

Constraints All the Way Down: DM in a Representational Model of Grammar

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1. Introduction

Distributed Morphology (DM; Halle & Marantz 1993) is a realizational framework for morphological theory and, like any such framework, it assumes an interface with a syntactic module that provides the structures to be realized. However, unlike other realizational models (e.g., Paradigm Function Morphology; Stump 2001), DM has assumed a particular syntactic framework for providing those structures: standard Chomskyan syntax (here called Minimalism for short, even though initial work in DM assumed a version of syntax that was antecedent to Minimalism). Given this consistent co-occurrence, it can be hard to easily identify where Minimalism ends and where DM begins. For example, the Y-model is a feature of Minimalism, as is the fact that head-movement and lowering are in the PF branch of that Y. In this paper, we identify the key features of DM that are independent of its interface with Minimalism and identify those features as effectively comprising DM in isolation.

We then offer our framework of Lexical-Realizational Functional Grammar (L_RFG), which marries DM as a theory of morphological realization to Lexical-Functional Grammar (LFG; Kaplan & Bresnan 1982) as a theory of syntax and grammatical architecture. We show that the result keeps all the key features of DM and thus is properly a daughter of DM, offering the same fundamentals of DM but also having different properties from DM's traditional form, thus allowing it to provide different types of explanations. We demonstrate L_RFG by providing a sketch of Ojibwe agreement morphology as a case study (adapting insights from analyses such as Déchaine 1999, Oxford 2014, 2019, and Barrie & Mathieu 2016). We close by summarizing potential reasons to adopt L_RFG as a version of DM.

2. What is DM without Minimalism?

In this section, we seek to identify the core properties of Distributed Morphology that are distinct from those that are inherited from Minimalism. This is challenging because DM has always assumed an interface with Minimalist syntax. For example, we assume here that phases-based analyses (Marantz 2006) are a function of Phase Theory (Chomsky 2001), rather than inherent to DM. Other such properties include head movement, the Y-model, and even derivations. We identify five features of DM that we can call its “principal properties”: morpheme-based morphosyntax, realization, morphology as an interface, three lists, and underspecification and the elsewhere principle.

2.1. Morpheme-based morphosyntax

DM is a morpheme-based model of morphology. In such models, complex words have internal structure and morphology is typically concatenative (we set aside here the completely confusing use of “morpheme” in the DM literature¹ and adopt the standard definition of the morpheme hypothesis). This

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¹ In this section, we will repeatedly make generalizations about “the DM literature”. If we had space, we would include a host of references pointing to where we draw these generalizations, but alas this paper lacks such space. We direct the reader to the many handbook chapters that summarize DM such as Harley & Noyer (1999), Siddiqi (2019).

means that words are not atomic in DM, and paradigms are epiphenomenal. Morphemes in DM are passive listings of an association between a phonological representation and a set of morphosyntactic properties. Stump (2001) calls this property of morphological theories “lexical”. Since parsimony dictates that there should not be two equivalent concatenative modules for word formation and phrase formation, many morpheme-based models of morphology assume a single generative module responsible for morphosyntax (see, for example, Lieber 1992). DM is such a model. This property of DM is often called “syntax all the way down” in the DM literature. The property of having one morphosyntactic component is called being “non-Lexicalist” by the DM literature in order to distinguish it from other varieties of Minimalism that assume a Strong Lexicalist syntax. This means that DM rejects the Lexicalist Hypothesis (Chomsky 1970, Lapointe 1980) in its strongest sense. However, importantly, while a single component responsible for both morphology and syntax follows naturally from the morpheme hypothesis, it is not entailed by it. We can sum this property then as comprising three distinct parts that go together, with the unfortunate side effect that the names for two of the parts appear to be contradictory:

1. words are comprised of morphemes (morpheme hypothesis)
2. morphemes are listed associations of sound and meaning (Stump’s “lexical”)
3. syntactic terminals do not correspond to words (“non-Lexicalist”)

We could in principle break this into three distinct parts, but these three properties so frequently align together that it makes sense to put them together. Lieber’s (1992) model, ESS, DM, and Nanosyntax all share these properties. The opposite of each these properties tend to align as well: Many word-based models of morphology today, especially Word-and-Paradigm models, are “inferential” in Stump’s terms (i.e. they assume word-formation rules) and assume words are atomic in the syntactic component (i.e. they are Lexicalist). So, it makes sense to present this as one confluence of properties.

