Developmental Minimalist Syntax

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Preface

Michael Diercks

This project grew out of moments that I am sure all syntax professors share, at least of those working in the Minimalist framework. For an entire semester, my students will have engaged the generative theoretical enterprise with me, working through Carnie's (2013) textbook. They survive formal discussions of c-command and binding, they internalize the structures of X'-syntax, they explore illustrations of the depth of complexity that occurs in the extended projections of clauses. And then … I introduce the Minimalist Program. Some students love it, namely, the ones who love abstraction, who love generalizations, and (especially) who are not cognitive psychology majors. But for anyone outside those demographics, the questions come fast and hard about bottom-up structure building, about the degrees of abstraction, about the idea of 'computational efficiency' in a model that is not modeling performance. In general, I have found that that point is where their ability to suspend their disbelief gets strained to the point of breaking.

It's not that the students doubt the existence of syntax, or the benefit of theorizing in this way: rather, the mounting cognitive dissonance between abstract theory and tangible empirical realities outside acceptability judgments becomes difficult. How can we continue to present such narrow, detailed analyses of syntactic structures, and still not be able to make any direct correlations between those findings and other aspects of cognition? This monograph grew out of my own attempts to answer the excellent questions that my students raise at this point in their education. The core idea of this manuscript (I quickly learned) is one that's been floating around the field in one form or another for a long time (that syntactic structure is acquired from bottom-up). The focus on counter-cyclicity and other details of derivational timing grew out of the observation that it might offer a new perspective on a theory of syntax-acquisition correspondences, and furthermore, might make sense out of some troublesome theoretical issues in syntax at the same time.

I have found responses to these ideas to be quite mixed, in the few opportunities we've had to get feedback so far. We received one especially lengthy, detailed, and gentle critical review on a conference abstract; that anonymous reviewer has our deepest gratitude for taking our abstract seriously (especially when they thought it was so wrong), and for teaching us many things about acquisition. As this monograph shows, we persisted with the idea nonetheless, though our approach has been significantly shaped by that (quite generous) review. The reviews overall on that conference abstract were the most mixed I have ever encountered on a piece of work. From that one round of review, some reviewers thought this idea is interesting, some that it is untenable,

others that it is actually already baked into the field as a whole and therefore uninteresting. And as we've continued to consider and discuss the ideas sketched in this monograph, we find the responses to be similarly mixed from a broad range of sorts of linguists and cognitive scientists. We're not sure what to make of that, and there are enough unsettled questions in this monograph to ensure that we have gotten a number of things wrong. Nonetheless, the core ideas are intriguing enough that we thought they were worth continuing to explore.

I have simply not been able to shake these ideas, to the point where I have started interpreting most syntactic analyses I encounter through this lens. It became clear to me that I needed to organize and systematize the ideas for myself and for my students, if for nobody else. Worst case scenario, this is just an interesting idea that is wrong (which, as a theoretical syntactician, I have a relatively high comfort level with). Best case, it has the promise of offering a bridge out of our intellectual silo, connecting the findings of the Minimalist enterprise with research in other domains. But before that's possible, we have to see if the ideas can hold up. Which is why we've written this up here, as a step toward evaluating its viability.

The Language Science Press reviewers and editors prompted a significant revision; as a result, the current version is more mature in how it engages language acquisition, while at the same time being more streamlined as a project that is primarily a work of syntacticic theory. In particular, the reviewers prompted us to make the correlations we propose significantly more precise, and therefore reasonably falsifiable. Part of what made this revision possible is that two new collaborators joined the project: Galia Bar-Sever and Katherine Johnson. Bar-Sever deserves particular credit our increased precision in our discussions of acquisition, and Johnson particular credit for being the engine driving the entire revision into existence.

This revised manuscript is more much more readable, concise, and precise. Our hope is that it is approaching being a piece of work that will be accessible to a broad range of interested parties, and that can motivate a range of research questions on the acquisition of syntax.

Michael Diercks
Claremont, CA
December 7, 2020

Acknowledgements

Michael Diercks

A comment from Brent Henderson is what first set me on this path (though apparently it was so fleeting that he does not even remember saying this to me). Specifically, we were discussing the state of generative syntax and its degree of isolation from other work on language and cognition, and wondering where points of connection might be. Brent suggested (paraphrased here) that the proposals in the Minimalist Program might actually simply be a formalization of the grammaticalization mechanisms that Construction Grammarians generally assume (but about which they often offer few fine-grained details). This core idea is pervasive in this volume, and should not be attributed to any of the authors here, but instead to Brent. He just had the enduring wisdom to not let himself become obsessed with the idea for a decade. Nonetheless, he had nothing to do with how we took this idea and ran with it, so he shouldn't be held responsible for any of the proposals here, only credited with whatever wisdom arose from his initial speculation.

This work has benefited from interactions with a broad range of colleagues, including (in no particular order) Travis Major; John Gluckman; Ruth Kramer; Franco Liu; Rodrigo Ranero; Jenneke van der Wal; John Beavers; Michael Ahland; the audience from a talk at Leiden University; multiple anonymous NELS reviewers; the audience and participants in a workshop in Tromsø; two reviewers and the editorial team from LSP. In addition, multiple generations of Pomona College students and other students at the Claremont Colleges have listened to and engaged with these ideas critically, aiding their coherency considerably.

Our deep gratitude goes to two anonymous reviewers from Language Science Press, and the editorial team at the Open Generative Syntax series. We want to especially thank Reviewer 1 for their detailed, critical review: this reviewer taught us a number of things we didn't know about acquisition and redirected the project in ways that have centrally shaped this revision. We expect don't necessarily expect that this revision will convince this reviewer, but due to their attention it is much more rigorous in a number of important respects.

As is clear from this work, I (Diercks) have been heavily influenced by work on Construction grammar and usage-based acquisition researchers, particularly by just how seriously they take acquisition facts in their conception of how Language works. The person who deserves credit for my openness to things I disagree with is Raffaella Zanuttini. She taught me that any well-educated person who has done intensive research on something has clearly noticed something about language. Even if we disagree with all of the conclusions, we can at least work to understand what it is that they noticed in the first place. Raffaella is deeply respectful of work

she disagrees with, understanding that it can be deeply valuable, whether or not it's ultimately correct.

I learned syntactic theory from Raffaella, I learned to be non-dogmatic from Raffaella, and I also learned to be courageous from Raffaella. As we chatted before my dissertation defense, she asked how I felt about the product, and I commented that I knew the work wasn't groundbreaking, but that I was proud of it nonetheless. Her response was: "how do you know it's not groundbreaking? We don't get to know that until later." Of course, it turns out that it wasn't, but the lesson stuck with me: do the work, and let it stand for what it is. Don't prejudge it. I probably never would have been the kind of linguist I am if it were not for Raffaella. She doesn't even know this manuscript exists as I write this, but she taught me to be the kind of linguist who can entertain these kinds of questions.

We also want to acknowledge our internal distribution of labor. The project was conceived of by Diercks and has been directed by him throughout, and he is a (co)author of every chapter. Madeline Bossi was central to the original development of the ideas during her time at Pomona College, and her undergraduate thesis was the first written/organized content on DMS and was the basis for earliest versions of this manuscript. Bossi is therefore coauthor of the chapter describing the foundational ideas in DMS. Galia Bar-Sever and Katherine Johnson joined the project in 2021 and have been central to the development of this heavily revised version of the manuscript. Bar-Sever is co-author on chapters with heavy empirical content (reflecting her contributions relevant to her expertise as an acquisitionist and cognitive scientist). Johnson is a coauthor on all chapters of the revised manuscript; she was centrally involved in revising the argumentation and making the claims more precise in this revision, and she was also the a major driver in preparing the revised manuscript for resubmission. This revised manuscript absolutely would not exist without Bar-Sever and Johnson.

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Contents

Chapter 1

Introduction

Michael Diercks
Katherine Johnson

1 Introducing Developmental Minimalist Syntax

While Mainstream Generative Grammar (MGG) is a thriving research tradition, at present there are not clear links between its framework-level claims and psychology and/or the cognitive sciences more broadly.[1] For over two decades, generative syntacticians operating in the Chomskyan tradition have been following the general framework laid out by Chomsky (1995, 2000a, 2001) that is known as the Minimalist Program, an iteration of the generative syntax tradition. By many measures, this work has been an extraordinary success, both in terms of the range of empirical phenomenon that our theoretical mechanisms now capture, as well as the depth of grammatical detail that those same mechanisms allow us to describe and explain with precision within a given morphosyntactic construction.[2]

Despite this, we think it is fair to say that there is a collective indifference to work in generative syntax among many linguists working outside this tradition, and moreseo among the more broad community of researchers on cognition. Some are even more outright pessimistic: "[E]vidence has overtaken Chomsky's theory, which has been inching toward a slow death for years. It is dying so slowly because, as physicist Max Planck once noted, older scholars tend to hang on to the old ways: 'Science progresses one funeral at a time'" (Ibbotson and Tomasello, 2016). This monograph offers a line of thought that can perhaps bridge some of these intellectual gaps in the academic community.

