locate generalizations, with LFG usually arguing for more lexicalist solutions in comparison to its GB counterpart. Lexicalism has thus received explicit and implicit support across a wide variety of different frameworks from the beginnings of generative grammar way into the modern era (Kiparsky 1982, Di Sciullo and Williams 1987, Ackema and Neeleman 2007, Williams 2007, Müller 2013, Müller and Wechsler 2014).

In some sense, the question still turns on the division of labour between memorized information and rules, and on the degree to which the lexicon is a module with its own primitives and structuring relationships within it. Work in the classic generative era tended to assume that there *was* a lexicon, and that verbs for example were listed with category and a list of thematic roles that they assigned, and had a variety of syntactic and semantic selectional information potentially associated with them. Linking Theory in LFG, or the Projection Principle within GB, regulated how this lexical information mapped onto syntactic representations.

While GB classically used a primarily derivational metaphor to describe syntactic hierarchical structure, LFG adopted a more representational mode of description, particularly well suited to a theory with parallel modules related by linking rules. However, derivation vs. representational models of grammar are independent of the modular question. It can be shown that derivational vs. representational ways of implementing a grammar are largely intertranslatable at the computational level (Lasnik 1999).

Even though the lexicon is the repository of memorized elements of language by hypothesis, the controversy revolves around the extent to which there are lexicon internal relationships that require hierarchical structuring, rules and generalizations, and whether this is separable from the hierarchical structuring, rules and generalizations required by the syntax that 'generates' complex novel forms.

2.1. *The Locus of the Computational System*

Having a lexical module with internal structure that is in principle distinct from syntactic relations forces the existence of mapping principles, thereby adding to the complexity of the grammar by some measure. If it can be shown that the two modules are qualitatively different, as has been the empirical claim of proponents of LFG over the years, then the representational system is richer, and the existence of mapping rules is a descriptive necessity (Bresnan and Mchombo 1995, Alsina 1992).

If however, the internal structuring rules of the lexicon look suspiciously like the ones that syntax itself requires, one might be tempted to reduce the former to the latter as in the proposals of Hale and Keyser in the mid eighties and early nineties (Hale and Keyser 1993). This line of thought reaches its apogee in the framework of Distributed Morphology (DM) where the lexicon is voided of even category information and reduced to the memorization of unstructured roots, as a matter of principle, in order to confine the generativity of the system to only one component. Everything that contributes to a generalization in language is captured by the abstract syntactic heads that combine with those roots. Relevant references in this tradition include Sadock (1991), Hale and Keyser (2002), Halle and Marantz (1993), Marantz (1997), Borer (2005), among others. See Bruening (2018) for a recent defense of this position.

Construction Grammar also seeks to reduce patterning and structure to one module, but makes the opposite decision to DM. CG claims that one does not need a procedural rule system at all once one acknowledges the systematic existence of patterning at different levels in the lexicon. Everything sits in the memorized module of grammar, from single symbols to complex constructions with open positions, with no qualitative difference between the two (Goldberg 1995, Goldberg and Jackendoff 2004).

Occam's razor here is wielded by some to argue that there can be only one locus for hierarchical structuring and patterning, and the thought is that since symbolic recursion is a major innovation within the language system (Hauser et al. 2002), it is not cheap, and we should not expect to find it everywhere. However, abstract evolutionary argument can be made to cut both ways, even if one agrees that symbolic recursion is key. For example, Stanislas Dehaene has argued that this key innovation in human cognitive ability is pervasive once it is achieved, and nestles itself everywhere at different levels of patterning and in different domains (Dehaene et al. 2022), in a human cognitive phenomenon he calls 'dendrophilia'.

While the architectural questions are as unresolved as ever in the theoretical literature, the nature of the *kinds* of generalizations found within e.g. argument structure and event structure have been more consensual across frameworks, and substantial progress has been made at this level (see Ramchand 2013 for discussion). Computationally speaking, it seems clear that different theories can make do with rather

different decisions in setting up a grammar. For example, there has never to my mind been any clear demonstration with respect to GB or LFG that there was some data that the one theory could describe which the other couldn't. Nor is it the case that constructivist theories of argument structure (Borer 2005) can be shown to model facts that lexicalist theories (Levin and Rappaport Hovav 1995), or construction grammar (Goldberg 1995) cannot. Differences in implementation are only resolvable ultimately if we are willing to allow these implementational decisions to have consequences for (and make predictions concerning) human behaviours or mental processes (we will take a look at this evidence in section 4).

2.2.   *The Internal Structure of 'Words': Inflection vs. Derivation*

Within morphological theory, a distinction has classically been made between derivation and inflection that aligns with the presumed modular divide between the Lexicon and the Syntax. If such a distinction is empirically justified, it could therefore be construed as evidence for the existence of two different modules.

Consider a 'word' like *formed*, which consists clearly of the *form* part that tells you what kind of eventuality is being described, but it also contains an *ed* part that tells you that the eventuality was instantiated at a time period before now. In many of the world's languages, we have evidence for temporal information being attached to symbols describing event types. In languages where temporal information is expressed with a separate free morpheme, the evidence from the syntax shows that is is hierarchically higher than the verb and the causational and argument structure information inherent to the event description (Julien 2003). Causational and argument structural morphological marking, when it exists, occurs *closer to the root* than tense information. Tense information is a case of what has been called 'inflection' in linguistics. If one form is free and another form is bound to it, it is never the case that basic symbols corresponding to PAST and PRESENT are then modulated with suffixes that give more specific content to those eventualities. Pervasive asymmetries like this have given rise to the distinction made in most theories of grammar between roots, or open class lexemes, and functional items (like tense marking, in this case). These asymmetries have implications for both word and sentence structure, leading famously to strong claims about the relationship between syntactic hierarchies and internal word structure (Baker 1985, Brody 2000).

The other source of internal word structure is 'derivation'. In one intuitive articulation of the difference between inflection and derivation, inflection modifies or modulates a particular basic lexeme depending on syntactic context; derivation creates a new lexeme from another one (Matthews 1991, Bauer et al. 2013). Thus a word like *formation*, consists of the *form* part that tells you about a particular kind of eventuality, and an *ation* part that converts the word into a noun that describes the action of, or outcome of, that eventuality.[1] Crucially for the way the distinction is being made, *form* and *formation* are two completely different lexemes. In the above example, *formed* is simply a different inflected version of *form*.

