

**Monotonic DM as a result of a pairing with LFG**

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**Abbreviations:**

DM: Distributed Morphology (Halle & Marantz 1993)  
GPFM: Generalized Paradigm-Function Morphology (Spencer 2013)  
LFG: Lexical Functional Grammar (Kaplan & Bresnan 1982)  
MPP: Minimalist Principles & Parameters (Chomsky 1995)  
PFM: Paradigm-Function Morphology (Stump 2001, Stump 2016)  
MSI: Morphology-Syntax Interface  
LIH: Lexical Integrity Hypothesis  
OT: Optimality Theory (Prince & Smolensky 2004)

**1. Overview**

Background: Lessons learned from Siddiqi & Harley (2016).

- There is a marked lack of consensus on the foundations of morphological theory (with the apparent contemporary exception of realization).
  - This is compounded by a very pronounced tendency to silo ourselves.

**Goal of today's talk:**

- Bridge-building endeavor between two silos
  - LFG (Ash) & DM (Dan)

**What we are going to do:**

- Argue for the potential benefits of a LFG interface with DM (as opposed to an MPP interface).
- Propose an architecture for such an interface.
- Discuss some potential strengths of such a model.

**What we are NOT going to do:**

- Argue for or against the many hypotheses we will discuss and/or assume here.
  - Lexical Integrity
  - The morpheme hypothesis
  - Spanning
  - Post-linearization insertion
  - Etc.
- We assume you know the arguments for and against these and we are not here to settle these debates.

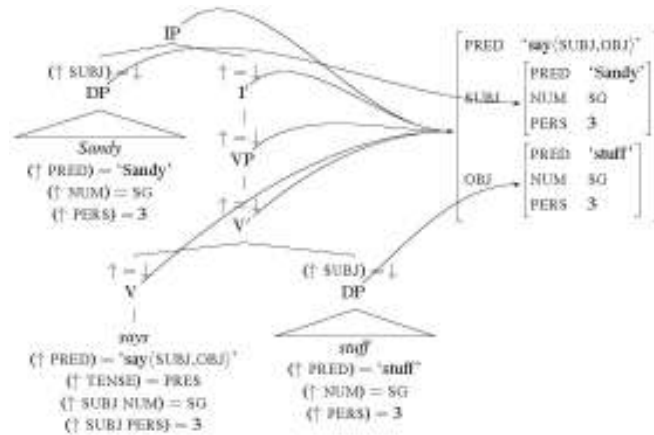
**2. The theory of LFG vs the formalisms of LFG**

- Like most formalisms, the LFG formalism allows us to capture a variety of morphosyntactic theories.
  - A certain set of theoretical assumptions (such as the LIH) have come to be associated with LFG.
  - But LFG is not constrained to these hypotheses.
- The formalism features of LFG (which can be employed by DM) include:
  - Monotonicity (syntactic operations are information preserving)
  - Declarative syntactic structure (wellformedness is captured through constraints on structure, not through derivations).
  - Model-theoretic satisfaction (grammatical constraints are descriptions satisfied by structures in some model).
  - Modularity (LFG comprises modules and functions mapping those modules to each other).
- LFG is a precise formal language that can be employed with many theories of grammar (such as those within DM).
- DM offers an alternative testbed for those formalisms.
  - Research Question: Can the formal tools of LFG accommodate a very different sort of framework (such as DM)?

**Quick and dirty summary of LFG and its key terms:**

- C-structure: a phrase-structure tree that normally represents dominance, constituency, linear order and syntactic categories.
- F-structure: represents more abstract aspects of syntax such as grammatical functions, predication, modification, case and agreement, and local and unbounded dependencies.
- Mappings between f-structure and c-structure are annotated on c-structure nodes using meta-variables.

## 1) Traditional LFG c-structure and f-structure for "Sandy says stuff"



## 3. Who does LFG as a practiced (the theory of LFG) exclude?

- LFG often offers an *incremental* approach to morphology, at least in pedagogical sources such as Bresnan et al (2016).
- At the same time, most models of morphology have abandoned the incremental approach to morphology over the course of the last two decades.
  - Contemporary morphology is typically *realizational* (Beard 1995)
- ❖ The work so far in interfacing LFG with a realizational MSI has been about interfacing it with PFM or GPFM. See for example:
  - Spencer 2003, 2004, 2005, 2013
  - Spencer & Sadler 2001, Sadler & Spencer 2004
  - Luis & Sadler 2003, Luis & Otoguro 2004
  - Otoguro 2003
  - Sadler & Norlinger 2004, 2006
  - Marcotte & Kent 2010, Marcotte 2014
  - Dalrymple 2015
- Nearly all these models make shared assumptions (which we sum here).
  - Realization is a mapping from f-structure to a morphological-structure (called m-structure) (Butt et al. 1996, Frank & Zaenen 2002) to PFM (or its ilk).
    - Avoiding c-structure mappings allows the preservation of the Lexical Integrity Hypothesis.
    - Mapping to this intermediate level preserves the morpheme hypothesis (Aronoff 1994)

The big question that we ask here is this: Who does LFG *exclude* by limiting its morphological research to a PFM-style realizational approach?

