RESPONSE TO THE COMMENTARIES

Modeling multilingual grammars

Constraints and predictions

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1. Introduction

We are grateful for the many thoughtful responses to our epistemological paper, 'The importance of features and exponents: Dissolving Feature Reassembly' (henceforth, L&P). It is impossible to do justice to all of the points that have been raised in this response; rather, we will focus on three main points which hopefully will address the most important comments and concerns that have been raised.

2. Models and first vs. second order constraints

The approach in L&P took the impressive empirical results from work on Feature Reassembly (FR) and asked a more fundamental question: To what extent is it possible to develop a formal model where the basic mechanisms of FR are inherent parts of the model itself. For instance, a model that clearly separates syntactic-semantic features from their associate exponents is a model which can account for this dissociation, as identified in all the empirical work, without having to create additional constraints. This is why we appealed to the distinction between first order and second order constraints. First order constraints are part of the theoretical model itself, whereas second order constraints are built on first order constraints, but they are not inherent parts of the core theory. What we have in mind is essentially Imre Lakatos' (1968) distinction between core principles and auxiliary assumptions. We tried to argue that the mechanisms of Feature Reassembly all fall out from first order constraints in an exoskeletal model, which should be a welcome result from the point of view of theory of science. It is also worth noticing that FR never had a distinction between first and second order constraints, which we view as a fundamental problem. As such, L&P could also be viewed as

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an effort in theoretical 'housekeeping', which could be compared to the rationalization that happened when X-bar theory was replaced by Bare Phrase Structure. As Lasnik and Lohndal (2013) and Alexiadou and Lohndal (2021) demonstrate, Bare Phrase Structures makes do without any additional stipulations – it simply relies on the content of the lexicon and not theory-internal notions such as bar levels. With this context in mind, we would like to address some of the objections that have been raised in relation to the overall goals in L&P.

Domínguez and Hicks (2024) argue that 'FR is an approach to understanding the *process* of second language acquisition', and furthermore they claim that the importance and application of FR 'in the field of SLA [Second Language Acquisition] transcend issues related to the syntax-morphology interface, an important point not really discussed by L&P'. We agree that the scope of FR is broader than exoskeletal approaches in and of themselves. However, we never claimed that exoskeletal approaches can or should account for everything that FR has been used to account for. To clarify this point, in previous work (Lohndal & Putnam, 2021: 11; (6)) we provided a non-exhaustive list of the various fates that functional features can undergo in bi/multilingual acquisition and development:

(1) Relative to a given baseline, a feature can:
  a. be retained in the same hierarchical position
  b. shift its hierarchical position
  c. be lost
  d. be (internally) restructured resulting in
    i. loss of [some feature]
    ii. reconfiguration of features

The 'reconfiguration of features' (1dii) is an outcome that we readily acknowledge; however, we maintain that this effect/process can be derived by more generalizable features (thus eliminating the need for specific reassembly-oriented processes).

As Inagaki (2024) argues, second-order constraints 'may well play a 'primary' role in explaining the partial success of L2 acquisition'. Gürel (2024) makes a similar point when she claims the following: 'It is therefore necessary to consider a proper treatment of what L&P refer to as 'second-order' constraints, alongside first-order constraints'. We do not object to that, but there is a distinction for instance between Merge and interface conditions. No one is denying the existence of either of these, but again, one is (arguably) a fundamental invariant structure-building principle, while the other leads to a vast number of possibilities. Our goal was to offer an approach that more clearly distinguishes between first and second order constraints, not to deny the importance of second order constraints as such.