Perhaps predictably, frameworks like DM do not make a principled distinction between inflection and derivation since all structuring is represented in the syntax. Construction Grammar makes a distinction between inflection and derivation but this does not correspond to a modular difference, since there *is* only a structured lexicon.

3.   **The Lexicon as Locus of Variation**

Under the classical view that the Lexicon is the repository of idiosyncratic information that must be memorized, a lot of the differences among languages must reside there. But this kind of variation is of the trivial Saussurean type, related to the essential arbitrariness of the form of the sign which is set by convention (de Saussure 1959). This much nobody would disagree with. Linguists do however disagree on how much,

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[1]Many derived nouns in *-ation* are systematically ambiguous between a noun denoting the action, and a noun describing the result of that action. This is interesting, but irrelevant for the point at hand. To understand the issues involved, I refer the reader to Borer (2013).

or indeed whether, any other part of natural language is universal, and where the locus of morphosyntactic variation lies.

One prominent view in the Chomskyan tradition seeks to confine variation to the lexicon more broadly— lexical variation is due to the saussurean arbitrariness of roots; morphosyntactic variation reduces to memorized (i.e. in this sense 'lexical') variation in the inventory of functional items. This idea has come to be known informally as the Borer-Chomsky conjecture.

> It is worth concluding this chapter by reiterating the conceptual advantage that reduced all interlanguage variation to the properties of the inflectional system. The inventory of inflectional rules and of grammatical formatives in any given language is idiosyncratic and learned on the basis of input data.
> (Borer 1984 pg. 29)

This more 'microparametric' view has now largely superseded the earlier GB system of Principles and Parameters designed to model variation in the syntactic component of human grammars. The older idea was that Universal Grammar consisted of a set of given principles whose only scope for variability lay in the constrained choice of parametric settings that each principle allowed. This was intended as a solution to Plato's problem and as a way of elegantly accounting for the broad similarities of grammars and their rich differences without invoking unlearnable variability. However, the general enterprise of finding principles and macroparameters of this sort that are robust, learnable and account for all the variation we find, ultimately failed (see Newmeyer 2017 for discussion), and the very system and principles that the parameters were claimed to modulate also were largely abandoned in the move to more minimalist grammars (Chomsky 1995 and beyond).

In its place, UG might be more minimal (e.g., just MERGE) and therefore subject to no variation at all, while apparent variation in the syntactic systems found in different languages could be confined to the Lexicon, specifically in the inventory of functional items.

> Apart from lexicon, [the set of possible human languages] is a finite set, surprisingly; in fact, a one-membered set if parameters are in fact reducible to lexical properties [associated with functional categories – FJN] ... How else could Plato's problem be resolved?
> (Chomsky 1991: pg 26) (quoted in Newmeyer (2017))

The move from the Borerian formulation in terms of 'inflection' to the chomskian formulation in terms of functional categories, potentially allows differences in word order and extraction possibilities to be brought under the umbrella of this kind of microparametric variation without the use of macroparameters, and without the necessity of overt morphological differences. One potential worry here is that too abstract a theory of morphological exponence risks voiding the notion of functional item of any content other than the notion of 'language specific syntactic rule'.

If one believes in a universal cartography, some problems of determinacy go away (Cinque 1999), but the problem of abstractness remains. Classical cartography claims that the functional sequence is universal and non parametrizable, essentially because it is sufficiently rich and abstract as to be unlearnable from morphological evidence alone. However, other linguists have pushed back on the existence of such a rich specific and innate component for grammar, arguing instead that languages can have their own functional heads within a more minimal and general abstract space of functionally motivated 'zones' (Ramchand and Svenonius 2014; Wiltschko 2014). If these latter researchers are correct, then the very inventory of functional heads is up for language particular variation, not just the featural properties of those heads.

But this raises another question, which is the question of what we mean by the term 'lexical item'. Functional items, unlike contentful items, do not have conceptual content, but modulate the content of open class lexical items in context, and are not produced in isolation. As we have seen, some frameworks like DM make a sharp distinction between these two kinds of elements in the language system in principle. In a realizational morphology involving separation between the syntactic representation with its hierarchically

organized featural representations and exponents, functional items are inserted late, and in many versions of DM in a rather different way than roots. Functional structure and the properties of those heads are Syntax, and for such models, this is where the variation lies, as a matter of definition, built in to the very architecture.

Thus, the Borer-Chomsky conjecture is sufficiently vague as to be consistent with theories that believe that there is no substantive role for the lexicon at all, as well as theories that are more projective. But ultimately, the conjecture cannot be made to do predictive work in the absence of a clear proposal concerning the space of possible functional heads and what they are allowed to do. I conclude that the conjecture is currently not doing very much substantive work to constrain our theories of linguistic variation.

3.1. A Case Study in Universality and Variation

To see what is at stake, I step through an example from my own research involving the crosslinguistic variation in the manifestation of complex predication. By complex predication, I mean cases where the contributions to theta role assignment and basic aktionsart seem to be shared across more than one predicational element. Definitionally, constructions involving complex predication must be 'monoclausal' by the diagnostics of the language, and must involve more than one 'lexical' predicator.

I take this area of language as an example because it is one where a lot is known about the generalizations that seem to be pervasive across languages, *and* much is also known about the ways in which the details of the complex predication can differ radically from a morphosyntactic point of view. I obviously choose this area because it is one which I know well. Complex predication is interesting for the main topic of this article because it represents a case where a set of properties that are usually thought to be associated indivisibly with single verbal lexical items (LIs), are distributed or shared across more than one LI.

Before we proceed to the examples though, it is worth restating the state of the art concerning aktionsart and event structure within language, and the strong typological generalizations that are attested in this domain.

The description of different event types goes back a long way, at least back to Aristotle. Most modern classifications draw directly or indirectly on the classification proposed in Vendler (1967), who divides aktionsartal categories into 'states', 'activities', 'accomplishments' and 'achievements' . As far as linguistically relevant distinctions are concerned, it is clear that the different classes have different behaviours, as evidenced by the linguistic diagnostics used to distinguish them in the literature (see Dowty 1979).