- Realizational morphologists who work with LFG tend to be those that subscribe to the word-based approach.
- This, of course, excludes those morphology practitioners that subscribe to morpheme-based approaches (in this context, we refer here to the *realizational-lexical approaches*; see Stump 2001)
- This makes intuitive sense because LFG takes as one of its core assumptions the Lexical Integrity Hypothesis (Aronoff 1976, DiSciullo & Williams 1985, LaPointe 1980, Bresnan et al 2016).
- HOWEVER, in the context of a realizational MSI, you can give up the strictest version of the LIH without giving up much of the motivation for the LIH
  - ◆ The observation that morphological operations and the syntactic operations are only *partially* overlapping

So, what ties does LFG *gain* by countenancing an alternative theory of the MSI?

- a. As above, practitioners of *morpheme-based models*.
- b. Similarly, those seeking *syntactocentric explanation* for morphological phenomena.
- c. Related, supporters of *the Mirror Principle* (Baker 1985).
  - This is significant because early standard incremental LFG is really good at the Mirror Principle (as pointed out by Baker 1985).
- d. The model we propose here does not require the intermediary m-structure.
  - Extant realizational LFG models typically assume that f-structure is the syntactic level that interfaces with morphology (via m-structure).
  - If you don't assume the morpheme hypothesis, then a model without an intermediate m-structure is more parsimonious.
    - ◆ Will be appealing to those practitioners that *reject the morpheme hypothesis*.
  - This should appeal to *extant LFG practitioners* as well.
    - ◆ Mapping from f-structure, while preserving the LIH, runs into its own problems.
      - F-structure does not make the right structural distinctions to facilitate realization of forms.
        - e.g. agreement information is contributed to the f-structure from many places in the c-structure.
      - WHERE it comes from in the c-structure is important to the morphology.

4. What does DM *gain* from incorporating formalisms from LFG?

DM doesn't have to be married to Minimalism (MPP).

- There is no reason for DM to exclude the many syntacticians who reject tenets of MPP but would not necessarily reject (at least some of) the tenets of DM.
- DM doesn't (necessarily) need to be derivational:
  - Declarative models have their appeal
    - Almost every other model of syntax other than MPP.
    - A syntactic model that is more surface-true (e.g. LFG's c-structure) is in some ways easier to interface with a realizational model.
      - There is no need to derive MS from SS (to use antiquated terminology).
    - There has been recent debate about the proliferation of post-syntactic operations in DM ( see for example Trommer 1999, Caha 2009, Bermudez-Otero 2013, Haugen & Siddiqi 2016)
      - Many of these post-syntactic operations can be eliminated by a spanning account for morphosyntax (Ramchand 2008, Svenonius 2012, Merchant 2013, Haugen & Siddiqi 2016)
        - NB: Spanning approaches are inherently *declarative* (which makes them compatible with declarative models such as LFG).
      - Many others can be alleviated by OT accounts of morphophonology. (Bye & Svenonius 2014, Haugen 2011, Haugen & Siddiqi 2016)
        - NB: OT accounts are also fundamentally *declarative!*
    - These alternative models of DM that are inherently declarative largely aim to account for particular classes of phenomena:
      - Non-local morphophonological relationships.
      - Stem Allomorphy.
      - Root Suppletion.
    - Not coincidentally, these are the types of phenomena that word-based realizational approaches (such as PFM) are particularly good at (and these are the theories typically interfaced with LFG).

## 5. Distributed Lexical Functional Grammar (DLFG)

We take LFG as our starting point and add DM to it (rather than the other way around).

Step 1: Abandon the hypothesis that c-structure contains phonological strings at all.

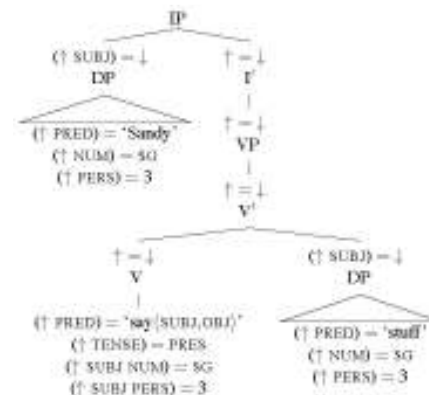
Step 2: Assume that c-structure contains f-descriptions that are NOT linked to words.

