Alternative theories of morphology in the Parallel Architecture:
A reply to Benavides 2022

Ray Jackendoff
Tufts University
ray.jackendoff@tufts.edu

Abstract

The Slot and Structure Model of morphology (SSM: Benavides 2022) presents itself as an extension of the Parallel Architecture (PA: Jackendoff 1997, 2002). The present article compares SSM to Relational Morphology (Jackendoff and Audring 2020) and Construction Morphology (Booij 2010), which also claim allegiance to the Parallel Architecture. It is shown that (a) SSM does not segregate semantic structure from syntactic structure, violating the fundamental premise of the PA; (b) SSM is concerned primarily with deriving productive morphology, while the PA is stated in terms of declarative schemas that license nonproductive as well as productive morphology; (c) SSM enforces a strict division between morphology and syntax, while the PA allows a degree of interpenetration. Finally, Benavides accuses RM of lacking a direct connection between semantics and syntax. It is shown that this is based on a misunderstanding of the RA formalism.

Keywords: Parallel Architecture, Slot and Structure Model, Relational Morphology, Construction Morphology, morphology.

1. Basic principles of the Parallel Architecture

Benavides 2022 develops a theory of morphology called the *Slot and Structure Model* (SSM), which is explicitly intended as an extension of the Parallel Architecture (PA: Jackendoff 1997, 2002, 2010) into the domain of morphology. The abstract states that the PA "lacks a fully developed model of word formation." However, it immediately concedes that "[m]ore recently, a theory called Relational Morphology (RM) (Jackendoff & Audring 2020) has been developed, that integrates into the PA." Benavides offers arguments in favor of SSM and against RM and another PA-based theory of morphology, Construction Morphology (CxM: Booij 2010, 2019). This brief note assesses what I take to be the fundamental differences between the approaches.

The grounding premise of the Parallel Architecture is that phonology, syntax, and semantics are independent levels of representation, each with its own characteristic primitives and principles of combination, and each connected with the others by interface links (a.k.a. correspondence rules). A word establishes a small-scale link between the structures. For example the word *elephant* is a linkage between a piece of phonology /ɛləfənt/, the syntactic features [N, singular], and the meaning [ELEPHANT] (however this meaning is to be filled out by semantic theory). A well-formed sentence has well-formed phonological, syntactic, and semantic structures, with links between them determined by the words and various additional principles.

2. The SSM formalism compared with Relational Morphology and Construction Morphology

With this overall characterization in mind, ldet us compare SSM's formalization with that of RM and CxM. First consider the representation of the word *driver* and the *-er* affix in the RM formalism.

(1) a. **RM representation of *driver*** (cf. Jackendoff and Audring 2020, 89)

Semantics: $[\text{PERSON}^\alpha; [\text{DRIVE (Agent: } \alpha\text{, Patient: INDEF})]_1]_2$

Morphosyntax: $[_N V_1 \; \text{aff}_3]_2$

Phonology: $/\text{drajv}_1 \; \text{ər}_3 /_2$

b. **[$_N$ V-*er*] *affix***

Semantics: $[\text{PERSON}^\alpha; [\text{F (Agent: } \alpha, \ldots)]_z]_w$

Morphosyntax: $[_N V_z \; \text{aff}_3]_w$

Phonology: $/\ldots_z \; \text{ər}_3 /_w$

The formalism in (1) explicitly segregates semantic, syntactic, and phonological structures. The links between levels of representation are encoded by subscripting: subscript 1 connects the levels of the base *drive*, subscript 2 connects the levels of the entire word, and subscript 3 connects the levels of the affix (this last an issue to which we will return). Thus it directly embodies the basic principle of the Parallel Architecture.

Next consider the CxM formalism.