[1] We borrow the term Mainstream Generative Grammar from Martin Haspelmath as a term that covers the general approach adopted by the research community working in the Chomskyan tradition.

[2] We use the term "explain" here loosely to mean that some level of generalization is available beyond simply describing the most immediate facts; there are of course deeper levels of explanation still necessary.

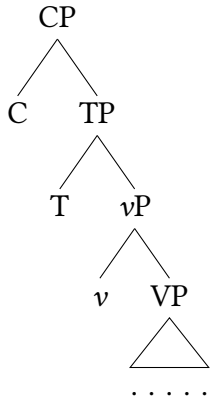
1.1 The Core Proposal

We propose that there are systematic correlations between some foundational aspects of Minimalist analyses and an external psycholinguistic reality: pathways of acquisition of syntax by children.

(1) **Developmental Minimalist Syntax (DMS)**
The Minimalist derivation of adult language structures recapitulates the ontogenetic (i.e., organism-internal) development of those same syntactic structures.

As (1) states, we suggest that there is a systematic correlation between a Minimalist derivation of a sentence and the timeline of acquisition of productive grammatical structures by children. The suggestion is that for a typical syntactic phrase structure as in (2), a structurally lower element (like VP) is acquired in an adult-like fashion before grammatically higher elements are (i.e., VP is acquired before TP/CP).

(2)



This claim is inherently relational internal to the properties of the growing grammatical knowledge: nothing about DMS ties grammatical structures to particular chronological (or even developmental) ages, at least not inherently. Instead, DMS simply claims that the sequence of a derivation (in the Minimalist analysis of an adult grammatical construction) reflects the sequence of acquisition for the particular grammatical elements under consideration.

As we will discuss at length, the empirical consequences of this idea are far-reaching, and it is therefore impossible to exhaustively defend this claim empirically in a single monograph. Beyond that, it is non-trivial to evaluate children's grammatical knowledge at any point, so it is not straightforwardly obvious what and how to measure in order to evaluate the core DMS claim. Nonetheless, we show that what we do know about child language is consistent with this claim, and it is achievable to evaluate these claims with more precision in the future. What we will show, for example, is that children reliably produce utterances that only indicate adult-like knowledge of VP-level structures, then they show evidence of an adult-like TP, and only after that do they demonstrate adult-like competence with full-clause utterances.

(3) Acquisition stages (adapted from Rakhlin and Progovac 2021, 7)

Syntax	Age (mo.s)	Examples
Pre-syntax	12-22	*are-you-ok*; *there-you-go*; *all done*
VP/small clause	1.5-2.0	*wash hands*; *more milk*; *baby fall*
*v*P	28-36	*I chewing*; *I text mama*; *Daddy go me around*; *I come it closer*
TP	37-42	*I goed to school*; *We maked chapatis*
CP	43-48	*relatively adult-like sentences*

The examples and commentary in (3) are drastic simplifications in service of presenting these main ideas: we explain in Chapter 3 how we understand child linguistic development to proceed and how we therefore interpret different kinds of utterances from children.

Despite the general "bottom-up" character of this process, the claim of (1) is not inherently that timelines of acquisition correlate with structural height in adult syntax: that is, it is not a claim that structurally lower elements are *necessarily* acquired before higher ones. Rather, (1) proposes that acquisition correlates with the derivational sequence of a Minimalist analysis. This typically does mean that lower structures are acquired before higher ones, because standard assumptions result in structures (generally) being built "bottom-up." But DMS claims that acquisition tracks with **Minimalist derivations** of sentences, even when those derivations are not strictly bottom-up (i.e., when they are **countercyclic**).

The evidence and analyses for many kinds of countercyclic phenomena are nuanced and complex, and they are generally not suitable for an introduction; Chapter 4 explores these in more detail. A relatively accessible example is this: children actively produce *wh*-questions much earlier than they have structures that are obviously CP-level or even TP-level.

(4) a. Where daddy go? (Adam 2;3)
b. What I doing? (Eve 2;0)
(Thornton 2016, (3), attributed to Guasti 2002)

Do children already have CP structure, even before learning TP structures? Such a conclusion would not be unreasonable given children's behavior, as illustrated in (4), and precisely these ideas have been advanced for this reason (see, for example, Schütze and Wexler 1996). But we argue that children do not yet have CP structure; lacking a large range of other evidence for CP, it is not necessary to posit an adult-like CP structure in the child's grammatical knowledge. More simply, children may instead have a position for *wh*-phrases at the left edge of *v*P, and at developmental stages as in (4) we need not posit grammatical structures above the *v*P level. In fact, this is exactly what is argued within Minimalism: *wh*-elements are proposed to move through the edge of *v*P, as in the simplified structure in (5).

(5) [$_{CP}$ What did [$_{TP}$ Alex T° [$_{vP}$ ~~what~~ [$_{vP}$ … ~~Alex~~ … eat … ~~what~~]]]]

However, this analysis of *wh*-words at the edge of *v*P poses a problem within the theory. Most versions of Minimalist syntactic theory require feature-driven operations, where some feature at the landing position of movement (for example) "triggers" the operation in question. But a *wh*-phrase moves to the edge of *v*P *before* the CP with the feature to prompt such movement is Merged into the structure. Such theoretical issues are termed "look-ahead" problems, because the *wh*-phrase seems to be able to look ahead in the derivation to know what will happen (Merge of a C° with the requisite features to trigger the *wh*-element's movement) before the merger of C° actually takes place.[3]

When considering the facts through the lens of DMS, however, this look-ahead is not a problem. English-learning children *can* look ahead to see what the end result of the derivation will be, because their input makes it overtly clear that *wh*-elements are sentence-initial. Thus, when a child has only learned *v*P, their *wh*-elements move to the edge of *v*P, as that is the linearly-initial position of their growing grammatical structure at that point. The movement is not unmotivated; it is motivated by a generalization that the child has learned from readily available patterns in their input.

More broadly, we discuss a range of well-documented anomalies in adult grammars that diverge from the canonical "bottom-up" derivations that (1) typically predicts. However, we will show that these apparent anomalies in fact provide further evidence for DMS. Deviations from the standard bottom-up derivation of Minimalist syntactic structures—like look-ahead problems—can in fact be explained when viewed in light of language acquisition. When a Minimalist derivation breaks the strict cycle of bottom-up Merge, the derivation is still correlating with the sequence of acquisition. Such deviations are simply indicative of sequence in which the different grammatical components of the construction are acquired in an adult-like fashion by the child.

1.2 Impact of DMS and Goals of the Manuscript

The impact of (1) (if it can be demonstrated to be on the right track) ought to be apparent to researchers on language and cognition. Frequent complaints about MGG research include allegations that it is built on a shaky empirical foundation, that too much of its work is purely theory-internal adjustments to annotation strategies, and, perhaps most controversially, that the foundational notion of a "Universal Grammar" that drives so much research is itself suspect.[4] Critiques like these are important and deserve careful consideration because if they proved to be accurate assessments, it does in fact call into question the practices of MGG researchers. However, if central aspects of the theoretical framework prove to systematically correlate with empirical evidence distinct from the adult speakers' acceptability/grammaticality judgments that are the foundation of MGG theorizing, it would demonstrate that Minimalist syntactic theory is in fact capturing aspects of human language knowledge that are cognitively real and that ought to be of

[3] We illustrate in matrix object *wh*-questions to keep the discussion straightforward, but the issue arises even more distinctively in long-distance *wh*-questions, where standard analyses assume raising through the edge of the embedded CP, despite that CP most plausibly not itself being an interrogative CP.

[4] A large range of work by Michael Tomasello is perhaps most representative of these claims, e.g., Tomasello (2003) and Tomasello (2009). Other relevant work includes Croft (2001), O'Grady (2008), O'Grady (2012), and Everett (2005), as well as popular polemicist work like Ibbotson and Tomasello (2016), Everett (2012), and Evans (2014), among many others.

interest to researchers on cognition with any interest in natural language.[5]

Ideas similar to (1) have been considered repeatedly throughout the history of the field, as we will describe in this volume, but the proposal in (1) represents a tighter alignment between Minimalist theory and acquisition than (to our knowledge) has ever been proposed. Our claim is also distinguished by the recognition that countercyclic processes and other aspects of non-canonical derivational timing—generally regarded as anomalies within MGG—are in fact deeply informative, correlating to acquisition pathways in systematic ways. While this claim distinguishes our proposal from predecessors, it also potentially provides new insight into the persistent puzzle of countercyclicity in theorizing about adult language.

It is important to note from the outset what we will and will not attempt to do in this manuscript. It is impossible to empirically prove (1) to be true, because it makes too many predictions (i.e., correlations between acquisition and Minimalist derivations in every syntactic construction in every language). Beyond that, the task of measuring and testing DMS is itself deeply complex and requires intensive, extended empirical work that requires a robust research program or even research community. We also do not attempt to exhaustively argue from the theory that DMS is true; such an undertaking would also be too expansive for a single manuscript.