- Not an entirely novel proposal: Asudeh et al 2013, Asudeh & Toivonen 2014
  - F-descriptions for “constructional” meanings are introduced directly into the c-structure (which means constructions do not have to be adopted as theoretical primitives).

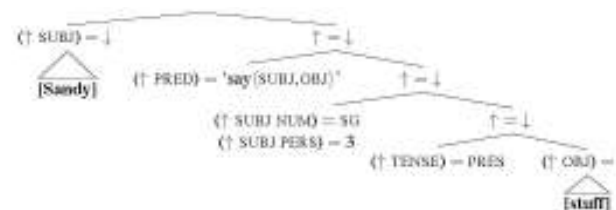
Step 3: **New Proposal:**

- All there is in the c-structure is these independent f-descriptions.

- No “words”
  - Depending on your model of morphology, you might also assume:
    - Lexical Identifier
    - Meaning constructors
  - ( $\uparrow$  PRED) = ‘Sandy’, etc., is minimally sufficient though.
- 2) Revised c-structure for “Sandy says stuff”: No phonological material in the terminals.



- This hypothesis enables ANY realizational model to be read directly off the c-structure.
    - Avoids the f-structure mapping problem (discussed above).
  - To get a morpheme-based model, we need to split off the individual f-descriptions into smaller “morpheme” sized nodes.
- 3) Possible DLFG c-structure “Sandy says stuff”



- Without further architecture, this model is not compatible with the tenets of LFG (i.e. monotonicity) because of DM's various post-syntactic operations.
  - We need to enable a spanning account.
  - Here we adopt a post-linearization spanning account for the reasons given in Haugen & Siddiqi (2016) and Merchant (2013).

Step 4: **New Proposal:**

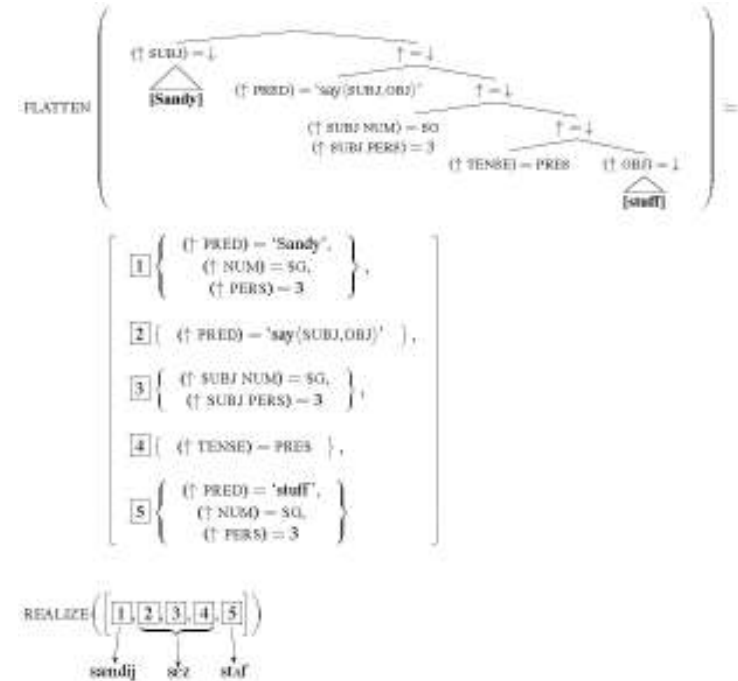
- The FLATTEN function operates on c-structure and maps c-structure to an ordered list of (sets of) the terminal f-descriptions.
  - Flattening is just the standard tree-theoretic operation of taking the yield of the tree, where the yield is the information in the terminal nodes, preserving their order in the tree.
  - So the yield of a standard vanilla phrase-structure tree would be the string that the tree parses.
  - In our case, as the terminals are sets of f-descriptions, the yield that results from the FLATTEN function is not a string, but an order-preserving list of sets of f-descriptions
- Stating constraints and operations on the yield of a tree in LFG has been independently motivated prior to this proposal. See Asudeh (2009).
- Predicts realizational forms can be dependent on linear precedence, not (necessarily) hierarchical relations.
  - English Nominative Case

## 4) English nominative case.

- Me and Jack went to the store.
  - \*I and Jack went to the store.
  - Jack and me went to the store.
  - Jack and I went to the store.
- Us linguists hate pedants.
  - %We linguists hate pedants.
- Me kicking a desk shocked the audience.
  - \*I kicking a desk shocked the audience
- GENERALIZATION:** English nominative case is sensitive to linear precedence (in additional structural conditions; adverbs present the usual problems).
  - Realizational morphology can't be sensitive to this type of condition unless it acts on a linearized or flattened structure.

Step 5: **New Proposal:**

- The REALIZE function maps flattened structures (the output of FLATTEN) to phonological forms.
    - This mapping is subject to constraints familiar from DM (or Nanosyntax) (see 6 below).
- 5) "Sandy says stuff".