2.2. Realization

Incremental approaches to morphology (using Stump’s opposition) assume that morphology is information-adding: Words gain morphosyntactic properties (i.e., inflection) *because* they acquire complex morphology. Realizational approaches, on the other hand, assume that morphology *expresses* morphosyntactic information. They typically assume completed featural structures as the input to morphological operations (where insertion in this case is a “morphological operation”). In other words, a particular morphological operation is *licensed* by a particular combination of morphosyntactic features (e.g. a root and inflection). This licensing is called *exponence*, the licensing features are called *exponenda*, and the licensed morphological form is called the *exponent* (i.e., the exponent expones the exponenda). The DM literature calls this property *late insertion*, but the procedural tinge of the term is misleading—what’s at stake is the property of being realizational, which DM shares with most contemporary models of morphology (for further discussion, see the editor’s note in Siddiqi & Harley 2016). Note that this property, realization, and the previous property, morpheme-based morphosyntax, are not linked properties. For example, A-morphous Morphology (Anderson 1992) and Paradigm Function Grammar (Stump 2001) are Word-and-Paradigm realizational models. In Stump’s (2001) classification, such models are *Inferential-Realizational*. DM is, in contrast, *Lexical-Realizational*.

2.3. Morphology as an interface

In contemporary DM, the ideal appears to be that morphology is an interface rather than a separate generative component of the grammar, as summarized usefully by Bermúdez-Otero & Luís (2016: 311):

Morphology has no proprietary categories, but deals only in morphs, understood as pieces of phonological material lexically specified with instructions for their use as exponents of syntactic properties.

This is most relevant in DM's rejection of the morpheme (Aronoff 1994), the word, and the paradigm (see, e.g., Trommer 2016 for discussion of how apparently morphomic patterns are addressed in DM). Because the Lexicalist Hypothesis/Lexical Integrity Hypothesis (Chomsky 1970, Lapointe 1980) assumes that words are atomic in the syntax, the hypothesis strongly implies the existence of an independent generative component of the grammar that is responsible for word formation, as opposed to a passive list—this is typically captured through the terminological distinction between a “Lexicon”, which is generative, and a “Vocabulary”, which is passive. Because the existence of such a component follows from the Lexicalist Hypothesis, the property of lacking it is typically characterized as “non-Lexicalist”.

However, this alignment is not necessarily entailed. It is certainly possible to reject the claim that words are atomic in the syntax *and* nevertheless assume a Lexicon. As a result, while it is standardly assumed that DM is non-Lexicalist, that view is contested. Many practitioners consider DM to have a generative lexical component, just not a *pre-syntactic* one. In Halle & Marantz (1993), M-structure clearly has proprietary rules. Indeed, a view of DM in the literature today is that the post-spellout, PF-branch rules, (such as Local Dislocation, Rebracketing, Impoverishment, Fusion, Fission, Enrichment, and Readjustment) constitute a Lexicon. Support of this view comes from versions of Minimalist syntax that do not assume a DM interface, such as those that appear in most syntax textbooks, which do not assume any of these mechanisms. From this point of view, these mechanisms are morphological and separate from the core syntax.

However, it is very important for the present discussion that all these rules serve to address syntax-morphology mismatches. Concordantly, we assume here that these particular mechanisms are not properties of DM, per se, but rather are properties of the DM-Minimalism interface (which is why they are typically referred to as “PF operations”). However, since morphology-syntax mismatches are an empirical reality, most of these mechanisms are likely to have some analog in any version of DM, even if it is interfaced with a non-Minimalist syntax. For example, impoverishment and enrichment as theories of syncretism and multiple exponence fit naturally within DM, but their specific implementation is dependent on the syntactic theory that DM is interfaced with.