Instead, this manuscript aims to show that (1) is *plausible*, that it is testable, and that, based on what we do know about both acquisition and adult syntactic knowledge, it is a reasonable perspective on the nature of human language knowledge. In this way, this is primarily a work of theory, showing how the perspective articulated in (1) accounts for what is known about adult and child language. Stated in another way, this volume can be thought of as relatively careful description of a hypothesis about the connection between acquisition of syntax and adult syntactic structures. It is a hypothesis we find to be well-founded in the acquisition literature, but much more empirical work is necessary to test and refine the proposals here; we don't mean to give the impression that what is presented here is a settled conclusion. We do believe that the concomitant empirical and theoretical work will be able to proceed on the basis of this manuscript, but it is difficult for that to happen without the theoretical foundation to build on. Our hope is that this manuscript can provide that foundation.

2 Structure of the Book

Our overall goal in structuring the monograph is that the earlier chapters of the book will be most accessible to the broadest audience; as the book progresses, the discussions become more technical within the Minimalist syntactic framework, such that chapters 4 and 5 will most likely be accessible mainly to students and practitioners of Minimalist syntax. In Chapter 2, we sketch the central proposals about Developmental Minimalist Syntax and provide an overview of the kinds of evidence that support this view. For the most part, Chapter 2 limits engagement with the complexity and nuance both in the evaluation of the relevant data and the DMS proposals

[5]For what it's worth, the value of MGG itself is not dependent on this; DMS can be completely wrong without affecting the value of MGG - that is, DMS could be wrong but MGG can still be getting many aspects of grammatical cognition correct, simply in different domains than posited here. We, of course, are inclined to think that DMS is on the right track, but we also are quite confident that the value of MGG more generally doesn't specifically lie on the viability of DMS. It is simply that DMS offers a pathway to bridging some of these intellectual divides.

themselves. We do this to facilitate communication of the central proposals; the remaining chapters in the book take up the many kinds of nuance that the account requires. Similarly, there are a broad range of pre-existing proposals about acquisition of syntax that propose similar (though not identical) ideas as those advanced as part of DMS. For expository reasons, we don't survey these as a central part of advancing the main claims, but the appendix to Chapter 2 surveys the relevant theoretical precedent from the literature.

Chapter 3 discusses a variety of theoretical and empirical perspectives associated with our main claims about DMS. This includes some necessary consequences of a DMS perspective, including the view that syntactic knowledge is composed of, in part, an inventory of constructions. We also comment on some aspects of universal syntactic structures that have implications for how we think about syntactic development: adverbial hierarchies, the universal hierarchy of projections, and syntactic movement. This chapter also includes an extended discussion on our perspective on interpreting child language data. We make clear our perspective on how children make linguistic generalizations based on their input, as well as ideas about how predictions of DMS can be measured in child language data. We are only as specific as makes distinctions for our current purposes: there are many aspects of acquisition (e.g., specifics about children's learning mechanisms) that are tangential to the core claims of DMS, and on those points we take no stance. The goal of this chapter, among other things, is to make relatively precise what point in acquisition we refer to when we say that sequences of "acquisition" correlate with sequences of operations in Minimalist analyses. Acquisition is complex, and measuring acquisition is likewise complex, so this point is nontrivial.

DMS, in canonical instances, predicts a "bottom-up" acquisition sequence that correlates with the "bottom-up" sequence of structure building in Minimalist analyses of adult grammar. But the core DMS claim is not that acquisition timelines correlate with structural height, but rather than they correlate with the Minimalist derivation. Chapter 4 discusses a range of instances where there may be mismatches between structural height/constituency and derivational timelines. Notably, in the jargon of Minimalist syntacticians, the "timing" of derivations specifically refers to sequences of operations in analyzing syntactic structures, and not (canonically) any real-world time-course. In this chapter we consider instances of so-called "late merger," where a structure-building operation occurs that does not extend the root of the clause, i.e., occurring "later" than it should have, per standard assumptions. (That is to say, the late merger operation occurs after the constituent structure that it is being added to had previously been built.) We also look at instances of so-called "look-ahead," where operations are initiated before standard assumptions would entail that they would be initiated (again, here, "before" means that it precedes the position in a sequence of analytical steps that would be expected). We also consider the relatively recent proposal of "layering" operations that are suggested to explain a broad range of standing puzzles regarding structure building of nominal phrases (Thoms, 2019). The argument is that nominals are not added to a syntactic structure as a complete unit, but rather the structure of nominal phrases is expanded as the derivation of a clause continues. All of these are instances where the "timing" (i.e., sequence of operations) in the analysis of adult grammatical constructions does not follow directly from the simplest versions of Chomsky's (1993; 2000a; 2001) model of Merge-based structure-building.

The main takeaway from Chapter 4 is that all of these apparently anomalous instances of

structure building (all proposed based on adult grammatical properties) in fact have fairly direct correlating properties in sequences of child language acquisition. That is to say, these apparent anomalies in adult grammar are only anomalous from the highly constrained view that a strict cyclic Merge is the only structure building mechanism. A DMS perspective allows for the timing of derivations to diverge from this strictest view, but it is not unconstrained: children's grammars ought to be acquired in a similar sequence to the derivation of adult grammatical structures, even when those derivations diverge from the strictest bottom-up structure building. This not only bolsters the core DMS claims (showing that there are robust correlations between Minimalist analyses and acquisition timelines) but it also has significant implications for Minimalist theory itself: these anomalies have often been viewed as problematic, with countercyclic processes considered illict by many theoreticians. The argument here is that countercyclicity and other kinds of nontraditional derivational timing may in fact be well-founded empirically, even outside the core puzzles in adult grammar.

Chapter 5 discusses several extensions of the DMS perspective that are intriguing enough to be worth mentioning, but all of which require more attention to be fully worked out. We discuss a DMS perspective of the Minimalist construct of the *phase*, suggesting that phases may correlate to stages of acquisition wherein children's hypothesis spaces for various acquisition targets are restricted in particular ways, suggesting this can account for various kinds of locality and anti-locality effects in adult grammar. In this chapter we also discuss a perhaps-unexpected consequence of DMS: some aspects of non-syntactic linguistic knowledge are acquired (in an adult-like fashion) before various components of syntax are acquired. On a DMS approach, that non-syntactic knowledge would presumably be accessible to children as they acquire additional components of grammar, and therefore potentially can be included in specific kinds of syntactic generalizations. We suggest that this is what happens in a variety of instances where prosody and metrical structure have been argued to influence syntactic structure. That is, DMS predicts interleaving of phonology and syntax precisely where children acquire productive, target-like knowledge of phonology at early stages of acquisition (which we suggest is most likely restricted to limited prosodic structures). We also discuss in this chapter a pervasive pattern in Bantu languages where content that is structurally high in many languages (information structure) occurs structurally low, in verbal inflections related to objects and the verb phrase. We show that this morphosyntax is surface-oriented: despite being structurally low, it is derivationally-late. We suggest that DMS predicts exactly these kinds of correlations and creates specific predictions about timelines of acquisition of those constructions.

Chapter 6 concludes with a brief overview of our conclusions, directions for future research, and some commentary on the consequences of a DMS approach for core theoretical assumptions about so-called "Universal Grammar."

Chapter 2

Developmental Minimalist Syntax

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This chapter provides a baseline introduction to Developmental Minimalist Syntax (DMS); here, we neither attempt to deduce DMS (i.e., motivate it as a necessity from axiomatic assumptions) nor do we attempt to provide an inductive argument for DMS (i.e., argue from evidence that it is the most plausible approach). We discuss DMS from both perspectives at times in this volume, but the goal of this chapter in particular is simply to introduce the main ideas in sufficient detail to facilitate the empirical and theoretical discussion that follows in the remaining chapters. So this chapter sketches the overall framework, with many crucial details filled in throughout the following chapters.

In §1, we briefly recap basic Minimalist assumptions about Merge-based structure building, and §2 briefly summarizes the kinds of critical questions that have been raised in response to this approach to analyzing grammar. §3 lays out the foundational assumptions of DMS, and §4 overviews the kinds of broad patterns in sequences of acquisition that accord with the predictions of DMS. This discussion will necessarily leave many details underspecified; some of those details will be addressed in following chapters, and others we won't be able to address (though in Chapter 6 we do attempt to reference and acknowledge relevant issues that we have not addressed). In the appendix to this chapter (§5), we overview the theoretical precedent in the literature for the claims advanced here; we don't incorporate all of this lit review into the main text itself in an effort to avoid obscuring the main claims we are advancing.