3. Mechanisms vs. processes

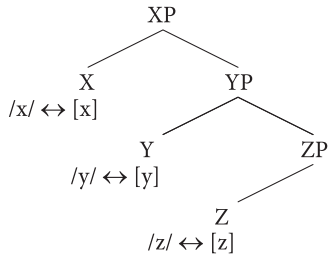
By clarifying the distinction between first and second order constraints that have been, in our opinion, blurred in previous research using FR, we are situated in a better position to arrive at a better understanding of the architectural and structure-building principles responsible for generating mental representations as well as the processes responsible for making them interpretable for 'external' interfaces. To this end, we wholeheartedly agree with Leal and Shimanskaya (2024), who point out that "theorists of acquisition should abandon hypotheses that propose or build on constraints that do not result directly from core structure-building operations". This position is also compatible with Sheehan's (2024) remarks that all grammars – irrespective of whether we are investigating properties of L1/2/*n* grammars – are built using the same grammatical architecture. In experimental studies, the hypothesis has been advanced, and is well-supported at this point, that many of these representations are 'shared' across different source grammars, although we readily admit that this should not be misunderstood as a prerequisite for *all* representations. The fact that we, and other scholars, embrace a universalist view of the structural-building operations and the cognitive architecture underlying the language faculty should not be understood as a call to accept any sort of "presupposed monolingual base", as Aboh and Parafita Couto (2024) purport. We feel it is essential to clarify this oft overlooked, yet crucial distinction; namely, that by building a theory of mental representations in L1/2/*n* grammars based on core structure-building principles, we are not simultaneously calling for this to include any sort of "presupposed monolingual base" (Putnam, 2020a, b). In this regard, we are also sympathetic to Gardani's (2024) point that research on bi- and multilingual grammatical competence also shares close ties to the field of contact linguistics. Relatedly, we want to emphasize that the approach in L&P relies on one version of the Null Theory, not two, as Sheehan (2024) argues in her commentary. For L&P, all grammars are built using the same grammatical architecture. The fact that some grammars have shared syntactic representations is a potential but not necessary outcome.

Equipped with this crucial distinction in mind, we also wish to address a second comment issued by Aboh and Parafita Couto (2024) with respect to processes carried out on mental representations. In their response to our proposal, they claim that "one cannot unravel processes underlying multilingual speech and develop an adequate model of language, if one does not know how the relevant syntactic features in the varied inputs that individual SLs [speaker/signer-learners] are exposed to in their respective community networks". In our view, this point raised by Aboh and Parafita Couto (2024) highlights the intrinsic value of a generative approach in modeling properties of

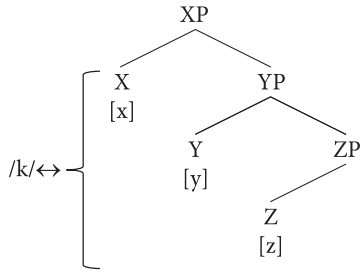
grammar. From a simply comparative point of view, we must adopt the fundamental assumption that the operations, features, and structures bound in one language are equivalent – or, at the very least, approximate – to those found in others. If we adopt this assumption, we can further project that the inventory of features and their position in syntactic structure are roughly the same cross-linguistically (cf. Alexiadou's (2024) commentary). This is the position that scholars like Ramchand and Svenonius (2014) have adopted, which serve as the foundation for approaches to Universal Grammar in which learning to parse roughly equates with acquisition of these grammatical structures (Westergaard, 2009, 2014; Lightfoot, 2020). Assuming our position is on the right track, establishing equivalence between structures (consisting of a finite pool of similar features) is less daunting than sometimes assumed. We agree with Müller's (2024) assessment that this 'sequencing' is a strength of the exoskeletal approach, one which also lends itself to more precise and detailed predictions, which we discuss in more detail in the subsequent section.

An important tool included in structure-building principles that cannot be overlooked here concerns mechanisms that determine when individual features can and cannot function as a single unit for spell-out/realization purposes. As Alexiadou (2024) emphasizes, 'multilingual data help us scrutinize the feature-exponency mapping', which in turn 'raises a number of questions about the role of the lexicon and the precise mechanism that allows for mapping features-exponents in a way that subsumes the theoretical premises of FR' (Gonzalez 2024). That is, what exactly is the relationship between underlying syntactic(-semantic) features and their morphophonological expression? The literature is ripe with alternatives for how to model this relationship. Here we want to simply illustrate the difference between the standard way of doing this within Distributed Morphology and the approaches known as Nanosyntax and spanning (cf. the discussion in L&P). The latter are quite different in their technical implementation, but they share the intuition that a morphophonological form can 'span' multiple syntactic positions. Consider the abstract structures in (2) and (3).

(2)



(3)



In (2), each syntactic feature corresponds to a morphophonological form. This is quite different in (3), where one form, call it /k/, realizes all the three syntactic heads.