2.4. *Three lists*

Perhaps the most salient and distinctive feature of DM is that it gives up on the claim that syntactic, semantic, and phonological domains of “word” (or morpheme) align on the same domain (see Di Sciullo & Williams 1987 and Marantz 1997 for discussion). Indeed, Distributed Morphology gets its name from this property. Instead, it created three distinct lists, one for each domain: 1. The Vocabulary is the list for phonological properties. 2. The Encyclopedia is the list for semantic properties. 3. The third list is frustratingly without a name agreed upon in the literature. Its members are the formal features that populate syntactic structures (these are the things called “morphemes” by some practitioners of DM). Distributed Morphology, in the 90s, was distinct among theories in asserting that the apparently unified domain of “word” was epiphenomenal, instead isolating the various definitions of word from each other. “Words” has been replaced with more specific concepts such as “syntactic terminals”, “feature bundles”, “spans”, “idioms”, and “prosodic words”.

2.5. *Elsewhere principle, underspecification, and competition*

DM employs a common type of linguistic rule called the Elsewhere Principle (also called the Paninian Principle), which is quite standard in morphological theory and dates back to the 70s, when formal morphological theory saw its nascence (see for example Anderson 1969, Kiparsky 1973). The classic view of the elsewhere condition is seen in Aronoff (1976): a morphological rule with more specific conditions is applied before a general rule. This has long been the main means through which irregular rules block the application of regular rules, for example. In contemporary realizational models, this blocking is achieved through competition, where a more specific form outcompetes a more general form. In the DM literature, this is implemented as a version of the Subset Principle.

DM also employs underspecification, whereby a morphological form underdetermines its syntactic and semantic properties, as a theory of syncretism, polysemy, and distribution. This allows morphological forms to appear in many different environments, often with slightly different meanings. There are many

ways that morphological models can deal with this, such as *rules of referral*. DM, like many other models, capture this by assuming that morphological form underdetermines its syntactic and semantic properties.

A key strength of realizational models of morphology is that they allow morphological forms to underdetermine their meaning, a ubiquitous empirical fact in the world's languages (see Stump 2001 for good discussion). DM leans into this via the combination of underspecification, the elsewhere principle, and competition. Underspecification and the subset principle combine to resolve realization through a competition of Vocabulary Items.

3. Comparison of L_RFG with Minimalist DM

Having established the principles of Distributed Morphology without a Minimalist interface, we now compare the traditional (Minimalist) DM with L_RFG (Asudeh & Siddiqi 2016, Melchin et al. 2020), a variety of DM developed to be interfaced with Lexical-Functional Grammar (LFG) as its syntax. The two key resulting differences discussed here are 1) L_RFG is a non-derivational, constraint based model of grammar; and 2) L_RFG allows exponence to be subject to dependencies on several different modules.

3.1. L_RFG is a non-derivational, constraint-based model of the grammar

Distributed Morphology is a realizational model of morphology and, as such, is conceptually akin to harmonic approaches to phonology (such as Optimality Theory; Prince & Smolensky 2004). The task is to identify the surface representation that best realizes the featural content of an underlying form that has been constrained by certain well-formedness conditions. Indeed, Vocabulary Items themselves, along with the Subset Principle, are the well-formedness conditions that must be satisfied in order to satisfy a legal surface representation. In this way, realizational morphology is inherently non-derivational. As a model of morphology, aside from the fact that insertion is cyclic in some varieties of DM, there is nothing derivational at all about DM. The five core principles of DM, as described above, describe a model of grammar that assesses the well-formedness of a surface representation (Vocabulary Insertion) against the final output of PF-branch operations (at least on a phase by phase basis). Intuitively, a surface-oriented model of morphology, like DM, would seem to fit better with a surface-oriented model of syntax, like LFG, than with a derivational model like Minimalism.