(2) a. **CxM representation of *driver*** (cf. Boiij 2019, 2)

$$[[drive]_{V1}\ er]_{N2} \leftrightarrow [\text{PERSON who } [\text{DRIVE}_1]]_2$$
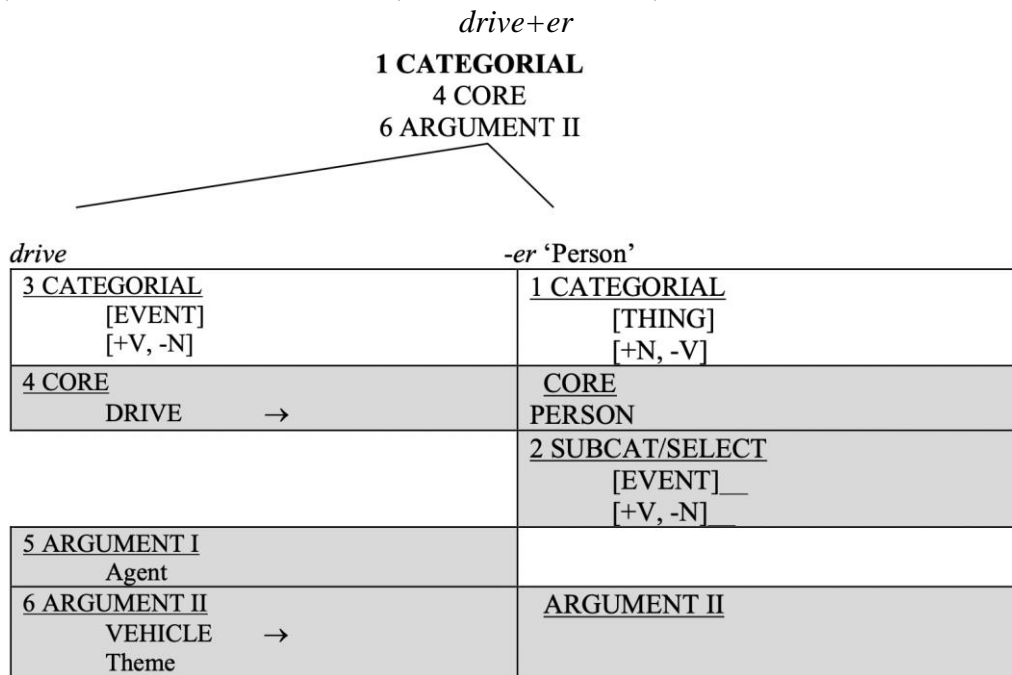
b. **[$_N$ V-*er*] *affix***

$$[[X]_{Vi}\ er\ ]_{Nj} \leftrightarrow [\text{PERSON who SEM}_i]_{SEMj}$$

This formalism can be thought of as an abbreviation of the RM representation: the left-hand expression encodes phonology and syntax, and the right-hand expression encodes semantics. The subscripts play the same role as in (1), indicating what parts of the phonology/syntax correspond to what parts of the semantics. Booij 2010 (pp. 7-8) also offers a formalism isomorphic to (1).

      In both RM and CxM representation, the affix consists of pieces of structure on all three levels. The constraints that the affix imposes on its base are represented by variables in the affix's lexical entry. For instance, in (1b), the semantic function F has to be instantiated by the meaning of the base. Moreover, F is stipulated to require an Agent argument. The phonology of the affix has an empty slot that has to be filled by the phonology of the base. Finally, the morphosyntax of the affix dictates that this is a noun whose verbal base is followed by an affix that is linked to the fixed phonology /ər/.

      Let us now look at the SSM version.

(3) **SSM derivation for *driver*** (Benavides 2022, 55)

drive+er

1 CATEGORIAL
4 CORE
6 ARGUMENT II

drive	-*er* 'Person'
3 CATEGORIAL [EVENT] [+V, -N]	1 CATEGORIAL [THING] [+N, -V]
4 CORE DRIVE →	CORE PERSON
	2 SUBCAT/SELECT [EVENT]__ [+V, -N]__
5 ARGUMENT I Agent	
6 ARGUMENT II VEHICLE → Theme	ARGUMENT II

This representation also segregates the information in a morphologically complex word, but in entirely different fashion. The lexical entry is divided into *slots* – the boxes in (3) – each of which contains a characteristic repertoire of features. Consider first the slots labeled CATEGORIAL. They contain basic semantic features, such as EVENT and THING, plus syntactic features such as [+V, -N]. Benavides writes (p. 14): "These two types of features have been placed together in this slot given the close link between the two." However, this violates the basic premise of the Parallel