It is important to establish the role and function of the operation(s) that relate features to exponents, which, if we adopt some version of an approximate cartographic approach to syntactic structure such as Ramchand and Svenonius (2014), is driven by the need to create well-formed and interpretable syntactic operations. Rather than proposing that grammatical competence consists mostly of larger units such as *chunks* or *constructions* (as is argued for in other (formal) approaches), our subsumption of FR into general exoskeletal principles interprets chunks as a derivational procedure (see e.g., Fasanella & Fortuny (2016) for a detail proposal to a derivational procedure to 'chunking' which is compatible with our proposal). One could also conceivably develop an analysis here that incorporates spanning as the responsible operation to form complex objects for interpretation (e.g., Svenonius, 2016; Blix, 2021); however, the main point that we want to emphasize here is that exoskeletal approaches such as the one we developed in our revised treatment of FR can achieve these goals without the addition of stipulative principles and conditions. Note that an exoskeletal approach does not commit you to a particular view on morphology as such. As Gardani (2024) emphasizes, there are multiple models on the market, and as Borer's (2005a, b, 2013) work demonstrates, there are also exoskeletal models that utilize the same morphological models as Gardani (2024) himself favors.

This perspective on features and exponents also leads to a straightforward response to the development of complexity in bi/multilingual grammars. Although Alexiadou (2024) expresses concerns as to 'whether we can really distinguish embeddedness from complexity', Kramer (2024) also touches on this point, noting that "cross-linguistic variation can be viewed in terms of additive complexity". Embeddedness is primarily a notion that relates to feature geometry, whereas complexity goes far beyond that, as Lohndal and Putnam (in press) illustrate. That said, future research should probe the precise interplay between these notions in more detail.

By providing additional clarification regarding how we view the mechanisms responsible for core structure-building principles interacting with processes for generating well-formed syntactic objects that we be realized and interpreted via spell-out/lexical insertion, notions of "reassembly" can be reduced to two procedures: (i) adjusting one's chunk/span size and (ii) identifying which lexical material or semantic meaning should be associated with this syntactic object. We hope that these additional comments add some clarity to the precise mechanisms or processes that allows the learner to map/associate/match the exponent, which Gonzalez (2024) found to be unclear in our proposal.

4. Predictions

One of the motivating factors behind our call to subsume previous and ongoing research on FR into a general exoskeletal model is that, in our view, this would improve our ability to advance and refine predictions in bi/multilingual language development. Leal and Shimanskaya (2024) echo this sentiment to some degree, stating that it is not clear that the FR always 'provided clear, testable predictions regarding learnability'. Other commentaries, such as those written by Domínguez and Hicks (2024) and Guijarro-Fuentes and Romano (2024) express serious doubt that our proposal supersedes FR with respect to this issue, as in the following quote from Domínguez and Hicks (2024):

> it can only be replaced or subsumed by another theory or approach that generates predictions for the processes of SLA. As far as we can see, exoskeletal approaches to syntax do not. […] it is difficult to see how the exoskeletal approaches mentioned by L&P generates predictions that account for the second language acquisition process specifically along the same lines.

We respectfully disagree with their assessment on the follow grounds: First, it is difficult to identify any formal operations in the extant FR-literature that clearly illustrate a finite number of mechanisms and/or procedures that feed into any predictions. In contrast, this literature champions the role of formal features in SLA and heritage language development (see e.g., Liceras et al. (2008)) but does not provide a clear set of mechanism and procedures. In our view, this makes the alleged 'clear predictions' that several commentaries refer to less clear. Distinguishing between first and second order constraints within a formal mechanistic model should be an advantage in formulating clear and testable predictions.

Second, the predictions that do exist in the formal literature on bi/multilingual acquisition and language development can be easily grafted into an exoskeletal approach. We are grateful to Kramer (2024) for providing another case study