3.2. Exponence in L_RFG is subject to dependencies on several different modules

Affixation in L_RFG is conditioned by morphosyntactic features, but also semantics and phonology. This of course is empirically true of morphology. It is well-known that affixes (and other morphological processes) are not only subject to (morpho)syntactic conditions. Affixation can also be conditioned by semantics (see, for example, the semantic restrictions *re-* requires of its base) and phonology (see, for example, the phonological restrictions the comparative *-er* and the deadjectivizer *-en* require of their bases). L_RFG is able to capture all three of these types of conditioning on morphological processes precisely because the morphological representation, v(ocabulary)-structure, imposes constraints on the mappings (either directly or indirectly) to not only c(onstituent)-structure, but also f(unctional)-structure, s(emantic)-structure, and p(rosodic)-structure. In contrast, PF in Minimalist DM is explicitly blind to LF in the Y model, so meaning directly affecting form, such as the correlation between irregular allomorphy and specialized meaning such as the difference between *brothers* and *brethren* or *older* and *elder* (see Aronoff 1976), is excluded from Minimalist DM outside of treating all such phenomena as Root phenomena. Additionally, surface phonology is ordered after insertion is complete, so output-sensitive morphology such as the legality of the deadjectivizer *-en* in *hasten* (see Halle 1973 for discussion) is difficult or even impossible to obtain absent a DM-OT interface such as proposed by Bye & Svenonius (2012). L_RFG easily accounts for output-sensitive well-formedness via the constraints on the mappings between v-structure and p-structure.

4. L_RFG as a daughter of DM

In this section, we compare Lexical-Realizational Functional Grammar to the five properties of DM that we identify in section 2 to show that L_RFG is properly a daughter framework of DM (and of LFG) as opposed to a competing model.

4.1. Morpheme-based morphosyntax

L_RFG is a variety of DM, despite the different syntax interface, so L_RFG maintains all the key properties of DM. First, L_RFG upholds morpheme-based morphosyntax. Additionally, like Minimalist DM, L_RFG rejects the part of the Lexical Integrity Hypothesis that mandates that complex words map to syntactic terminals. L_RFG directly adopts the monolistemicity and spanning model of Vocabulary Items developed for DM in Haugen & Siddiqi (2016). Haugen & Siddiqi's (2016)'s model of the Vocabulary is neither purely morpheme-based nor word-based, but rather is listeme-based. In L_RFG, the key property for determining what is a Vocabulary Item is not decomposability, as is true in standard DM, but rather listedness. While Spanning is not universally accepted in DM, it is certainly a prominent part of the DM literature. Spanning is crucial to L_RFG, rather than optional, but otherwise L_RFG's view on morphemes and syntactic structure is virtually the same as in DM. Indeed, L_RFG c-structures are largely the same as syntactic trees found in DM outside of the featural content. See Figures 1 & 2 for an L_RFG analysis of example (1), an example of Ojibwe agreement taken from Melchin et al. (2020: 288).

- (1) gi- gii- waab -am -igw -naan -ag Ojibwe
 2 PST see VTA INV 1PL 3PL
 'They saw us [inclusive].'

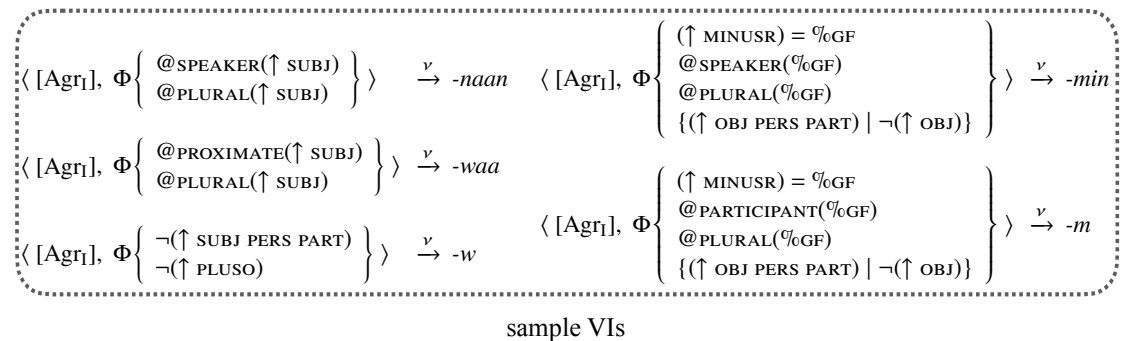


Figure 1: Sample Vocabulary Items for Ojibwe example (1)