In general, then, there is much linguistic evidence for the four natural classes of event shape as laid out in (1) (taken from Truswell 2019).[2]

(1)   a.   Culminated processes (process + culmination) ≈ accomplishments (e.g., *run a mile*)

      b.   processes ≈ activities (e.g., *run*)

      c.   culminations ≈ achievements (e.g., *hiccup*)

      d.   (neither process nor culmination) ≈ states (e.g., *exist*)

Notice that this internal event complexity is rather restricted both within and across languages. It is well known in the literature that in the building of complex causatives, direct causes give rise to single lexical items or monoclausal constructions, while indirect causes (implying intermediate causal links in the chain) give rise to expressions that are more likely to be biclausal (Shibatani 1973). With respect to the addition of result, the data also suggest that only one such delimitation per event is possible (Simpson 1983, Tenny 1994 on the unique delimitation condition). The typology of lexicalizable event types that we find in language can be created by augmenting the dynamic core event with either a causally upstream state or causally downstream state, but no further.

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[2]Starting with Smith (1995) many would add the category of semelfactives to this list. I take Truswell's typology here because I think that semelfactive behaviour can be derived from other more primitive properties (cf. also Rothstein 2004).

(2) DYNAMIC EVENT: e_{dyn}
CAUSED DYNAMIC EVENT: $e_{cause} \rightarrow e_{dyn}$
DYNAMIC EVENT WITH RESULT: $e_{dyn} \rightarrow e_{result}$
CAUSED DYNAMIC EVENT WITH RESULT: $e_{cause} \rightarrow (\ e_{dyn} \rightarrow e_{result})$

We can see the pervasiveness of both causation and result in the building blocks of events. Morphological causatives (see Shibatani 2002 for discussion and references), and complex predicates of result (including the Germanic verb particle construction) (Hoekstra 1988, Kayne 1985, Guéron 1987, Svenonius 1994) throw up paradoxes for lexical theories of argument structure precisely because they introduce additions to the event profile which affect the argument structure of the output. I repeat the well-known examples from English below in (3) and (4).

(3) **Causative Augmentation**

a. The stick broke.

b. John broke the stick.

(4) **Resultative Augmentation**

a. John ran.

b. John ran his shoes ragged.

There have been arguments in the literature that subevental decomposition of this type is 'syntactically' real and can be diagnosed via certain kinds of adverbial modifiers such as *almost* and *again* (von Stechow 1996, Beck and Johnson 2002). However, the evidence for this internal structuring being syntactic as opposed to distinctly lexical is rather equivocal (see Siloni 2019). As we have seen, ideological commitments concerning where hierarchical generalizations must reside seem to determine whether a particular linguist represents these patterns as being part of the syntax in terms of a set of rigidly ordered functional heads, or part of a hierarchically organized conceptual template in the lexicon. Surprisingly, the agreement on the actual basic ingredients of this structuring is rather solid, and has emerged from a raft of great comparative research on aktionsart and argument structure over the past five decades (see Levin and Rappaport Hovav 2005 for a historical overview.)

Whether represented 'in the syntax' or 'in the lexicon' the causing event, when it can be seen to be explicitly added, always adds morphology or participants that are hierarchically *above* the core dynamic event; result events are always added *below* the core dynamic event. Thus, in the literature, the CAUSE head when it is invoked in the syntax is always on top of the main V (Pylkkänen 1999, Folli and Harley 2006), and the result projection when added is always downstream of the main V (Hoekstra 1988). Moreover, the CAUSE event is associated, when it exists, with an *external* argument, whereas the result predicate either introduces a new *internal* argument or is constrained to modify it (Levin and Rappaport Hovav 1995). These points are not new or controversial, but it is worth pointing out that they are in some sense so natural that their remarkableness sometimes escapes attention.

There is evidence therefore that the event structure and argument structure are hierarchically organized in the same way across languages, essentially in lock step. This hierarchical organization underpins many important linguistic generalizations of comparative linguistics concerning argument structure, and for the scope of lexicalization and morphological event augmentation.

While the abstract template is strikingly universal and unvarying across languages, the same cannot be said for ways in which the template is lexicalized. In what follows, I show informally how different languages spell out the different elements of a fully expanded event structure.

In English, *destroy* is a change of state verb with an explicit obligatory CAUSER and an obligatory internal argument which is both the UNDERGOER of the change of state and hence the participant that ends up in a resulting state. No part of that event structure is morphologically separable (in the synchronic

language), or augmentable by causation or resultative formation that is not biclausal. The verb *destroy*, then, corresponds to a full template. This is shown in (5), preceded by a sentence that exemplifies a use of this verb.