1 Minimalist Structure Building

For over two decades, generative syntacticians operating in the Chomskyan tradition have been following the general framework laid out by Chomsky (1995, 2000a, 2001) that is known as the

Minimalist Program, an iteration of the (Chomskyan) generative syntax tradition. On the Minimalist approach, syntactic structures are built bottom-up, with a verb (or more abstract root) merged with a complement to form a basic predication relation, and all additional syntactic structure is built on top of this in a cyclic operation where new material is merged with the root of the existing structure in an iterated cycle. As (6) shows, a verb merges with a noun phrase (DP), resulting in a VP, and the resulting VP is then a candidate for merging with additional material, here little v to form a vP (and so on).[1]

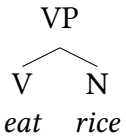
(6) V , DP →
$[_{VP}$ V DP] →
$[_{vP}$ v $[_{VP}$ V DP]] →
$[_{TP}$ T $[_{vP}$ v $[_{VP}$ V DP]]] →
… (etc.) …

As the "etc." in (6) references, this is a cyclic operation in the sense that the phrasal element resulting from Merge is itself a candidate to undergo another Merge operation, ad infinitum (at least, in principle).

To see how this works in a simple example, consider the simple English transitive sentence in (7).

(7) Amelia will eat rice.

We abstract away from various details and adopt some simplifying assumptions in what follows in order to focus on the core mechanisms that are relevant for our concerns. The external Merge operation combines lexical items into syntactic structure. In our example here, the verb merges with its nominal object, yielding a verb phrase (VP):[2]

(8)


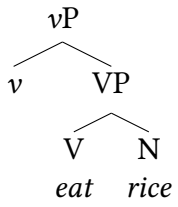
This Merge operation continues to add more and more structure on top of existing structure: after creating the VP, then v is merged to form a vP, after which the agentive subject is Merged to the vP.[3]

[1] Strictly speaking, on current assumptions Merge does not result in the labels assigned to the resulting phrases (VP and vP in (6)): a labeling algorithm of some sort is assumed to apply to clarify the properties of the resulting phrase (Chomsky 2013, Bauke and Blümel 2017). This is largely tangential to our current concerns, and as with other work where the labeling algorithm is tangential, we simply label the resulting structure appropriately and don't address the question of how such labels arise derivationally.

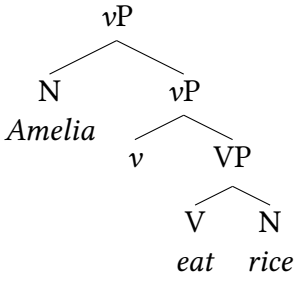
[2] We intentionally annotate this as a N and not a DP for reasons that will become clear in Chapter 4.

[3] For those unfamiliar, vP (pronounced "little vP") is a piece of functional structure distinct from VP; vP is canonically understood to introduce agent arguments to a structure. On this approach, agents are not arguments of V, but of v (Kratzer, 1994).

(9)

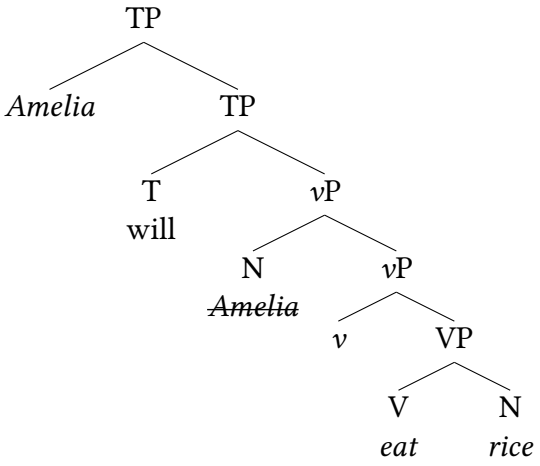


(10)



After the *v*P is constructed (denoting the predicate and arguments), the Tense Phrase (TP) layer is then Merged onto the growing clause structure. Among other things, T has an EPP quality[4] which attracts the subject *Amelia* to its specifier; a copy of *Amelia* is then merged with TP, creating the structure in (11).

(11)



This obscures many, many details, but it captures the core properties relevant to our current concerns. The result is a strict cycle of structure building: successive applications of Merge build hierarchical syntactic structures step-by-step. This means that a Minimalist analysis of the sentence in (7) is not just the tree in (11), but also the sequence of derivational steps that produced it.

This approach to structure building comes with various foundational assumptions that relate to restricting the theory to Merge as the only structure-building operation. According to the **Extension Condition**, Merge operations must extend the root of the structure (Chomsky, 2000a, 2001, 2008). This has also been expressed as a "**no tampering**" condition: i.e., a requirement against modifying/tampering with existing structure. New operations only add structures;

[4]Following a suggestion by David Pesetsky (pc, Facebook) we can think of EPP qualities no longer as the Extended Projection Principle (an explanatory concept that is far distinct from its modern use), but rather as the requirement that a phrase have an "Extra Peripheral Position," i.e., the requirement to merge or move something to that position.

they cannot remove or modify the existing structure in the course of a derivation.[5,6] In the context of our example above, this means that when T is merged, it may only Merge as the sister of *v*P, not into any lower part of the structure.

Focusing on that core structure-building operation, this requires a strict cycle that is monotonic, with each new cycle extending the root of the structure without any changes to the existing structure at that point of the derivation.[7] This requirement necessitates that any additional Merge operations in (6) would add new structure on top of TP rather than modifying any phrase inside of TP. This Merge operation does not alone account for all syntactic phenomena (there are other posited components of UG and other empirical aspects of morphosyntax), but it is where we direct our attention for the moment.

2 Reasonable Questions for the Minimalist Approach

2.1 Questions from Intro to Syntax

I (Diercks) teach at Pomona College, a member of the Claremont Colleges. I only have undergraduate students, so their levels of exposure to standard generative syntactic theory are modest. That said, they are incredibly intelligent and almost impossibly curious. They want to understand, and they want to relate the things we learn to other things they know. When introducing Minimalist syntax, I frequently receive a range of questions that I think are reasonable, good-faith questions that can and should be directed at the model.

Perhaps the first question is: do we produce sentences bottom-up, in the manner that the Minimalist derivation might suggest? That is, if a speaker is going to utter a sentence, do they first mentally construct the sentence in a Minimalist bottom-up fashion, then utter it? It seems transparent from the psycholinguistic literature that the answer to this is, "no" (Ferreira and Swets, 2002; Wheeldon et al., 2006; Konopka, 2012; Brown-Schmidt and Konopka, 2015). The quick-hit response I often give students is that we know that we don't need to mentally build a sentence bottom up before producing it, because we can start producing a sentence without knowing how we're going to finish it. This itself should be impossible if bottom-up structure building were a prerequisite to producing a sentence.

The parallel question that comes is with respect to the flip side of language processing: do we perceive sentences bottom-up? As is well known, the answer to this is also, "no." If we did, garden path sentences wouldn't exist. In a garden path sentence (e.g., *The horse raced past the*

[5] "A natural requirement for efficient computation is a 'no-tampering condition' (NTC): Merge of X and Y leaves the two SOs [syntactic objects] unchanged. If so, then Merge of X and Y can be taken to yield the set X, Y, the simplest possibility worth considering. Merge cannot break up X or Y, or add new features to them. Therefore Merge is invariably 'to the edge"' (Chomsky, 2008, 138).

[6] There is a relatively vast literature on various exceptions and/or redefinitions of these notions in order to accommodate a range of empirical phenomena, including but not limited to late merger, tucking-in movements, timing conditions on feature-driven operations, parallel/sideward movements, layering-type derivations, and others. We simply mention them here, as much of the volume is dedicated to these apparent exceptions to canonical methods of structure-building in Minimalism; see Chapter 4 in particular.

[7] "Suppose we restrict substitution operations still further, requiring that $\emptyset$ be external to the targeted phrase marker K. Thus, GT and Move α extend K to K*, which includes K as a proper part" (Chomsky, 1995, 190).

barn fell; *The old man the boats*), the entire reason that they are perceptually difficult is that in processing sentences we build plausible structures incrementally as we hear a sentence, and if the sentence contains structure that was relatively unpredictable, we are then forced to re-evaluate the structure we had been building.

It seems clear that the Minimalist model is *not* a model of language processing in any way. At this point, students' responses vary based on how charitable they are feeling towards the work. Some responses fall along the line of, "so is this just all bullshit, then?" (and it is clear that some amount of linguists/cognitive scientists feel roughly the same). The more congenial way of asking a question from a similar intellectual position is perhaps: "Why does the model work bottom-up in this way, if it doesn't relate in any obvious way to what our minds/brains are doing with language?" Generative syntacticians are relatively familiar with this kind of question, and as far as I can tell, the typical answer is that we are building a theoretical model, and no subpart of the model *has* to correspond to any particular external (psychological) reality, at least not at this stage of its development. Essentially, this response posits that the model is an extended metaphor: perhaps, with time, the metaphor will approximate measurable psycholinguistic or neurological properties, but it seems that we are not close to that at present. Personally, I think these answers are reasonable, but they also don't answer the question, which itself is also reasonable.

Rephrased, I have been asking the question this way: why does a bottom-up derivation of syntactic structures work so well to capture syntactic structures across languages, when it shares no correspondence with language processing—or any other cognitive property of language outside of grammaticality judgments—in any obvious way?