Ojibwe exhibits a number of properties that present challenges to an analysis of its morphosyntax. Descriptively, it is a nonconfigurational polysynthetic language with a direct-inverse system of agreement. The choice of direct or inverse marking depends on the relative positions of the subject and object on a prominence hierarchy, where prominence is determined by a combination of person, obviation and animacy. This prominence hierarchy also plays a part in the realization of certain agreement morphemes. Inspired by feature-geometric Minimalist analyses of prominence (Béjar 2003, Béjar & Rezac 2009, Oxford 2019), our L_RFG analysis (Melchin et al. 2020) encodes the hierarchy in a series of nested LFG *templates* (Asudeh et al. 2013, Dalrymple et al. 2004); e.g., the templates @INCLUSIVE for 1st pl inclusive and @PROXIMATE for 3rd person animate proximate, as seen in Figure 2. For the direct-inverse marking, we propose that the language has a general constraint that subjects must rank higher than objects in prominence; this leads to situations where the patient argument is the subject and the agent argument is the object, in which case the inverse Voice head is present, as in Figure 2. Otherwise the Voice is direct. See Melchin et al. (2020) for further details of the analysis.

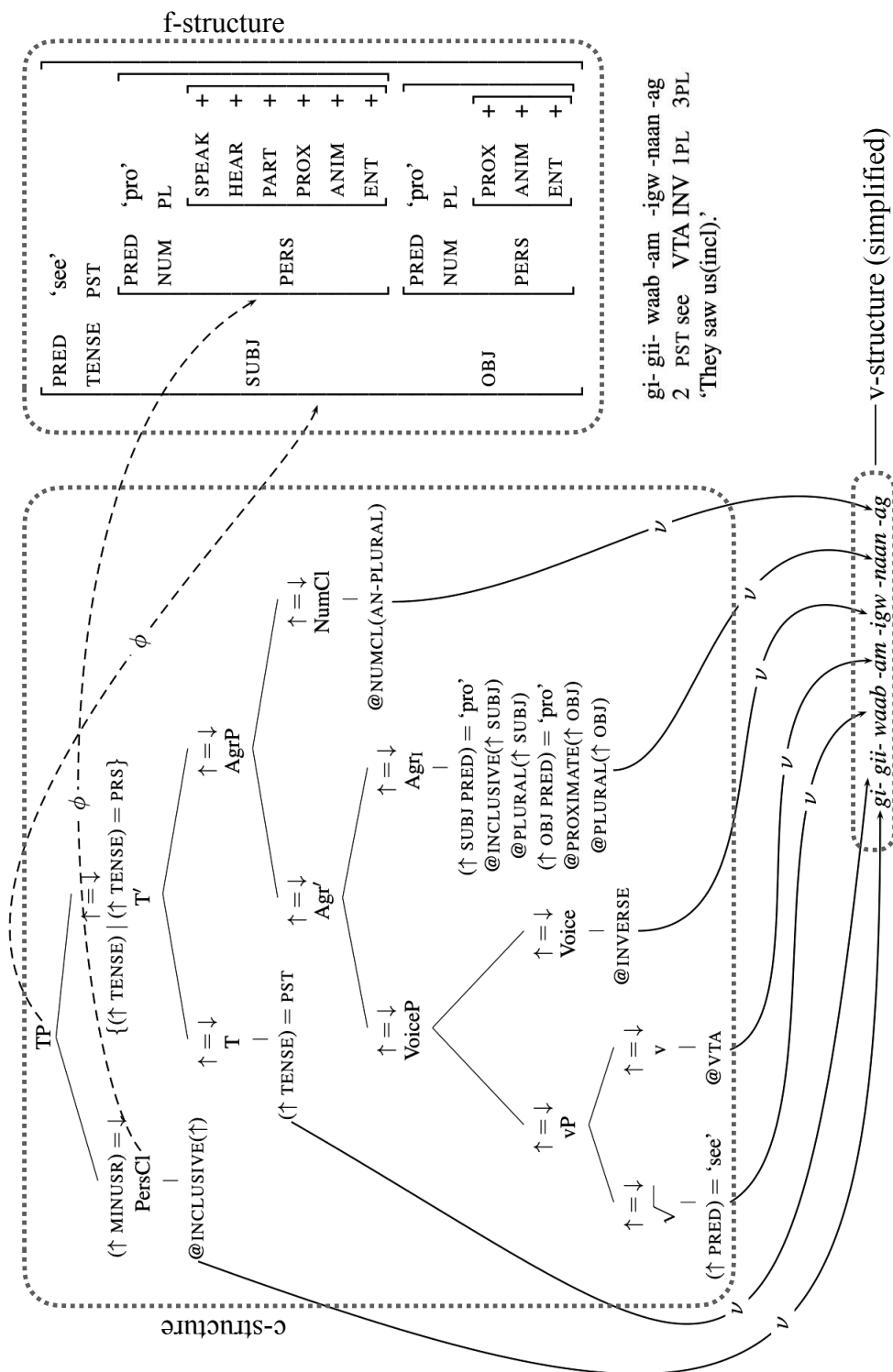


Figure 2: c-/f-/v-structures for Ojibwe example (1)

4.2. Realization

L_RFG upholds realization. Exponence in L_RFG is essentially Vocabulary Insertion. The crucial innovations are that a Vocabulary Item in L_RFG is a more complete representation than that of Minimalist DM, as it also contains information relevant to prosodic structure constraints, and there is no procedural