(5) John destroyed the sandcastle.
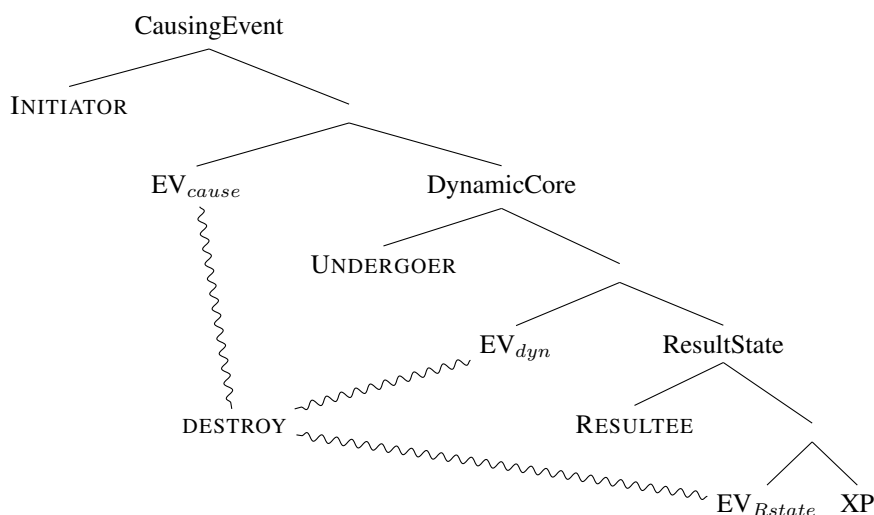
This informal representation is not intended as a claim about how lexical insertion is implemented.[3] In a DM framework, the root 'destroy' is probably inserted at the base of the structure. The functional heads that give rise to the accomplishment event structure need to be built on top of that root, with the root-structure compatibility achieved either by some kind of subcategorization frame (Harley and Noyer 1999)[4] or some kind of ontological compatibility (Beavers and Koontz-Garboden 2020). Neither is this informal picture intended to take a stand on what is 'in the lexicon' and what is 'in the syntax'. The event structure hierarchy pictured above is simply a dendritic visualization of a lexicon internal hierarchization of concepts as in Levin and Rappaport Hovav (1995) and work in that framework. The point is simply that there are a core of universal and hierarchized components that seem to exist across the world's languages in the expression of eventualities. In the case of English *destroy*, it reliably invokes all three subevents, as demonstrated by language internal diagnostics.
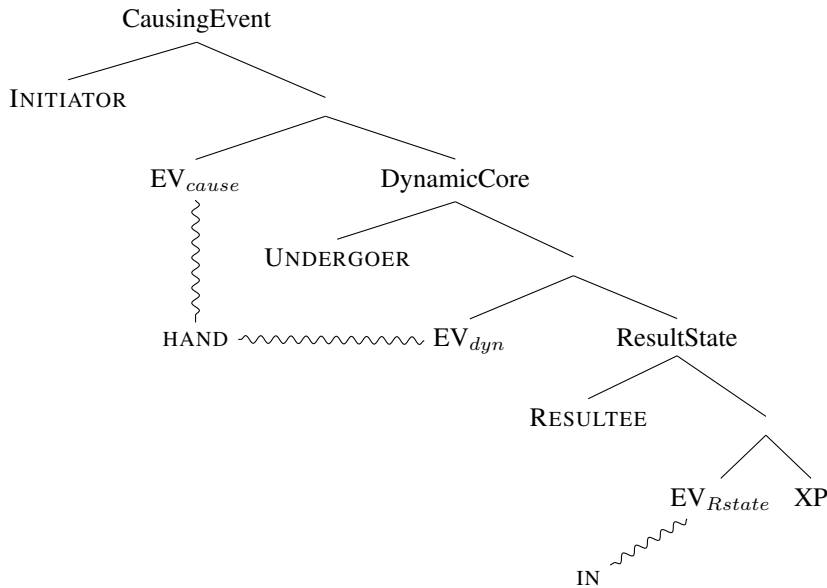
If we turn now to the English particle construction, we see a slightly different 'correspondence' between the event template and the LIs that are associated with it. The tenseable verb *hand* is a verb describing manner of transfer motion. On its own, it can only be used as a double object verb. In the presence of the particle, we assert an abstract result state (here, intuitively the abstract possession of some receiving institution) which the UNDERGOER of the transfer achieves. Here we could say that the verb *hand* is associated with the existence of a caused process, while *in* corresponds to the existence of a particular kind of result, as we see in (6).

(6) Mary handed her assignment in.

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[3] Although this 'picture' would be most directly compatible with a 'spanning' account, Ramchand 2008b, Bye and Svenonius 2012.
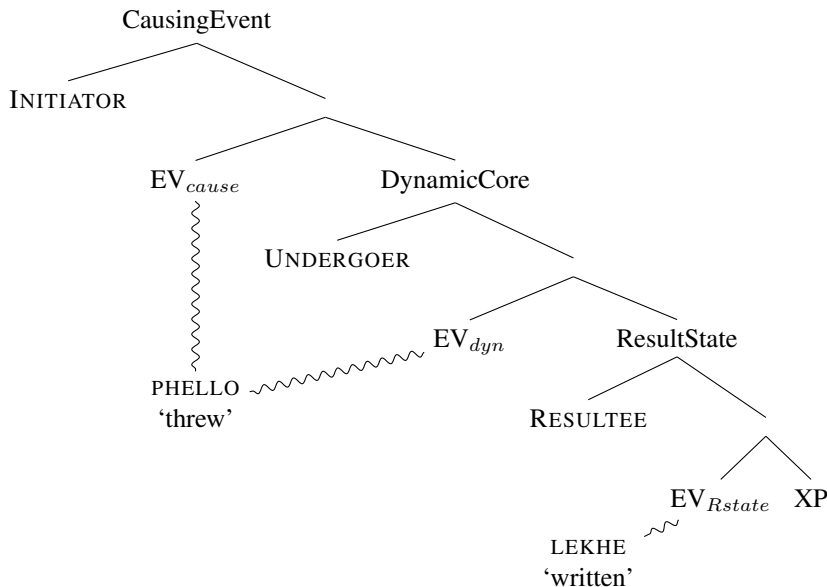
[4] Such frames by stipulation, have to be local and so DM cannot decompose the heads in exactly the same way as I have done here. Thus DM needs to have little v head flavours for all the different aktionsart types and does not decompose them into primitive causationally related dynamic components.

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                    CausingEvent
            INITIATOR
                    EV_cause    DynamicCore
                       ⌇      UNDERGOER
                       ⌇
                    HAND ∿∿∿∿∿ EV_dyn    ResultState
                                      RESULTEE
                                            EV_Rstate  XP
                                               ∿
                                            IN
```

Finally, we should compare this case to that of the Bangla complex predicate *lekhe phæla* – 'written throw' which corresponds to exactly the same decomposition of subevents. In this case, the participle *lekhe-* 'written' tells us that the final state of the dynamic event is that something comes to be written. The tenseable verb *phæla-* 'throw' indicates that there is a CAUSER of some event involving an UNDERGOER participant. Thus 'write' correponds to the result subevent, while 'throw' indicates the presence of causation and change, as in (7).

(7) Ruma cithi-ṭa **lekh-e** **phello**
    Ruma letter-DEF *write*-PERFPART *drop/throw*-3RDPAST
    'Ruma wrote the letter completely.'