2.2 Similar Questions from Linguists

It is clear that my (Diercks's) own students are not the only ones with questions about how the Minimalist framework connects to anything outside of patterns of grammaticality judgments. As many researchers have pointed out, the approach to principles and parameters of so-called "Universal Grammar" might lead one to expect children to essentially-immediately acquire their language as they encounter it, contrary to fact. "A key flaw in Chomsky's theories is that when applied to language learning, they stipulate that young children come equipped with the capacity to form sentences using abstract grammatical rules. (The precise ones depend on which version of the theory is invoked.) Yet much research now shows that language acquisition does not take place this way. Rather young children begin by learning simple grammatical patterns; then, gradually, they intuit the rules behind them bit by bit" (Ibbotson and Tomasello, 2016).

Likewise, there is pessimism that the idea of a foundational "UG" (like Merge and other similar operations that explain grammatical patterns in the MP) doesn't offer much in terms of explanation. "There is little hope that UG, in whatever form it still exists, can contribute much to our understanding of the many typological and developmental phenomena for which it once accounted. Almost all of its former explanatory burden must be shifted to the other two factors at our disposal—experience and principles not specific to the language faculty" (O'Grady, 2012).

These are just two selections: there are an almost endless variety of similar critiques available. The persistent question: what does this framework add to our understanding of human

language? Clearly, generative research (and formal theory in general) provides a toolkit that contributes to the depth and breadth of empirical discovery, but that in itself is often not a compelling answer to researchers on other domains of cognition, or from competing frameworks. But if it turns out that DMS in (1) is on the right track, it would begin to give an answer to that question in ways that would make it easier to draw connections to other research in cognitive science.

3 Developmental Minimalist Syntax (DMS)

In this section, we provide some initial description and discussion of the central ideas of DMS, including what it predicts for both child language acquisition and adult grammars. Here we simply sketch the foundational ideas: additional evidence and discussion of the theoretical and empirical consequences are discussed at length as the volume proceeds. In (12), we repeat the core claim of this monograph.

(12) **Developmental Minimalist Syntax**
The Minimalist derivation of adult language structures recapitulates the ontogenetic (i.e., organism-internal) development of those same syntactic structures.

In canonical instances (of simple sentences), this predicts an acquisition timeline that correlates with the widely-accepted hierarchy of clause structure (Ramchand and Svenonius, 2014; Wiltschko, 2014, among many others).

(13) Predicted Acquisition Timeline
   a. VP $\rightarrow$ *v*P $\rightarrow$ TP $\rightarrow$ CP
   b. 1. verbs and theme objects (direct objects) (i.e., VP) before agentive subjects;
      2. predicates with their arguments (i.e., *v*P) before tense;
      3. tense-marked predicates before the full properties of CP.

This is a simplification, of course: adult syntax contains much more complexity than what is mentioned in (13). But (13) offers some major benchmarks to first consider before we go into more depth.

Ideas along these lines have been present in the field for quite some time. Radford (1990), Rizzi (1994), Clahsen (1990/1991), and Clahsen et al. (1996) all suggest some version of a bottom-up acquisition sequence (or at least a model that is consistent with it). Lebeaux (1988, 2000, 2003) made various proposals that are precursors to what appears here. Vainikka and Young-Scholten (2011) suggest a highly similar framework, though with some important differences (particularly, they consider their approach a departure from standard Minimalist theory). A framework like this is suggested implicitly and sometimes explicitly in both Progovac (2015) and Rakhlin and Progovac (2021), though without fine-grained detail. All of these will be discussed when relevant, and we provide a more detailed overview of the theoretical precedent in §5, the appendix to this chapter.

Our proposal is a correlation specifically between sequences in Minimalist derivations and children's **productive** use of grammatical constructions. As we discuss in §4 of Chapter 3, it

is well-established that at initial points in acquisition of a piece of grammar, children simply repeat/mimic their input, and it is only over time that they begin to generate their utterances based on rules/abstractions about the grammar of their language rather than simply repeating utterances that they have previously heard. Thus, throughout the manuscript we use the term "grammaticalized" to refer to the point at which children have acquired knowledge of a grammatical construction such that they can use it productively: in creative and flexible ways. As we discuss in much more depth in Chapter 3, (12) is only contentful if we can narrow down which point in acquisition is supposed to correlate to Minimalist derivations. It is non-trivial to state when a child knows a piece of language or has acquired a pattern/generalization, and without precision in this regard it will be quite difficult to evaluate DMS. Our proposal is that the correlation is with children's productive use grammatical structures; this is discussed in more depth in §5 of Chapter 3.[8]

3.1 Cause or Effect?

As we have already noted repeatedly, we don't want to suggest that DMS is an empirical certainty. The empirical domain is too vast, and measuring is too difficult, to attempt such a claim at this stage of DMS's development. What we show in this chapter and in Chapter 3, however, is that DMS is at least empirically plausible and is reasonably falsifiable. So let us assume for a moment (for the sake of argument) that DMS is true in its main empirical claim: there is a direct correlation between Minimalist derivations and sequences of acquisition of syntactic structure.

Even if it's true that there is a correlation, this does not itself make clear *why* acquisition proceeds in this manner. That is to say, the traditional "learned vs. innate" debate is still available. It could be that adult derivations work the way that they do precisely because it is predetermined by UG, and therefore children must learn language in that sequence because UG has thus predetermined it. On this story, the correlation proposed by DMS could exist, but acquisition proceeds in this manner precisely because of UG. This approach can still assume a modular, innate language mechanism that is independent from the rest of cognition, but which (of course) has effects on acquisition, processing, etc. This is the traditional UG. This is essentially Radford's (1990) claim, that lexical categories are acquired before functional categories *because* trees are structured in the way that they are, i.e., essentially presupposing phrase structures as innate.[9]

Alternatively, DMS also allows for the opposite explanation of the correlation. On this view, adult grammars have a derivational quality (i.e., are built bottom-up) precisely *because* they are acquired in that sequence, and adult knowledge therefore contains a record of those developmental sequences (with new knowledge being added to older knowledge in acquisition). This approach does not (logically) require an innate, language-specific UG: we might refer to this as an emergent version of DMS.

On this **emergent DMS**, then, what relevance do the wide variety of **Minimalist Analytical Constructs** (MACs) have? Minimalist proposals regarding UG are generally composed of a variety of theorized analytical mechanisms: Merge, Agree, phases, movement, binding, PRO, etc. An emergentist DMS still assumes Minimalist analyses of sentences/constructions, so what then

[8] Our thanks to Reviewer 1 for their comments on this issue.

[9] A reviewer mentions that this is "one of the most controversial issues in language acquisition research in the 80s and 90s."

are these MACs? On this approach, it is readily possible to interpret these MACs as **Universal Cognition for Language** (UCL): fine-grained descriptions of cognitive mechanisms, constraints, or biases as they are realized in adult grammar. This approach allows for complete agnosticism as to whether the MACs that make up UCL are domain specific to language (a view that Pearl in press calls **linguistic nativism**) or not domain-specific to language (the view that Pearl in press calls **non-linguistic nativism**—innate properties of humans that are not domain-specific to language). While it is an interesting question whether the cognitive tools that enable language are language-specific or domain-general, it is one that is not crucial to resolve in order to explore an emergentist DMS approach.

Chomsky (2005a) says that there are three factors in language development: genetic endowment (i.e., UG), experience (language input), and principles not specific to the faculty of language. The bulk of the Minimalist enterprise was designed to posit as little content to the traditional UG as possible, shifting explanation from the first factor to the second and third factors. On this approach, it is possible to pursue what we might call a **radically emergent DMS**: one in which *all* MACs are in fact derivable from Chomsky's 3rd factor considerations: principles that are due to general cognition and are not specific to the faculty of language. In this case, the components of UCL are in fact components of domain-general cognition, as has been proposed by many linguists of the usage-based approach (Tomasello, 2003; Goldberg, 2013, 2006, 2019; Croft, 2001). Again, even if the central correlation that is posited by DMS does hold between acquisition and syntax, it's not necessary that it be a radically-emergent DMS; we are simply clarifying what DMS does (and does not) claim.

Even if a radically-emergent DMS turns out to be true, none of this diminishes the importance of Minimalist theorizing regarding so-called "UG" (what we will generally refer to as the MACs). To the contrary, theorizing on the basis of adult grammar can yield very precise formulations of these cognitive mechanisms. The main difference with respect to theorizing about MACs from the perspective of a radically emergent DMS is that the resulting MACs are assumed to be the outgrowth of general properties of cognition, rather than a traditional UG that is domain-specific to language.[10] This approach allows us to conceive of the MACs as a child's cognitive toolkit for grammaticalizing their language input whether the MACs arise from learning biases, representational biases, processing constraints, etc. The question of what they arise from is of course deeply interesting, but it does not need to be answered in order for the MP/DMS work to proceed.

Again, to be clear, a radically-emergent DMS is not a logical necessity of a DMS approach. Even if the proposed correlation holds up between sequences of acquisition and Minimalist derivations of adult grammar, a traditional UG may well still be at the heart of it. But for the most part, we write what follows from the perspective of an emergent DMS. There are a number of reasons for this. First, an emergent DMS is directly in the Minimalist spirit, even if it is not an example of traditional Chomskyan UG. The stated goal of the Minimalist Program is to eliminate as much content from UG as possible. Furthermore, an emergentist DMS is consistent with a wide range of work within Mainstream Generative Syntax that takes an emergentist stance (e.g., Roberts,

[10]Sometimes this kind of view (an emergent approach to grammar, domain-general approaches to language) is taken to discredit generative-style research based on adult's grammaticality judgments; we see no reason why this should be.