Architecture, namely that phonological, syntactic, and semantic levels of representation are independent and internally unified. In RM and CxM, the close link between basic semantic categories and syntactic parts of speech is captured not by putting them in a box together, but rather by specifying the interface between the two levels. Similarly, the SSM slot labeled SUBCAT/SELECT encodes the affix's constraints on its base. It too mixes semantic and syntactic information. Moreover, it makes no connection with the syntax and semantics of the CATEGORIAL slot. The remaining slots deal with aspects of semantics: "core" lexical semantics and argument structure. So semantics is scattered throughout the slots. And on the other hand phonology has no slot at all, just an informal listing at the top of the table. In short, on this reading, SSM, unlike RM and CxM, cannot be considered an instantiation of the Parallel Architecture.

3. Derivation of productive morphology vs. schemas for both productive and unproductive patterns

A second major difference between the theories is cued by the label on (3), "derivation for *driver*." SSM is presented as a theory of the derivation of regular, productive morphological patterns.

> [SSM] accounts for regular morphology, but it accounts for irregular morphology as well through the adoption of Pinker's (2006, 1999) dual-route model … It posits that while regular forms … are computed by combinatorial rules, irregular, semiproductive, or unpredictable forms … have to be memorized and are stored in a sort of analogical (associative, relational) network that is a part of the lexicon and implements lexical redundancy rules." (Benavides 2022, 9-10).

The distinction is described in processing terms:

> [W] when speakers hear or produce a complex word, they first attempt to form a derivative via the regular route…, but if an irregular form already exists for that concept, the regular route is blocked and the irregular form stored in the lexicon takes over. The search for the stored form and the operation of the rule work in parallel, until one of them "wins." (Benavides 2022, 10).

RM and CxM also endorse a dual-route theory of processing, in which compositional derivations are in competition with stored complex items (Jackendoff and Audring 2020, chapter 7; Huettig, Audring, and Jackendoff 2022; Booij 2010, 251-253), and RM develops an extensive account of the network of stored forms. In fact, given the sheer volume of "irregular, semiproductive, or unpredictable forms" that "have to be memorized," RM might well be thought of as primarily a theory of the "relational network that is part of the lexicon." Such a theory should say that on one hand, *driver* is related to *drive* through its base, but on the other hand it is related to *baker*, *singer*, and *winner* through its affix. Moreover, it should be related to *butcher* and *carpenter* through its affix, even though the base of these words is a "bound root" rather than an independent word on its own. RM encodes these relations in affix

schemas such as (1b), which represents the respect in which all agentive -*er* words are alike. RM argues that this schema and its links to its instances are explicitly represented in memory, that they smooth processing of its instances, and that they make new instances easier to learn. These roles, internal to the lexical network, constitute what RM calls the ***relational*** function of schemas.

Benavides (p. 69) is correct in surmising "that, in essence, relational schemas are a modification and formalization of lexical redundancy rules." However they are not identical, and in particular are no longer represented in the format of Jackendoff 1975, which Benavides appears to adopt (p. 68).

Where does that leave online composition? One of the most important results of RM (Jackendoff and Audring, chapters 2 and 3) and CxM (Booij 2010, 2019) is that productive patterns can be captured by means of schemas that are in exactly the same format as nonproductive schemas. The only difference is that, while the legal instances of a nonproductive schema have to be listed in the lexicon, the variables of a productive schema can be freely instantiated by any novel material that meets the schema's conditions, through the operation of unification. In this latter case, the schema is operating in a ***generative*** role. In other words, the distinction between freely generated forms and memorized forms is not a transcendental difference between linguistic rules and an associative network, as Benavides proposes, following Pinker. Rather, it simply amounts to the difference between open and closed variables in a schema.

There is a further consequence. Consider the English regular plural: it clearly can be used generatively to produce novel forms. However, it also appears inside of forms that have to be memorized, for instance *clothes*, *woods*, *dregs*, *smarts*, *best regards*, *raining cats and dogs*. In these cases, the plural schema is being used relationally, capturing the similarity between these forms and regular forms, rather than generating these forms online. This is not an isolated case: it turns out that any productive pattern can also be used relationally.