```
                    CausingEvent
            INITIATOR
                    EV_cause    DynamicCore
                       ⌇      UNDERGOER
                       ⌇
                    PHELLO ∿∿∿∿ EV_dyn    ResultState
                    'threw'               RESULTEE
                                            EV_Rstate  XP
                                               ∿
                                            LEKHE
                                            'written'
```

The important lesson from this sort of comparative example is that we here have an example of generalization apparently *within* lexical items concerning the ingredients and hierarchical organization of

event concepts. We can see that, intuitively, languages can vary with respect to how they 'chunk up' that complex conceptual structure to form symbol sized bites that can be memorized. The chunking seems to respect some kind of locality within the hierarchical conceptual representation, but once set for a particular language, the underlying hierarchy predicts the hierarchical functioning in the syntax of the pieces that correspond to it.

As we see from the last Bangla example, the word order of this language is radically different from that of English, with projections pretty systematically head-final.However, it is the hierarchical generalization that is respected here, the tenseable verb is the one that indicates the presence of 'cause', while it is the participle (the lower, non-tensed form) that identifies the result. The comparison with the particle verb case is instructive: while the hierarchical generalizations line up correctly, the main repository of rich lexicalized content varies between the two cases. In the case of English, the element that identifies the presence of a caused change of some kind (*hand*) is richly endowed with conceptual information about the 'manner' of transfer, while the particle which identifies the result (*in*) is fairly abstract and gets its meaning in the context of the main verb. In the case of Bangla, it is the participle 'written' that provides rich lexical content, while the light verb 'throw' has lost all of its conceptual specificity of 'throwing' and has a light interpretation corresponding to agentively oriented initiation of change. For this reason, it has always seemed to me that relegating a certain kind of rich conceptual content to the lowest (and non-relational) part of a syntactic representation does not do justice to the empirical pattern we find in languages and language variation, where rich lexical content interleaves with more abstract polysemous items to build up a concrete representation of the world (see Ramchand 2008b, Butt and Ramchand 2005, Ramchand 2008a for more detailed discussion of the decomposition of complex predicates).

Both the Bangla complex predicate construction and the English particle verb construction have posed major paradoxes for classical lexicalist theories of argument structure. On the one hand, they are clearly morphemically compositional, and it can be shown that the component parts are even independent syntactic units. On the other hand, the combination of lexemes changes the argument structure properties (something that lexicalists assume to be in the domain of the lexical module) and the constructions are monoclausal by all diagnostics.

What these examples show is that 'what is lexicalized' can indeed vary from language to language, and even between different constructions in the same language. They do *not* show that the difference between memorized symbols and the constraints on how they may be combined with other memorized symbols needs to be dissolved.

3.2. *An Aside on Talmy's Typology*

One important 'parameter' that has been proposed in the literature with regard to lexicalization has been Talmy's famous typological distinction between verb-framed languages and satellite-framed languages (Talmy 1972, Talmy 2000). The proposed typological parameter separates languages in which the manner conceptual information is lexicalized within the verb (English, and other satellite framed languages), expressing result by means of adjuncts or satellites, and those in which the result component is lexicalized within the verb and the manner component is an adjunct (verb-framed languages like Spanish). The generalization has been criticized as being too monolithic, with languages of the first type having some instances of the second kind of pattern, and vice versa. More recently, Levin and Rappaport (1998)) have proposed a related constraint on lexicalization that says that a root can identify the 'manner' of an event, or a 'result' but not both.

If Manner-Result complementarity is a correct generalization then it says something important about the way in which lexically encoded conceptual content can be paired with event structure skeletons of the type shown above. However, it is an idea that emerges most naturally under a system that expects lexical items to insert under a single terminal node. Interestingly, Rappaport-Hovav and Levin (2008) concede that the lexicalization constraint as they state it must apply not to whole verbs but to simplex forms more

generally. In other words, when morphemes can be seen to combine productively to create verbal lexical items in certain languages, *the lexicalization constraint applies to the individual morphemes*, not to the verb itself. Once one allows for multi-morphemic manner-result verbs however, it seems artificial and surprising to disallow a portmanteau/synthetic version of the same thing where the individual components are not morphologically clearly separable. In fact, I think there are a number of relatively clear cases of verbs in English whose lexical conceptual meaning contributes content to more than one element of an abstract event schema. For example, the verb *slice* in English is specific about the 'manner ' of effecting material separation, as well providing conceptual content as to the shape/physical properties of the resulting pieces. Perhaps even clearer, the verbs *to lay* and *to stand* in English are verbs where one can see quite clearly the separation of manner and result and show that specific nature of the result can be specified separately. In English you can *put* something on the table, but it doesn't matter how it ends up in its final spatial orientation. This contrasts with *lay* and *stand*. Here both verbs require that change in position must be directly effected by an agent, but in one case the object must end up in a horizontal position with respect to its own axis of symmetry, and in the other case the object must end up vertical with respect to its own axis of symmetry.[5] If this is not a case of contributing lexical conceptual content to both process and result subevents, I don't know what kind of example would satisfy those who wish to deny it.

While there seems to be some functional trend in the direction of manner-result complementarity, we need to ask ourselves whether the patterns are absolute or merely tendential, because of natural overall limits of usability on the complexity and specificity of lexical items. In fact Rappaport-Hovav and Levin (2008) end up modifying the manner-result complementarity prohibition to one that rather involves the incompatibility of scalar vs. non-scalar change. The idea here is that a morpheme cannot conceptually describe both a scalar change and a non-scalar change simultaneously. This places the incompatibility within the semantics of conceptual content, and not with a constraint on how monolithic lexical items can be associated with event templates.

My tentative conclusion is that large macro parameters (as in Talmy's initial proposal of two 'types' of languages) regulating lexicalization on a language basis are not empirically tenable. On the other hand, the micro-parametric approach as expressed in the Borer-Chomsky conjecture does not have any teeth in the absence of a clear framework stating the space of functional heads and their possible feature values. Moreover, the prospect of reducing even word order variability to differences in functional head specifications (EPP features, triggers for roll-up movements, etc.) strikes me as both entirely feasible to implement but almost impossible to falsify. What many of the microparametric approaches share is the assumption of a clean separation between the memorized idiosyncratic listed symbol and its formless web of conceptual associates, from the computational mechanisms and abstract functional categories. We will have reason to question this basic assumption in the light of recent neurolinguistic research.