2019; Biberauer, 2019a,b; Biberauer and Roberts, 2017; Wiltschko, 2014).

Additionally, as a more practical/methodological point, a major motive of this manuscript is also broader than tackling theory-internal questions. Part of this investigation is a consideration of how to make sense of generative findings to researchers outside the generative research community. Therefore, if we succeed in showing that DMS is at minimum empirically plausible, we think that there is an intellectual/sociological benefit to exploring an approach that takes generative findings seriously while remaining relatively compatible with broader work on cognitive science.

None of this diminishes the importance of MGG research. As the chapters that follow make clear, DMS proposals are largely about how to interpret MGG findings: it stands on the shoulders of theoretically rigorous and empirically robust work on the nature of UCL, most of which has been conducted within a framework of theorizing about "UG." Therefore, in what follows, much of the theorizing assumes an emergent DMS and remains relatively agnostic as to whether the MACs that make up UCL are derived from properties of cognition that are domain-specific to language or not. At various points we offer limited thoughts/comments on these traditional questions regarding the domain-specificity/modularity of the innate properties of language, but at most points the issues are tangential to our main concerns and we simply set them aside.

3.2 Acquisition as Addition Rather than Replacement

An important consequence of DMS (12) is that language acquisition is additive; a child's early grammatical knowledge is not replaced with more mature grammatical knowledge as they learn. Instead, new knowledge is built on top of older knowledge. Thus, the proposal is that all grammatical generalizations, once acquired in an adult-like fashion, are permanently part of a child's language knowledge, even as the child continues to acquire more complex patterns. It is certainly possible for new knowledge to obscure old knowledge, but the old knowledge still underlyingly exists (see §3 of Chapter 3 for a discussion of movement, which we propose is one such instance of old grammatical knowledge being retained but obscured by new knowledge).

A good illustration of this comes from very early stages of children's productive utterances. As we will discuss in the next section, some of children's earliest syntactic formulations are what Tomasello (2003) calls *pivot schemas* and Rakhlin and Progovac (2021) call *small clauses*. At this stage, children have a very simple predicate that has one slot to be filled (i.e., takes a single argument): examples include things like *more X*, *allgone X*, *X fall*, etc. Tomasello (2003) claims that pivot schemas are replaced by more complex constructions as a child's knowledge grows. What we will claim instead is that pivot schemas are semi-abstract constructions that eventually become maximally abstract, something like [PREDICATE X]. And in fact, most Minimalist formulations of argument structure assume a structure quite similar to these at the bottom of almost every grammatical sentence. In verbal sentences, this is VP [$_{VP}$ Verb THEME]. The claim is then that as structure grows (both in acquisition and in analyses of adult grammar), additional structure is added on top of this VP, but the VP itself is not changed. So as agentive causation is acquired, agents are added to structures, but VP is retained as a component of that more complex structure: [$_{vP}$ AGENT [$_{VP}$ Verb THEME]].

We discuss all of this in more depth and with more evidence below. We raise the issue here

to highlight a central point: syntactic acquisition is canonically additive. Previous generalizations that are productive in adult-like ways are not replaced, rather, new knowledge is built on top of them. We don't mean to imply, of course, that pivot schemas are "adult-like" in the sense that adults regularly utter such things (though see Progovac's 2015 discussion of fossilized small clauses in adult grammars). Rather, the generalization that predicates can take a relatively underspecified THEME argument is the adult-like generalization that children eventually arrive at. And it is this generalization of the small clause/VP that successive acquisition/grammaticalization processes can build on, referencing and interacting with it.

4 Existing Evidence Consistent with DMS

In Chapter 3, we engage the question of empirical support for DMS in more depth. In this section, we briefly summarize the existing, well-documented sequences of child language acquisition in order to show the initial plausibility of the DMS approach and to set the stage for the more in-depth discussion that follows. A number of researchers have argued for precisely these sequences of acquisition previously, so we don't want to replicate their argumentation too much (Vainikka and Young-Scholten, 2007, 2011; Rakhlin and Progovac, 2017, 2021). But we do want to provide readers that are unfamiliar with these core patterns with sufficient evidence and background knowledge to follow our discussion as we proceed.

4.1 Early: Mimicry

Children's earliest utterances are what Tomasello (2003) referred to as **holophrases**: unanalyzed, memorized strings that convey holistic communicative intention. Holophrases are essentially early words, a basic connection between form (sound/sign) and meaning. Crucially, though, they need not correspond to "words" or "morphemes" in adult grammar, and often they are composed of segments and interpretations that correlate with entire phrases in adult grammar, as illustrated in (14).[11]

(14)
- enuni (based on "excuse me") = performative used to get adult attention
- are-you-ok? = response to anyone (including the child himself) falling down
- there-you-go = statement said upon accomplishing anything

Holophrases are excellent examples of children's mimicry-based early learning: at this stage, children's utterances are largely rough associations between words/phrases and some communicative intent. Sometimes these uses are performative/interactive in nature, whereas other times they seem to be mere associations, like the child uttering *there-you-go* to herself after accomplishing anything (a reenactment of her parents uttering the same thing when they do something for her). At early stages some holophrases may simply correlate with adult words (*milk*, *cracker*), but they also often correlate to adult phrases, which the child only later decomposes into component parts: the examples in (14) illustrate this. The point: holophrases lack internal analysis (at least in any obvious way) and are directly mimicked from the child's input.

[11] Examples in (14) were generated by children that Diercks served as a caregiver for.

Table 2.1: Examples of early pivot schemas/small clauses in Western European languages (Rakhlin and Progovac, 2021, 3)

English:	Eve climb. Go truck. See Adam. Put baby. Hurt doggie. Kittie go home.			
German:	Weint die Katze.	Macht das Baby.	Schlafen mein Bruder.	Mache ich auch
	cry.3SG the cat	make.3SG the baby	sleep.INF my brother	do.3SG I too
French:	Ouvre la porte.	Monter Grégoire	Mangé (l)e chien	Est tombé voiture
	Open.3SG the door	climb.INF Gregoire	eat.3SG the dog	have-3SG fallen car
Russian:	Ubasku simat'.	Midet' idjot	Osik kusiit.	
	shirt.ACC take.off.INF	bear.NOM go.3SG	donkey.NOM eat.3SG	

4.2 Acquiring VP

As stated by Rakhlin and Progovac (2021, 6), "at the onset of combinatorial language (MLU ≈ 2.0), when, according to our theory, children's grammar lacks a formal means for expressing transitivity, children's utterances appear to refer to events without an explicit expression of agency/causation or, frequently, without individuating the agent." This results in small-clause-type utterances, as in Table 2.1, the kinds of utterances that Tomasello called pivot schemas.

At an early stage, as argued by many researchers, these constructions are not wholly general, but are linked with specific predicates (Tomasello 1992, 2000b; Culicover 1999; see also Mintz 2003; Mintz et al. 2002; Wang and Mintz 2008). So a child may be able to productively utter *more X* or *X allgone*, but they have not generalized this conclusion to all predicates and arguments. That is to say, Tomasello's pivot schemas are arguably the item-specific stage of acquiring the small clause that is the foundation of so many adult grammatical constructions:[12]

(15) Abstract small clause: [PREDICATE X]

So a child's earliest syntactic patterns are item-specific, but, assuming that they generalize to full abstraction at some point, we would expect a wholly abstract small clause to be developing, as in (15).

It is important to note that we are not claiming in any way that the entirety of a child's grammatical knowledge is composed of pivot schemas; it has long been a question to what degree children's early grammatical knowledge is abstract: see the early debate on this matter, e.g., Tomasello (2000a), Fisher (2002a), and Tomasello and Abbot-Smith (2002) as well as more recent work like Fisher et al. (2019), among many others; McClure et al. 2006 provides a good overview of the discussion up to that point, and Shi et al. 2020 is a recent exploration of that same topic.[13] In fact, there is robust evidence that even young children have a broad range of grammatical knowledge that doesn't necessarily appear in their expressive productions, and which they can potentially employ in acquisition processes (Soderstrom, 2003; Gerken et al., 1990; Shi et al., 2020;

[12] Adult grammar retains small clauses like this, sometimes in matrix-utterance contexts like *him a doctor?!?* (Progovac, 2015) but also in a variety of embedded contexts, such as in the complement of causative *make*: *The parents made [the children leave.]*. But the broader claim here is that almost every utterance in adult grammar contains inside it the foundational "small clause" of a verb/predicate and its complement.

[13] Our thanks to an anonymous reviewer with Language Science Press for pointing this out and directing our attention to relevant research.