This conclusion undermines any attempt such as SSM to treat productive patterns in isolation, and to set aside nonproductive patterns as a matter for some sort of loose association – or as a matter for lexical redundancy rules. At the same time, RM upholds the distinction between computation and storage in processing by appeal to the difference between generative and relational functions of schemas.

4. The relation between morphology and syntax

A third difference between SSM and RM concerns the relationship between morphology and syntax. RM proposes an architecture along the lines of (4), in which the upper three components are concerned with the grammar of phrases and the lower three with the grammar of words. The double-headed arrows represent interface correspondences. (Thus Benavides is mistaken in claiming (p. 60) that "[i]n this model, morphology is not seen as being located below the word level.") From the perspective of PA and RM, a theory of morphology has to be concerned not just with morphosyntax but also with its interfaces with phrasal syntax, word phonology, and lexical semantics.


(4)   (Jackendoff and Audring 2020, p. 16)

Phrasal phonology	⟷	Phrasal syntax	⟷	Phrasal semantics
↕		↕		↕
Word phonology	⟷	Morphosyntax	⟷	Lexical semantics
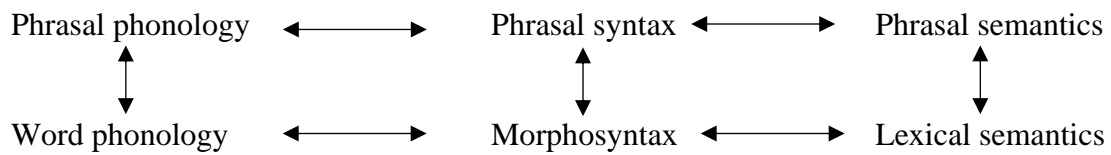
This diagram does not have a separate component called "lexicon," because RM and CxM, along with Construction Grammar, argue that the entire grammar can be said to be "in the lexicon." Elaborating an earlier point: a typical word is a stored mini-network consisting of a piece of word phonology, a morphosyntactic structure, a piece of lexical semantic structure, and the interface links between them, notated by coindexation (and corresponding to the arrows in (4)). But words are not the only linguistic entities stored in this fashion: there are also phrasal idioms, collocations, clichés – and schemas. This view of lexical storage leads to what Construction Grammarians call the Constructicon, and what RM sometimes calls the "extended lexicon."

SSM proposes the architecture in (5).

(5) (Benavides 2022, p. 58)

[modification of Jackendoff 2007, Culicover & Jackendoff 2005]
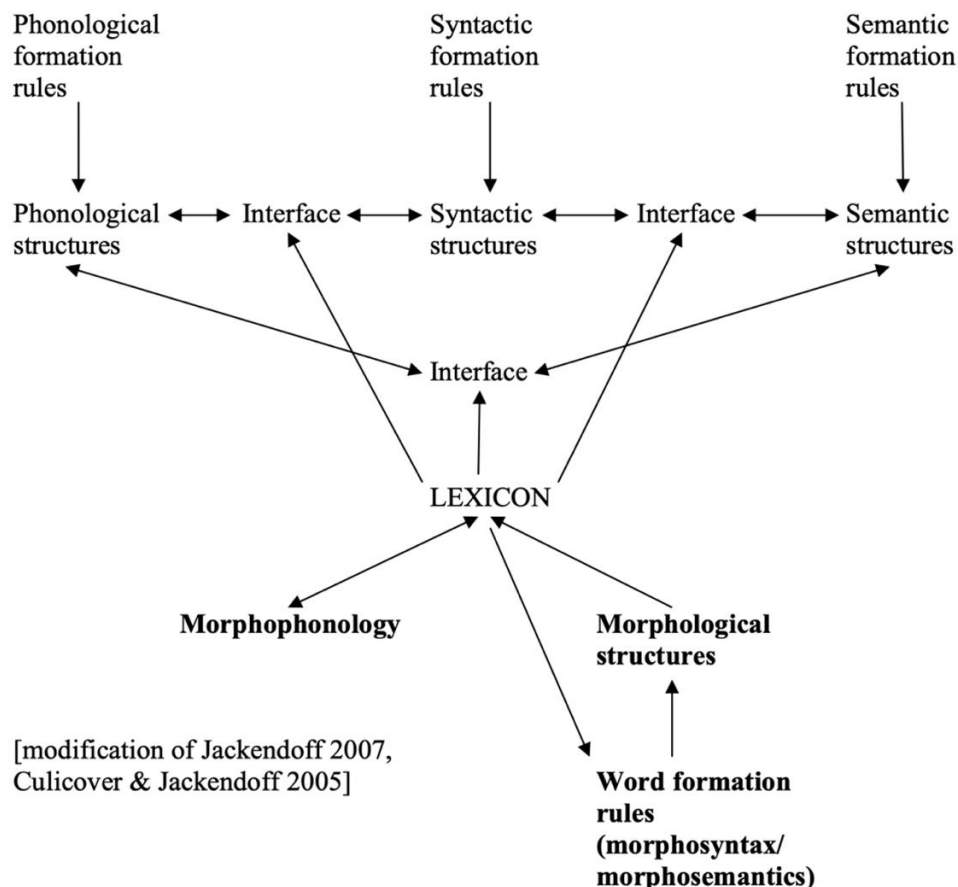
This differs from (4) in (at least) two respects. First, it does include a separate Lexicon component, evidently borrowed from earlier expositions of the PA such as