4.   The View from the Brain Sciences

To summarize the last two sections, we have seen that the lexicon has long been acknowledged as a 'module' of grammar distinct from syntax. Those who would like to 'dump lexicalism' (Marantz 1997, Bruening 2018), nevertheless do not wish to deny that symbols need to be memorized at some level, but deny rather that there are any exciting generalizations or relationships among lexical items that are not historical accidents, or contingent outcomes of a person's idiosyncratic experience. The question hinges on hierarchical generalizations. Those who wish to accord a single place to the combinatoric device that drives human language and makes it unique, giving rise to recursive structures, create architectures that assert that division by fiat. We have seen that it is rather difficult to tease apart differences in empirical consequences out of these rather different architectures and theoretical commitments.

The question now is whether the vast work on neurolinguistics, brain imaging and psycholinguistics

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[5]In Norwegian, there seems to be no commonly used general usage verb corresponding to 'put'. One needs to choose a specific orientation for the placed object (*legge*- 'lie', *stelle*-'stand', *sette*-'sit'). 'Sit' is maybe the most general of the three.

more generally ends up supporting one or the other of these architectures. What do we in fact know about memorization, symbols and the internal structure of linguistic memory? And what do we know about the brain's ability to do syntactic tricks? How are these abilities related in space and time within real human brains?

4.1. *The Lemma Level*

Over the course of the last five decades or so, we have accumulated a lot of evidence concerning the location of lexical recognition activation and its time course. It appears that the mid temporal gyrus (MTG) is involved in semantic lexical access independent of whether the sensory input is visual or auditory (Indefrey and Levelt 2004, Hickok and Poeppel 2007, Friederici 2012). Activation in this area can also be tracked using MEG and fMRI. This is the area approximately known as Wernicke's area after the early work of Carl Wernicke on stroke patients who suffered lesions leading to severe comprehension difficulties and nonsensical speech with fairly fluent and intonationally plausible production. Based on both neurolinguistic and behavioural evidence, we have strong support for the existence of hub here for the LEMMA which is the lexeme family underlying a symbol *and all of its inflectional forms*. Specifically, we know that lemma frequency as a whole (not the frequency of individual FORMS) modulates effects in the 300/450 ms time window in the MTG (Solomyak and Marantz 2010).

This literature is important because it shows that there is a lemma hub for all inflectional forms of the 'same' lexeme, within the mid temporal gyrus (most likely bilaterally).

There is still a lot we do not fully understand about how these associational networks function, and the degree to which different symbolic networks are related to each other. In general, though, there is strong evidence for interconnected networks in memory. The cohort model of Marslen-Wilson and Tyler (1980) assumes a straightforward forward feeding model of recognition from bottom up phonetic information as it unfolds in time. These cohorts gradually get winnowed down to a unique most highly activated target as the incoming information becomes fully discriminatory. Later models, such as the TRACE model of McClelland and Elman (1986) build in top down information flow from higher levels of representation such as at the word level, allowing many different competitors to be activated and to compete for recognition based on similarity and frequency. The current consensus appears to be that recognition involves both bottom up and top down processes of this kind.

Through priming studies of lexical access in comprehension, we can gain evidence for which representations co-activate others. Briefly, the speed of word recognition is reduced if that word has been previously activated in memory, but it is also, interestingly, affected by the prior activation of phonologically and semantically similar items. The strength and latency of these effects varies (with identity priming being the strongest, and semantic priming being the weakest and also with a longer latency), giving additional evidence for the architecture of the links within this kind of network.

We also know from production studies in picture naming that lexical access proceeds via the semantic or conceptual representation, thereby accessing an abstract lexical entry or 'lemma level', which in turn activates the abstract phonological representations and articulatory gestural programmes required to pronounce the word. This network and its latencies are now fairly well understood, giving rise to interactive models of competition and frequency effects that mirror the behavioural evidence found under experimental conditions, and also account for patterns in speech errors (Levelt 1999).

4.2. *Combinatorics*

It is often assumed that the locus of syntactic competence is Broca's area, or a certain region of the left prefrontal cortex. In fact, early lesion studies first isolated damage to Broca's area as the source of *production* deficits. It was only the highly influential paper of Caramazza and Zurif (1976) that proposed it was a more generally syntactic area, based on the evidence of syntactic deficits in comprehension that they also

detected in these patients, once real world plausibility was controlled for (see Matchin to appear for a recent historical discussion). The standard view is clearly expressed in Friederici (2017) (also quoted in Matchin to appear).

> "The data suggest that the basic syntactic computation of binding two elements into a phrase (called Merge) assumed by linguistic theory can be evidenced at the neurobiological level in a confined brain region, BA44 [the posterior part of Broca's area]" (Friederici 2017:55)

Under this view, the locus of the lexicon, or hubs for lexical access is distinct from Broca's and was thought to be the posterior temporal cortex (Grodzinsky 2000; Hagoort 2005; Hagoort 2014).

But more recent work using both detailed neuroimaging and more fine grained lesion studies has begun to undermine that classical position.

An important potential sentence type for isolating syntactic competence in the fMRI literature has been the use of Jabberwocky sentences. Jabberwocky sentences consist of syntactically well formed sentences with nonsense content words like this one I just made up: *She didn't glorph their lividar.*

For syntacticians, using nonce words in a syntactic frame like this is a potentially clever way to eliminate the effect of real lexical items and conceptual content, and zero in on combinatorial processes which underlie sentential structure and generativity. The very fact that we can make these sentences, seems to show that this aspect of language is distinct and modularizable away from the Lexicon per se. It is good to be able to abstract away from contentful Lexical Items in a variety of methodologies, because controlling for frequency, semantic prediction, association, etc., can be hard. From the point of view of a syntactician, Jabberwocky sentences seem to offer a way of surgically removing the messy bits and to target pure syntax.

In an important and influential early study, Fedorenko et al. (2010) develop a localizer task for helping in the analysis of regions of interest (ROIs) for linguistic experiments using fMRI. They use four conditions:[6]

> A. Sentences (The Sentences condition):