notion of “insertion”. Exponence in L_RFG is also more constrained, as it is sensitive to more information: it is conditioned by f-structure and by meaning constructors from Glue Semantics (Asudeh 2012, 2022, Dalrymple 1999, Dalrymple et al. 2019). Finally, rather than a non-monotonic/destructive replacement algorithm that discharges features from a derivation, exponence in L_RFG is a set of pairwise correspondence functions between representations in v-structure, c-structure, f-structure, and p-structure.

4.3. Morphology as an interface

In L_RFG morphology is an interface: “morphology” is a complex mapping among several representations. The representation most analogous to morphology per se is v-structure, which is quintessentially non-derivational. Rather, L_RFG ’s representation must satisfy many well-formedness constraints. While Minimalist DM has various operations that change the syntax along the PF branch, L_RFG has no such operations. The form of v-structure is entirely determined by the satisfaction of constraints on the mappings to other representations. Morphology is not an output of L_RFG : it is one of many representations described by a given co-description.

4.4. Three lists

L_RFG maintains the tripartite division of wordhood that defines DM. L_RFG further distinguishes vocabulary atomicity (i.e., spans) and phonological (prosodic) atomicity. In L_RFG , vocabulary atomicity, phonological atomicity, syntactic atomicity, and semantic atomicity do not necessarily align on the same object. Each corresponds to a different representation in the L_RFG grammatical architecture as described by co-description. The L_RFG architecture is a version of LFG’s Correspondence Architecture (Kaplan 1995). If we take “special” domains in the Marantz (1997) sense to mean the Vocabulary-determined mappings, Figure 3 highlights them in the L_RFG Correspondence Architecture.