Culicover and Jackendoff 2005 (p. 18). However, as the PA theory has developed, the separate Lexicon has become otiose for the reasons just mentioned.

More consequential is the absence in (5) of any direct interaction between word grammar and phrasal grammar. Benavides says (p. 64): "Another important contrast between the SSM (as incorporated into the PA) and RM is that,…. in the former, morphology does not interface directly with phrasal syntax or semantics. It does so via the lexicon." Benavides approvingly cites Bresnan and Mchombo's (1995) Lexical Integrity Principle, which insulates internal word structure from phrasal effects. In short, SSM apparently considers it a virtue to isolate morphology from phrasal grammar. But RM considers it a vice. Here are four representative phenomena that bear on the relation of word grammar to phrasal grammar.

First, consider inflectional morphology. An inflected form answers to two masters. On one hand, its abstract features such as, say, second person singular dative, have to be licensed by its syntactic position and the features of other items that it must agree with. On the other hand, its phonological form has to be governed by schemas in word grammar that say how this combination of abstract features is to be pronounced. There is no inherent order in which these constraints have to be met. Thus the grammar of inflection cuts across the border between morphology and phrasal syntax.

Second, Booij 2010 points out that the grammar of numerals intercalates what look like compounds (e.g. *seventy-six*) with phrasal combinations (*two and two thirds*). Similarly, the grammar of English place names alternates between compounding (*Crater Lake*, *Roosevelt Boulevard*) and phrasal combination (*The Gulf of Aqaba*, *The Bay of Biscay*) (Jackendoff and Audring 2020, 41).

Third, there exist paradigmatic relations between stored phrasal combinations and morphological combinations. For instance, alternating with phrasal *knock NP out*, there is the word *knockout*; likewise for *send NP off* and *sendoff*, and many others. More intricate examples appear in Booij 2012 (chapter 12), Booij 2019, and Jackendoff and Audring 2020 (section 1.6).

Fourth, phrasal combinations can sometimes serve as bases for derivational affixation. The wealth of examples from COCA listed in Bauer, Lieber, and Plag 2013 (513-514) include such examples as *do-it-yourself-er*, *dark-reddish*, *can-doism*, *down-to-earthness*, and *ex-man-of-steel*.

Such phenomena must be accounted for. In CxM and RM, which countenance interactions between phrasal and morphological structure, they are to be expected. In contrast, a theory that demands a strict distinction between syntax and morphology, such as SSM, cannot cope with them. Perhaps we are owed an explanation of why such phenomena (other than inflection) are relatively rare, but it cannot deny their existence or otherwise sweep them under the rug.