which clearly shows the predictive power of the exoskeletal framework itself. To further support this claim, let us take a closer look at recent claims in heritage language development and L3 acquisition. Recent research on heritage language grammars have revealed tendencies to 'shrink' domains of computation, resulting in 'fused' functional heads (or sequences of heads) and a higher degree of one-to-one form-feature mappings. Scontras et al.'s (2018) proposal of *Representational Economy* based on their work on agreement in heritage Spanish, which shows that [number] and [gender] are realized as a single exponent in speakers with lower proficiency in their study, would be represented by the bunding these features or making them a fused unit as a span. In our recent work (Lohndal & Putnam, in press), we claim that the expansion of computational domains for the sake of exponency realization. This is especially the case in agglutinating heritage languages such as Hungarian and Turkish. These changes are simply an adjustment to the computational domain for parsing, which can be straightforwardly modeled using some form of feature bundling or spanning. Furthermore, neither of these scenarios rely on some version of the Full Transfer Hypothesis, in connection with our proposal (Westergaard, 2021; Schwartz & Sprouse, 2021). Turning briefly to L3 acquisition, one of the key debates centers on whether sequence of acquisition or typological relatedness is the primary factor promoting (or inhibiting) successful acquisition (cf. Rothman, 2011, & Westergaard et al., 2017). Regardless of which position we support here, neither of them is going to impede or effect basic first-order structure-building principles. Rather, arguing for either typological proximity or acquisition sequence as a parsing strategy requires adjustments on top these fundamental principles (i.e., second-order constraints). To be clear, we are not claiming that these second-order constraints are not important, and fully agree with Domínguez and Hicks (2024), Gonzalez, Leal and Shimanskaya (2024), and Guijarro-Fuentes and Romano (2024) that future research will benefit from a concerted focus on these factors. Our principle point here is the rather heterodox and unformalized proposals found in the FR-literature can be simplified in an exoskeletal model without the risk of losing any empirical coverage.[1]

Third, the experimental studies cited at the conclusion of our article demonstrate the promising integration of experimental research uniting exoskeletal

1. As already mentioned, we also recognize that there are alternative approaches to the syntax-morphology interface, especially those that consider morphology proper to be a separate modular unit of linguistic competence (see Gardani's (2024) commentary). Our goal was not to attempt to adjudicate between these different views of morphology; however, we do feel that the literature that we cited – both formal and experimental – make a strong case for the distributed nature 'morphology'.

models and behavioral and electrophysiological studies. This nascent research is encouraging and shows great promise in aiding us in refining our understanding of how bi/multilinguals associate features – or bundles/spans of features – with exponents, addressing Gonzalez' (2024) point that 'the precise mechanism or process that allows the learner to map/associate/match the exponents is unclear'. We therefore feel that exoskeletal models are not only up to the task to deliver predictions on L2/3/*n* acquisition and language development in heritage language grammars, but also will continue to be refined in combination with experimental research moving forward. Thus, even though 'learnability predictions are less than clearly articulated in L&P's proposal, which we view as a potential loss' (Leal & Shimanskaya, 2024), future work will hopefully provide a more articulate picture of the interplay between learnability and the details in the formal model.

Another point is brought up by Guijarro-Fuentes and Romano (2024) when they say that exoskeletal approaches make 'no provisions regarding … [whether] predictions [can] be altered depending on the theoretical approach on takes within formal linguistics'. We struggle to understand this point, as there is a lot of common ground between various syntactic frameworks. A lot of issues are not as such specific to exoskeletal approaches, and the syntax and morphology of number is one such issue. Thus, we do not see the tension here.

Müller (2024) argues that an important testing ground for exoskeletal models comes from the ordering of syntactic and phonological operations. A possible counterexample she mentions is the possibility of phonological gender assignment. However, in ongoing work, Kramer (2022) argues that this is not really attested cross-linguistically. For instance, some cases of so-called phonological gender assignment are to be considered instances of morphological gender-assignment. At any rate, we agree with Müller (2024) that this is an important domain to investigate further.

Scontras (2024) is concerned with the formal nature of models in order for them to be able to make testable predictions that also can link up with experimental work. We agree with this point, obviously. He goes on to say that 'the three case studies offered by the authors each lack some of these formal details', which we also agree with. However, the relevant details can easily be found in the publications we refer to. For instance, we did not include a tree structure for nominal phrases in American Norwegian since this is well known by now and relates to the massive work on nominal phrases in Scandinavian (see Julien, 2005, for an overview and analysis).

5. The road ahead

Once again, we thank the editors and commentators for their probing and thoughtful questions and remarks that forced us to revisit and clarify our claims. There are a number of areas that remain for future research; for example, Guijarro-Fuentes and Romano (2024) assert that the exoskeletal approach 'needs to meet the challenge of making predictions for the way syntactic features interact with linguistic and non-linguistic interfaces, namely syntax-pragmatics'. We agree with them, while acknowledging that this is one of several domains that will benefit from continued research. Feature Reassembly has proven to be an extremely useful and successful framework in modeling development trends in bi/multilingual grammars. In our opinion, the best way to continue with this important research program is to subsume it within the architecture and associated mechanisms found in exoskeletal grammars.

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