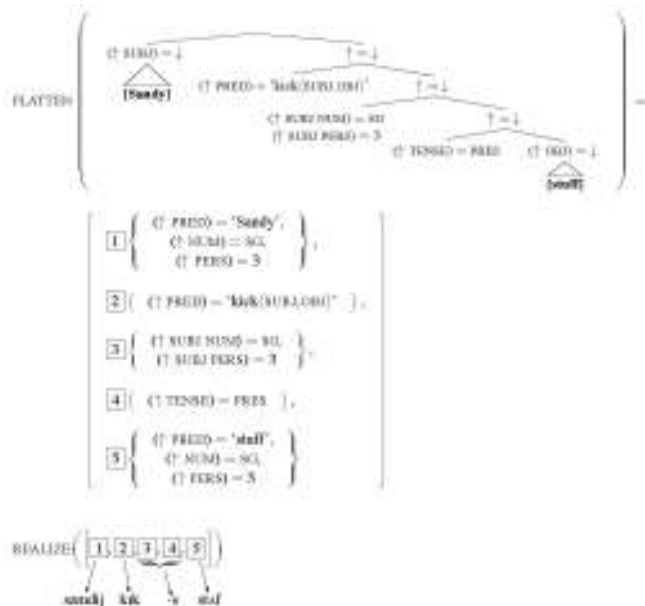
## 6) Constraints on realization (i.e., the function REALIZE).

- Use the fewest listemes you can for the job. (MINIMIZE EXPONENCE: Siddiqi 2009)
- Use the listeme that expone the most amount of information in the  $X^0$  it expone. (Subset Principle, Halle & Marantz 1994)
- REALIZE may expone multiple adjacent  $X^0$ s provided that the f-descriptions expone by the inserted listeme are as large a subset of the string of adjacent  $X^0$ s than that which could otherwise be expressed by separate listemes at the contained  $X^0$ s. (Post-linearization Spanning; Haugen & Siddiqi 2016)

## 5. Stem Allomorphy in DLFG

Compare derivation of “Sandy says stuff” in (5) above (stem allomorphy) with “Sandy kicks stuff” in (7) below (no stem allomorphy)

7) Sandy kicks stuff.



- *Says* expresses 2, 3, and 4 because *says* is a suppletive portmanteau form of [say+s] (despite its transparent spelling)
- *Kick* expresses 2 while *-s* expresses 3 and 4 because while *-s* is a portmanteau, *kick* is the regular expression of 2.
- In this way, DLFG accounts for stem allomorphy with a listing account but accounts for regular morphology with a morpheme-based account.
  - See Haugen & Siddiqi (2016) for details

## 6. Hybrid model

What we are presenting here:

- Does not fully accept or reject the word-based hypothesis.
- Nor does it fully accept or reject the morpheme-based hypothesis.

Rather, we countenance a hybrid of the two.

- Some forms involve whole word storage
  - High frequency word forms
  - Forms with low compositionality/parsability (stem allomorphy)
  - Suppletive forms
  - Forms with low productivity
  - Forms with borrowed morphology
  - Forms with irregular or moribund morphology
  - Forms with non-compositional/idiosyncratic (unpredictable) meaning
  - Certain types of portmanteau morphemes
  - Etc.
- Some forms involve morphemic decomposition
  - Regular morphology
  - Low token frequency, high pattern frequency forms
  - Forms with high productivity
  - Forms with clear concatenative boundaries
  - Etc.

This is not a novel assumption.

- Assumed by Nanosyntax (Starke 2005, 2009) and by practitioners of spanning within DM (see Haugen & Siddiqi 2016) and also increasingly by “root storage” models of stem suppletion within DM (see Harley 2014, for example).
- Called “Moderate Word-Form Lexicon” by Haspelmath & Sims (2010).
- This model has some benefits:
  - Incorporates most of the strongest arguments for a word-based approach.
  - Same with the morpheme-based approach.
  - Has been increasingly supported by psycholinguistic research into whole word processing.
    - See for example the work of Harald Baayen and his colleagues.

## 7. Conclusions

- Argued that DM could benefit from LFG formalisms.
- Argued that LFG need not exclude DM practitioners.
- Argued that both benefit from bridge-building (i.e. a DM interface with LFG)
- Proposed a possible architecture for such a DM-LFG interface.
- Showed the strengths of this model (hybrid word/morphology declarative model)

## Future Research

- ❖ We need to work out some phrase structure rules for the c-structures in this model.
- ❖ An obvious test of this model is ergativity and the distribution of case in split ergative languages.
- ❖ Verb classes seem to pose a particular challenge for this model.
- ❖ Multi-word expressions, such as *X kills Y dead*, may also be particularly challenging.

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