5. A mistaken interpretation of the RM formalism

To conclude, we must correct a mistaken interpretation of the RM notation. Here again is the RM analysis of *driver* and the [$_N$ V-*er*] affix.

(1) a. **RM representation of *driver***

  Semantics: $[PERSON^\alpha; [DRIVE (Agent: \alpha, Patient: INDEF)]_1]_2$
  Morphosyntax: $[_N V_1 \; aff_3]_2$
  Phonology: $/drajv_1 \; \partial r_3 /_2$

  b. **$[_N$ V-*er*$]$ *affix***

  Semantics: $[PERSON^\alpha; [F (Agent: \alpha, \ldots)]_z]_w$
  Morphosyntax: $[_N V_z \; aff_3]_w$
  Phonology: $/\ldots_z \; \partial r_3 /_w$

In these examples, coindex 3 connects only morphosyntax and phonology; one might expect it to connect to something in semantics as well. Likewise, one might expect a coindex 1 on the semantics DRIVE in (1a), connecting it to a verb in morphosyntax and the phonology /drajv/. And in (1b), one might expect a coindex z on the variable function F, connecting it to the verb in syntax and the variable in phonology.

Benavides evidently has these expectations, as he says (p. 62)

> while phonology and syntax are coindexed in the schema (25) [here, (1b)] and the derivative (24b) [(1a)], there is no mapping between phonology and syntax (form), on the one hand, and semantics (meaning). Thus, there is no direct mapping between form and meaning, as there should be in a construction. These are important inconsistencies in RM.

Similarly, "the affix does not contribute to the semantics" (p. 60); "affixes are found in morphosyntax and word phonology but their content or contribution is not found in word semantics (or in any of the phrasal components) (p. 60); "in RM …, the derivational suffix does not contribute any meaning" (p. 62); and "in *devour* (39), only part of the semantics, the Patient, is linked to phonology and syntax. The core meaning, DEVOUR, is left unlinked" (p. 66).

However, if one looks a little more closely at (1), these issues are resolved. First consider the absence of a coindex 3 in the semantics. The idea behind this notation is that the phonology /ər/ is an overt marker of the entire complex in (1b). The semantics of the complex is linked not to this marker, but rather to the morphosyntax and the phonology of the complex *as a whole*. This linking is accomplished by coindex 2 in (1a) and the variable coindex w in (1b). Since no part of the semantics corresponds specifically to the phonology /ər/, and since the job of linking the levels as a whole is accomplished by other coindices, there is no need to extend coindex 3 to the semantics.

As for the expected coindices on DRIVE and F: they are expressed in another place: on the first of the two square brackets at the end of the semantics. The reason for this is that DRIVE and F denote functions; they do not mean anything on their own. They only make sense if one includes their inherent argument structure. There can't be driving without a driver, and more generally there can't be an event of "F-ing" without an "F-er." The position of the coindex in (1) thus represents the semantic function *including* its arguments, whether in a word or in an affix schema. With this

understanding, the meaning of the affix can be roughly 'person who F's.' Hence the conclusion that RM words and affixes are semantics-free is unfounded.

Benavides's misapprehension has a further consequence. Consider again "there is no direct mapping between form and meaning, as there should be in a construction." Similarly,

> in schemas and derived forms, while the link between phonology and morphosyntax is retained, the link to semantics is lost. Since the semantics is delinked, this is no longer a triplet of linked structures, as per the definition of a lexical entry in the PA. (p. 62)

The implication is that an item that lacks one of the three levels of representation is not a lexical entry. However, unlike Construction Grammar, PA/RM countenances lexical items that do not involve all three levels (Jackendoff and Audring 2020, 11-12). Fortunately Benavides corrects this error on p. 72, listing some oft-cited examples such as *yes* (which lacks syntax), the *do* of *do*-support (which lacks semantics), and the *-duce* of *reduce* (also lacking semantics).

While further arguments could be mounted against SSM's claims of superiority to RM and CxM, it seems appropriate to stop here. I hope this exchange will enrich the broader conversation about the nature of morphology and its place in the language faculty.

Acknowledgments

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