> e.g., *She didn't see their automobile.*
>
> B. Scrambled Sentences (Word list condition):
> e.g., *Automobile their didn't see she.*
>
> C. Jabberwocky Sentences:
> e.g., *She didn't glorph their lividar.*
>
> D. Scrambled Jabberwocky Sentences (Non-Words Condition)
> e.g., *Lividar their didn't glorph she.*

Sentences > NonWords showed the language regions (including both Broca's and Wernicke's areas and most of the temporal lobe, including the connections between them). Words and Jabberwocky both showed intermediate activation of the sentence regions but could not be reliably distinguished from each other. Words > NonWords and Jabberwocky > Nonwords showed 'inconsistent and variable results across subjects'. This is disappointing if we think that Jabberwocky sentences should show the brain doing its pure syntactic thing.

This same disappointing result has recently been mirrored in research targeting the synchronization of brain oscillations. Since Ding et al. (2016), we have known that the processing of hierarchical linguistic structure is correlated with the synchronization of brain rhythms in various frequency bands. Kaufeld et al. (2020) recorded (EEG) while 29 adult native speakers (22 women, 7 men) listened to naturally spoken Dutch sentences, Jabberwocky controls with morphemes and sentential prosody, word lists with lexical

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[6]These are not the actual stimuli used by Fedorenko et al. 2010. They are my own inventions to illustrate the method, and relation between conditions. See the actual paper for actual examples.

content but no phrase structure, and backward acoustically matched controls. What they found was striking confirmation of the Ding et al. (2016) proposal for natural sentences as opposed to nonlinguistic acoustically matched controls.

> "Mutual information (MI) analysis revealed sensitivity to linguistic content: MI was highest for sentences at the phrasal (0.8–1.1 Hz) and lexical (1.9–2.8 Hz) timescales, suggesting that the delta-band is modulated by lexically driven combinatorial processing beyond prosody, and that linguistic content (i.e., structure and meaning) organizes neural oscillations beyond the timescale and rhythmicity of the stimulus."

So this analysis showed good evidence of rhythmic entrainment that was sensitive to both the word level and the phrasal levels of organization of a regular sentence. However, and consistent with the Fedorenko et al findings, the Jabberwocky sentences were no different from word lists with lexical content and no phrase structure on this measure.

One reaction to this kind of disappointing result is to say that syntax is just not really distinct from the lexicon in the way we thought. This seems to be the position of Blank and Fedorenko (2020), Rezaii et al. (2022), essentially embracing work in Construction Grammar (Goldberg 1995; Goldberg and Jackendoff 2004).

These kinds of authors are also quick to point out that we don't 'need syntax' to understand complex sentences most of the time, since lexical content and real world knowledge do the job for us. However, I think this line of reasoning presupposes a false pairing of analytic options. Part of the rhetorical battle has to do with the notion of 'module' going back to Fodor (1970), who defines it as involving 'meaning encapsulation' between domains, with only one channel of communication. This notion of modularity is presupposed by both camps, who argue either for an inert lexicon nested within a magical combinatoric system, or a rich internally structured web of memorized symbols with no distinct combinatoric module.

The disappointing holistic measure results (temporally coarse fMRI, and global entrainment facts) that fail to distinguish Jabberwocky from Word Lists, need to be complemented with evidence from other studies which do show temporally and functionally sensitive differences within the general language area.

Currently, there are at least two main candidate regions in the brain for the locus of syntactic competence: Broca's area—the posterior portion of the inferior frontal gyrus (pIFG) including the pars triangularis (pTri), and the posterior middle temporal gyrus (pMTG). Recently it has been shown in a neuroimaging metaanalysis that there is no robust difference in activation patterns between these two areas (Hagoort and Indefrey 2014; Meyer and Friederici 2016; Zaccarella et al. 2017).

The pMTG sits right at a crucial juncture between the lemma hub area and the dorsal stream that connects to the frontal lobe, but is an isolable subportion of it. While damage to Broca's area is associated with agrammatism in production (the absence of function words/telegraphic, halting speech), temporal parietal damage leads to the phenomenon of fluent paragrammatism (Dronkers et al. 2004; Rogalsky et al. 2018; Matchin et al. 2022), illustrated by the sentences below.

(8) "I'm very want it"
    "Isn't look very dear, is it?"
    "But it's silly, aren't they?"
    from Buttworth and Howard 1987, cited in Matchin (to appear)

Broca's area is also implicated in syntax, but with a profile that is slightly more skewed towards production than comprehension (Matchin and Wood 2020). It is also closely associated with tasks involving working memory (Bornkessel-Schlesewsky and Schlesewsky 2013; Pillay et al. 2017). So while Broca's area is *not* a domain general area of the brain (it is specific to linguistic computations), it is also not selectively sensitive to pure Merge. One speculation that we find in Matchin and Hickok (2020) is that it represents abstract combinatoric working memory in the service of syntactic structure possibly specifically with respect to linearization.

Liina Pylkkänen has also in the past ten years been focusing on the neurological basis for basic conceptual combination, which appears to be consistently located in the left anterior temporal lobe (LATL) (Brennan and Pylkkänen 2010; Del Prato and Pylkkänen 2014) although its relationship to general association on the one hand and syntactic combination on the other remain unclear. It is clearly associated with conceptual combination, but not clearly with actual syntax.

Thus, there is evidence from recent neurolinguistic work that there *are* specialized hotspots for some kind of hierarchical processing. These hotspots are distributed strategically at good communication posts throughout the language area, probably responsible for slightly different aspects of the triangulation between linear form and compositional meaning, and crucially interacting and feeding off information located in lexical hubs.

4.3. *Inflection vs. Derivation*

One of the questions that has occupied psycholinguists is the distinction between declarative and procedural memory, corresponding to the intuitive difference between memorized word forms and online 'rules' for creating forms. Much of the work in EEG, MEG and fMRI has been focused on looking for a distinction between productive and nonproductive affixation, with the additional factor of semantic transparency also taken into account (Gwilliams 2020, Leminen et al. 2018).

Interestingly, with respect to the question of whether one can reliably distinguish between inflection and derivation, there are fewer studies that start with this question explicitly. Productivity, transparency and the issue of whether speakers decompose cuts across this distinction. As far as decomposition is concerned, our most recent evidence suggests that speakers do aggressively decompose and extract affixes at an early stage of processing, even when the base stem is unique to that form and decomposition, and regardless of semantic transparency (Rastle et al. 2004, Gwilliams and Marantz 2018). At the same time, there is also evidence of whole word form access, especially for semantically opaque or highly frequent complex words. This is true of both inflection and derivation it seems. And while in general there seems to be support for a dual route model, both routes seem to often be activated. One caveat here is that the research to date has been disproportionately skewed in the direction of English. Work on other languages has if anything shown quite different kinds of patterns to those found for English (Leminen et al. 2018). Nevertheless, a simplistic cutoff between productive (rule based) and unproductive (memory) routes does not seem to be tenable, and that even productive, semantically transparent forms show some whole word effects, especially in derivation. Individual morphemes also clearly seem to be tracked and individuated, even when they are not productive.