Shi and Melançon, 2010; Bernal et al., 2010; Lukyanenko and Fisher, 2016; Kim and Sundara, 2021; Legendre et al., 2010; Bernal et al., 2007; Fisher, 2002a,b; Akhtar, 1999, among others). Rather, what we are proposing is that there is an empirical correlation between structures (specifically, derivational analyses of structures) in adult grammar and the sequence in which children begin to productively use those structures. This leaves open many big questions that we are in no place to answer, including why that point in acquisition in particular would be so significant with respect to adult grammatical knowledge (this is an important question, but it goes beyond the scope of our exploration). And as we will discuss repeatedly, the predictions of this proposal are too numerous to exhaustively defend, so instead we focus on showing that the existing empirical evidence does appear to be consistent with it (in this chapter) and on relevant test cases where atypical derivational timing in adult grammar nonetheless maps well to acquisition sequences (in Chapter 4).

4.3 Acquiring *v*P

After the pivot schema/small clause stage, children begin uttering sentences that include more structure, including (agentive) subjects. At this point in acquisition, children are still acquiring verbal argument structure, and sentence-level generalizations remain item-specific. Tomasello (1992) called this the Verb Island Hypothesis: each verb appeared to be its own constructional island, developing in parallel with others but at its own pace. On Tomasello's formulation of this, both subjects and objects for early uses of verbs are not general grammatical roles of "subject" and "object" but are instead specifically designated according to the verb they appear with.

(16) x's hitting y = HIT-SUBJ's *hitting* HIT-OBJ
x's broken = BREAK-SUBJ's *broken*
(based on Tomasello 2003, who borrowed the predicate-specific role annotation from Croft 2001)

Importantly, stages of acquisition are not discrete, easily distinguishable stages. At the same time that the VP small clause is becoming productive, children are beginning to use subjects in utterances with more complexity. This is not troublesome for DMS: on the approach we are suggesting here, the sequence of the Minimalist derivation (building syntactic structure) is associated with sequences of children acquiring those syntactic structures to the point of using them in adult-like ways; as we mentioned before, this does not preclude them from developing a range of knowledge about their languages' constructions concurrently based on their input, only that productive, adultlike (grammatical) structures proceed in particular sequences. In the context of VP/*v*P, the widely accepted generalization in adult grammar is that agentive subjects are structurally higher than internal arguments (e.g., THEME objects) (Baker 2009, among many others).

(17) $[_{vP}$ AGENT v° $[_{VP}$ V THEME]]

Our assumption is that the sequence of mimicry > item-specific constructions > abstract generalizations occurs with every piece of grammatical learning, and is not simple description of the overall stages of learning (as Tomasello 2003 seemed to suggest). That is to say, any specific piece of grammar that a child is learning will be first mimicked, then will be generalized in partial

and incomplete ways, and then will eventually reach a fully abstract adult-like generalization. This, again, is not a novel stance in any way, but perhaps is the standard assumption among acquisitionists for grammatical learning that shows statistical progression (Pearl, 2021a,b; Wang and Mintz, 2008).

What this means for verb phrases as in (17), therefore, is that predicates and (THEME) internal arguments ought to achieve adult-like grammatical status *before* agentive subjects do. This does not mean that productive utterances including (THEME) internal arguments will precede any utterances including agentive subjects, but rather that (despite the large amount of overlap) (THEME) internal arguments will become fully general in adult-like ways in children's productive grammar before agentive subjects do. Theakston et al. (2015) give evidence of precisely this: verb-object combinations become productive in adult-like ways before subjects. We will revisit the study from Theakston et al. (2015) in Chapter 3; they provide multiple quantitative measures of productivity based on the relative flexibility and creativity of children's utterances. See §5.2 of Chapter 3 for extended discussion.

Rakhlin and Progovac (2021, 6) note that "[a]round 2 years of age, children undergo a cognitive shift when they begin to refer explicitly to causes of events, instead of reporting events as simply happening." This is perhaps most evident in the causative errors that appear around this stage, where children over-generalize the transitive schema to produce errors as in (18).

(18) *Daddy go me around* (2;8); *I come it closer so it won't fall* (2;3); *Mommy can you stay this open* (2;6); *Drink me* (3;1); *I am going to fall this on her* (2;9).
(Rakhlin and Progovac, 2021, 6)

This overgeneralization suggests that children have reached a productive generalization about agentive subjects, which they are incorrectly applying to some lexical items which exceptionally exclude agentive/causativized structures. So while the errors in (18) certainly show lexical errors—verbs like *go*, *stay*, and *come* cannot be causitivized in English to include an agentive subject—they nonetheless demonstrate that children have acquired a grammatical generalization about agentive subjects.

(19) Abstract *v*P:
[AGENT [PREDICATE THEME]]

Centrally for our claims, the stage at which this level of abstraction is being developed *follows* the stage at which children are using and then generalizing small clause constructions (PREDICATE-THEME).[14] Just as central, it precedes them using tense and aspect structures in adult-like ways.

[14] A reviewer posed the question of how ditransitives/double object constructions fit into this progression. This is a very interesting question that is certainly relevant, but in our estimation it requires more time and attention than this broad-level manuscript allows. We do suspect that the cross-linguistic tendency for ditransitive verbs to have multiple structures within individual languages (and to show consistent hierarchical effects related to that) will create a number of interesting acquisition predictions from a DMS perspective, but we unfortunately have to leave the issue for future research.

4.4 Transitioning from *v*P to TP

There is a well documented stage in acquisition where children use some sort of non-adult-like verbal inflection (Grinstead 2016). That is, this is a stage where children are consistent in producing verbs with their arguments in systematic ways, but they do not inflect those verbs appropriately for tense, aspect, agreement, etc. This stage has variably been referred to as the root infinitive stage, optional infinitive stage, or root default stage (the latter due to Vainikka and Young-Scholten 2011).

(20)
a. Papa have it. **English**
b. Thee drinken. **Dutch**
tea drink-INF
c. Dormir petit bébé. **French**
sleep-INF little baby
d. Mein Kakao hinstelln. **German**
my cocoa out-INF
e. Lashevel al ha-shulxan. **Hebrew**
sit-INF on the-table
f. Mama spat. **Russian**
mommy sleep-INF

(adopted from Legate and Yang 2007 and Kallestinova 2007):[15]

During this stage, children are inflecting verbs in inconsistent and non-adult-like ways.

A good example of this is Swahili; as an agglutinative language, verbs rarely appear uninflected in adult speech. Given children's tendency to stay close to the input in their utterances, it is not surprising that we find tense and agreement morphology on verbs in children's utterances that we would suspect to be during the root default stage. The key, however, as pointed out by ud Deen (2001), is that in Swahili this stage is typified by frequent omission of either tense, agreement, or both. (21) gives the minimal template of a Swahili verb form (in adult grammar).

(21) Swahili verb form: Minimal verbal template
SUBJ.AGR-TENSE-verb.root-MOOD

Children in the root default stage who are acquiring Swahili will (in addition to inflecting verbs correctly at times) variably omit either subject agreement (22), tense marking (23), or both (24). For each, we give the child utterance and the equivalent adult form. Each of the child examples in (22)-(24) come from the same child.[16]

(22)
a. ta- tap -a — Swahili (2;1)
Ø– T– V –IND
'I will slap (you).'
b. ni- ta- chap -a — Swahili (adult form)
1SG.SM- FUT- hit -IND
'I will slap (you).'
(ud Deen, 2001, (17))

[15] There is a quite large range of research on this topic; Grinstead (2016) provides a relatively recent overview.

[16] Here, the child examples (the (a) examples) are glossed according to the source; the adult examples are glossed by the first author, adapted to the glossing conventions of ud Deen (2001).

(23) a. a- timam -a hapa — Swahili (2;1)
3SG.SM– Ø– V –IND here
'He has stood up here.'

b. a- me- simam -a hapa — Swahili (adult form)
3SG.SM– PRF stand.up -IND here
'He has stood up here.'
(ud Deen, 2001, (17))

(24) a. lal -a tini — Swahili (2;1)
Ø– Ø– V -IND down
'I am lying down (here)'

b. ni– na– lal –a chini — Swahili (adult form)
1SG.SM– PRS lie.down -IND down
'I am lying down (here)'
(ud Deen, 2001, (17))

Children do reach a point around age 3-4, however, where they acquire tense productively, again evident in overregularization errors. In English, there are a variety of morphologically irregular past tense forms of verbs, and children around these developmental stages often produce these verbs with (incorrect) regular past tense forms (Marcus et al., 1992; Pinker, 1995; Yang, 2002; Maslen et al., 2004).

(25) a. I goed to school.
b. We maked chapatis!

The term "root infinitive" can be a red herring in this sense: while in some languages the non-adult-like form children use is a morphological infinitive, in many languages it is either an uninflected verb form or a default version of a verb form (Grinstead, 2016; Vainikka and Young-Scholten, 2011; ud Deen, 2001). Some languages have been claimed to lack a root infinitive stage altogether, with the claim centered on null subject languages (Wexler, 2011; Hyams, 2002). There is fairly robust resulting literature from null subject languages, however, that children use default forms that language specific (common in their input): these forms are simply less morphologically marked than root infinitives are and therefore less obviously non-adultlike (Austin, 2010; Perales et al., 2005; Avram and Coene, 2007; Georgiou et al., 2016; Avram and Coene, 2011; Pratt and Grinstead, 2007, 2008). See §5.3 of Chapter 3 for further discussion.