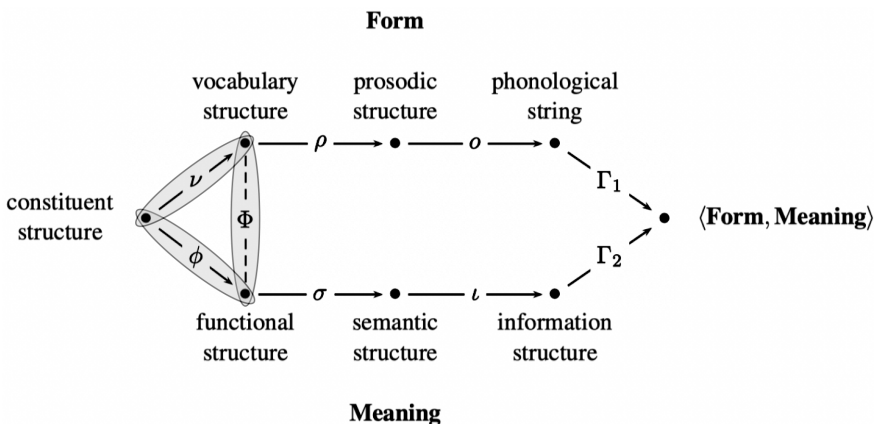


Figure 3: L_RFG ’s Correspondence Architecture with DM’s “special” domains indicated

4.5. Elsewhere principle, underspecification, and competition

L_RFG adopts the elsewhere principle and underspecification, though not directly from DM through Subset Principle. In L_RFG , the effects of the Subset Principle fall out of two independently motivated elsewhere constraints, MostInformative and MostSpecific, where MostInformative is conditioned by meaning and MostSpecific is conditioned by form.

5. Conclusions: Reasons to adopt L_RFG

Our principle MostInformative is well-formalized in terms of the subsumption relation on f-structures, which it inherits from LFG (Bresnan et al. 2016: 74–76). An f-structure f properly subsumes g ($f \sqsubset g$) iff f and g contain no inconsistent information and g contains some information that f does not contain.

The (proper) subsumption relation on feature structures is thus similar to the (proper) subset relation on sets. MostInformative can then be formalized as follows:

$$(2) \quad \text{Given two VIs, } \alpha \text{ and } \beta$$

$$\mathbf{MostInformative}(\alpha, \beta) = \begin{cases} \alpha & \text{if } \exists f \forall g. f \in \pi_2(v^{-1}(\alpha)) \wedge g \in \pi_2(v^{-1}(\beta)) \wedge g \sqsubset f \\ \beta & \text{if } \exists f \forall g. f \in \pi_2(v^{-1}(\beta)) \wedge g \in \pi_2(v^{-1}(\alpha)) \wedge g \sqsubset f \\ \perp & \text{otherwise} \end{cases}$$

This condition is both more precise than the typical formulation of the Subset Principle (see Harley & Noyer 1999) and simultaneously captures its effects and those of an economy condition that enforces spanning when possible (Haugen & Siddiqi 2016). MostInformative returns either the more specific of two comparable VIs or else returns \perp in the case of a tie, which can then be resolved by other principles—MostSpecific in the first instance—or else result in free variation if all principles allow the tie to stand.

Another property that $L_{\text{R}}\text{FG}$ inherits from LFG which we see as an advantage is the ability to treat a language “on its own terms” within a general model of UG. In the Minimalist framework, there is the initial assumption that all languages share an underlying phrase structure, in which subjects and objects are base-generated in a specific configuration, and specific heads (e.g., T(ense), Voice) play crucial roles in the licensing of core arguments. While this kind of assumption can easily account for patterns in English, other European languages, and certain other language groups, it requires a large number of additional mechanisms to derive languages that are typologically different. On the other hand, $L_{\text{R}}\text{FG}$ places similarities and universals across languages in the f-structure and other abstract feature structures, while the c-structures are allowed to vary widely depending on the properties of the language under analysis (Bresnan et al. 2016: 40–43). Thus, we can analyze tense and agreement as being combined in the head of IP in English and other languages with fusional morphology, while more agglutinative languages like Ojibwe have separate TP and AgrP projections. Similarly, the $L_{\text{R}}\text{FG}$ analysis of O’dam (Everdell et al. 2021) assumes a flat preverbal complex without sub-constituency, rather than trying to derive the free word order in this domain from some underlying configurational structure.

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