Putting the notion of productivity aside, if we look more closely at the neuroimaging data, and the details of lexical access and priming, clear differences do emerge between the two traditional morphological types of inflection vs. derivation. Processes that are sensitive to lemma frequency (for which there is robust evidence), lump together the open class item *with its inflectional instantiations* and not with all its derivatives, indicating that when it comes to individuation, derivational forms do seem to have more autonomous lexical entries than inflected ones. General priming seems to distinguish inflection from derivation. Recall that forms that successfully prime each other (like *form* and *formation*) do not need to be listed under the same lemma to interact in a network of activation spreading. The phonological similarity between the forms would be enough to give rise to priming (although Frost et al. 2000 demonstrate for Hebrew that morphological relatedness primes even over and above the form relatedness that often goes along with that relationship). Importantly then, in addition to derivational priming being somewhat weaker than inflectional priming and identity priming, there is also evidence that derivational suffixes *can prime each other* (Marslen-Wilson et al. 1996), whereas this has not been found for inflection. This suggests that derivational morphemes have their own lives as Things, in a way that inflectional forms do not.

In terms of localization as well, inflection directly engages the LIFG (Left Inferior Frontal Gyrus) (Marslen-Wilson and Tyler 2007, Whiting et al. 2014). This is also true even when morphology is covert

(Sahin et al. 2009). The evidence for engagement of the LIFG on the other hand is much weaker (inconclusive) for derivation (Leminen et al. 2018).

The conclusions I draw from this brief summary are that they are consistent with what we have seen already in that memorized vs. rule governed processes are not encapsulated away from each other. Two routes exist, but are not complementary. Memory based networks coexist with productive modes of combination, and probably influence different kinds of processing tasks differently. Given the picture that is emerging of a massive parallel, redundant system, it is nevertheless the case that inflectional and derivational morphology are involved in qualitatively different kinds of interactions, independent of whether the particular phonological instantiation is predictable or has to be memorized.

5.   Consequences for the Linguist

I started this article with a description of how the modules of lexicon vs. syntax have been a point of architectural contention throughout the Chomskian era. I concluded that many of the debates centred around proposals that were essentially descriptively undecidable, *unless* we are committed to these architectural claims having some cognitive reality. My summary of the state of the art in our rapidly expanding knowledge of how and where language is situated in the brain has suggested a couple of surprising findings, which should ideally be used to inform our architectures in the future.

The first main point is that the Lexicon and the Syntax are probably not modules in the strict Fodorian sense, and that the interplay of memorized and generated representations in long term declarative memory and short term working memory respectively, are aspects of language production and comprehension that go hand in hand. The neurolinguistic evidence points to these components of our competence being in constant cyclic communication, with decomposition and holistic representation simultaneously calculated. Dissolving modularity is not the same as dissolving the distinction between the combinatoric process and the primes of memory. Rather, it creates a new set of questions about how these two components interact, which should be seen as much more dynamic and interactive.

5.1.   *Variation and Universals*

When it comes to crosslinguistic differences, Saussurean arbitrariness is an obvious fact— we need to learn the words of our languages, which partition both the phonemic and the conceptual space in language particular ways. This much is an undeniable source of variation.

The answer to the further possible differences among languages largely rests on the attitude one takes to universals and how fine grained and specific they might be, as opposed to general and abstract. Certainly, relegating variation to the inventory of functional heads seems unproductive as long as we have no clear consensus on or independent way of assessing what those functional items are, or whether they are chosen from a constrained set of possibilities.

As we saw from our case study of complex predication, even when we notice a broad generalization concerning hierarchical ordering of structural elements at some analytic level, languages seem to vary in how the memorized symbols in the lexical inventory are associated with that hierarchy. It is not clear to me that the description of one language as 'doing it in the syntax' vs. 'doing it in the lexicon' is helpful in this regard. However, it *does* seem to me that languages vary with respect to the sizes of the repeatable structural pieces that get 'lexicalized', or reified as a symbol in the system. This way of describing the variation we saw in the complex predicate case does crucially involve properties of the Lexicon, but more in the sense of the parallel architecture of Jackendoff (2002), where the symbol is an associational hub for connecting the meaning and sound domains. Like constructivist theories, the meaning side of the symbol can also be structured in general and predictable ways. Unlike constructivist theories, one does not need to sever regular hiearchical patterns from idiosyncratic memorized form.

Word order is another source of difference among languages. We have seen that functional heads

can also be made responsible for those differences in the context of a theory that introduces features on functional heads that regulate linearization (e.g. triggering roll up movements, or forcing overtness as in EPP features). However this is one implementational decision out of many that could be taken. If one takes the view such as the one taken in Berwick et al. (2013) and Berwick and Chomsky (2016) that there should be a strict architectural split between hierarchical and linear computation, then there are good arguments that these kinds of word order movements are misplaced in the syntactic component. This view would also be congruent with the most recent proposals from Matchin and Hickok (2020) that the linear and hierarchical computations are actually split, with only the former being handled by the classic Broca's areas.

This short article has taken a cross disciplinary perspective to argue that memory and combinatorics are distinct components of the natural language generative system but that they are interleaved both temporally and logically, one depends on and continually cross-references the other. Further, externalization and linearization seem to be distinct from semantic composition and the build up of hierarchical symbolic representations. These two latter elements have traditionally been conflated when talking about syntax, with the lexicon traditionally separated out. My suggestion on the basis of the latest evidence is that both of those architectural decisions will probably turn out to be wrong.

At any rate, the comparative study of different languages will be crucial to testing the predictions of new architectural models in the future, precisely because the overt symbolic ingredients give different starting points for those predictions.

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