4.5 Transitioning from TP to CP

Recalling the predictions above, CP-level structures (across languages) are consistently structurally higher and derivationally later than TP and *v*P in adult grammars and are therefore predicted (on a DMS account) to be acquired later, sequentially-speaking. Empirically, there does appear to be a consistent, cross-linguistic tendency for CP structures to be acquired later than TP structures.[17]

[17]There is certainly evidence of CP-like knowledge in children at earlier stages in development: question comprehension is developed by 12 months (Geffen and Mintz, 2015) and *wh*-comprehension is robust at 20 months (Seidl

Table 2.2: L1 Acquisition of IP and CP in 12 languages (Vainikka and Young-Scholten, 2011, 77)

Language	**IP-elements acquired earlier** [*before or around age 2*]	**CP-elements acquired later** [*after age 2*]
English	tense	relative clauses
	auxiliary verbs	sentential complementation
Polish	tense/aspect	relative clauses
		complex sentences
Scandinavian	negation	relative pronoun
French	clitic pronouns	subordinate clauses
	tense	relative clauses
	negation	
Hebrew	tense	relative clauses
	negation	causal and temporal linking
	agreement	of clauses
Turkish	verb inflections	conjunctions
Georgian	agreement inflections	two-clause constructions
Mandarin	modals	topicalisation
	aspect marking	discourse particles
Japanese	verbal inflection	relative clauses
Kaluli	tense	discourse particles
Sesotho	tense/aspect	relative clauses
		topicalisation
K'iche 'Maya	aspect	yes/no question particle
	negation	

Table 2.2 summarizes a broad range of cross-linguistic patterns reported by Vainikka and Young-Scholten (2011), which show consistency in IP/TP-related structures being acquired before CP-related structures. Nonetheless, acquisition of CP material poses some challenges to a DMS account because there are consistent overlaps of acquisition of TP-level structures with acquisition of CP-level structures. Specifically, the early acquisition of *wh*-questions in English and the (apparent) early onset of V2 patterns are potentially problematic. We discuss *wh*-questions in Chapter 4 and V2 in Chapter 6.

In many—though certainly not all—languages, children begin producing questions (including yes-no and *wh*-questions) early in the acquisition process (e.g., as early as 1;6 years old for English-speaking children: see the more detailed discussion in §2 of Chapter 4). Although these early questions generally do not appear adult-like, they are clearly discernible as interrogatives, either through their syntactic structure or intonation. Nevertheless, children pass through a phase in which correctly formed questions co-exist alongside questions that display various types of inversion errors. *Wh*-question formation in English—as in many other *wh*-ex-situ languages—involves two related movement processes: the *wh*-element moves via A'-movement to Spec,CP while the verb—more specifically, the auxiliary—raises via head movement to C. Ambridge et al. (2006, 522) show that inversion errors for English-speaking children generally take the form of either non-inversion, (what they call) raising, or double-marking:

(26) a. What she does like? Non-inversion
b. What she likes? Raising
c. What does she does like? Double-marking

Crucially, English-speaking children struggle with subject-auxiliary inversion long after the close of the root default stage; Ambridge et al. (2006) observe all three types of inversion errors during the entirety of their study, which follows English-speaking children aged 3;6 through 4;6 years old. Though inversion errors are likewise present throughout the entirety of their study (2;3-4;10 years), Rowland and Pine (2000) note that the proportion of inversion errors peaks around 3;8 years of age.

The presence or absence of subject-auxiliary inversion in question formation is often cited as evidence in support of the existence or absence of the CP system in children's developing grammars, since this type of inversion operates at the CP-level in adult English. However, "the assumption that inverted auxiliaries are positions in C might seem to be called into question by the observation in Radford (1987) that inverted auxiliaries seem to be acquired several months before overt complementizers" (Radford 1992: 47). That is to say, English-speaking children first attempt subject-auxiliary inversion around 24 months of age, while overt complementizers appear in their earliest instantiations only later around 30 months of age. Although English-speaking children at 24-30 months of age are still firmly within the root default stage, it is important to note that these early instances of subject-auxiliary inversion and overt complementizers are not productive, adult-like structures, but rather represent children's initial attempts with these CP-level

et al., 2003) (our thanks to a reviewer for emphasizing this to us). The correlation that we draw in this manuscript, however, is between Minimalist derivations and children's productive *use* of grammatical structures; children's receptive knowledge of CP structures may well be developing at a young age, but our point here is that their productive use of CPs lags behind their productive use of lower structures.

Table 2.3: Proposed phases in the acquisition of syntax and the corresponding cognitive gains (mildly adapted from Rakhlin and Progovac, 2021, 7)

Syntactic Layer	*MLU range	Age	Surface elements consistently in place	Cognitive Development
Pre-syntactic	1.0-1.5	1;0-1;10	holophrases	non-verbal core knowledge
SC/VP	1.5-2.0	1;11-2;3	Verb variety increases; verb–noun combinations increase relative to single words, intransitive grammar	Basic predication; enhancement of core knowledge
*v*P	2.0-3.0	2;4-3;0	Frequency of transitive (with overt subjects and objects) structures increases; acquisition of more complex verb types, such as perception, desire, etc.	Enhanced reasoning about independent agency; understanding of more complex (indirect) causal inferences; enhancement of ToM, namely in desire attribution
TP	3.0-4.0	3;1-3;6	Consistent tense and agreement marking; consistent use of auxiliary verbs and case distinctions	Temporal and spatial displacement; more stable autobiographic memories
CP	4.0-4.5	3;7-4;0	Clausal subordination; overt complementizers	Further enhancement in ToM, namely in the understanding of pretense; False Belief attribution and counterfactual reasoning

phenomena; Diessel (2004) observes that complement clauses and relative clauses become productively adultlike around ages 4-5 or later (this is discussed in much more depth in §2 of Chapter 4). In this way, this slight timeline disconnect noted by Radford is not particularly troublesome for DMS or its sister approaches (Vainikka and Young-Scholten, 2011; Rakhlin and Progovac, 2021). This is an illustration of how we interpret child language data throughout: use of a particular form does not itself mean a child has adult-like grammatical control of that form. The relevant stage in acquisition for the DMS correlation is when children consistently produce a piece of grammatical structure in a productive, adultlike way (see §5.1 of Chapter 3).

4.6 Intermediate Summary

In this section we have outlined evidence that structures that are canonically low in adult grammars are acquired earlier by children (using the term 'acquired' here as shorthand for productive, expressive use of those forms), and structures that are canonically high are acquired later by children. This same argument is advanced by Rakhlin and Progovac (2021) and summarized nicely in Table 2.3. On their account, extra-linguistic cognitive development and linguistic development are mutually reinforcing and mutually co-enabling, though the extra-linguistic cognition goes beyond the scope of our discussion here.

In broad strokes, then, it is clear that something like bottom-up acquisition does in fact happen—there is at the very least a rough correlation between the structural hierarchy that MGG researchers have adopted for adult grammars and the sequence of acquisition that children pro-

ceed through.[18] It is for this reason that ideas similar to this have been proposed repeatedly throughout the history of MGG: Lebeaux (1988), Radford (1990), Rizzi (1997), among others. To streamline our discussion, we don't overview these all here, but there is a summary in the appendix of this chapter (§5) for the interested reader.

That said, there is also a reason that this correlation of bottom-up acquisition and bottom-up structure building has not become canonical linguistic theory: there are too many exceptions and complications in acquisition pathways for the story sketched in this section to simply apply straightforwardly. These various factors will make up a lot of our concern in this monograph. To adjust a phrase from Eric Reuland[19], bottom-up acquisition is right about too many things to be completely wrong, but it is also wrong about too many things to be completely right. In an impressionistic sense, it is clear that something like a bottom-up acquisition process is what occurs. But it is non-trivial to ask what a child "knows" at any particular stage of acquisition, so it's not always clear whether or not this apparent bottom-up sequence can hold up to more detailed evidence from both adult and child grammars. Beyond that, there are apparent exceptions: apparent early acquisition of *wh*-questions is precisely one, but there are also others. Chapter 4 takes up the question of atypical derivational timing (including countercyclicity) to address these issues.

All of these issues are taken up in the chapters that follow. What we mean to establish in this chapter is the broad pattern that, on the whole, children do acquire structurally lower grammatical structures (in productive, adultlike ways) before they acquire structurally higher ones. And the main point, of course, is that this closely mirrors canonical structure building in Minimalist analyses of syntactic structures, consistent with DMS (12).

The appendix to this chapter overviews the precedent in the literature for DMS. A reader who is simply interested in gathering the main ideas about DMS can readily skip the appendix and move on to the next chapter. But a reader seeking a more thorough understanding of how the DMS proposal is situated in the literature on acquisition of syntax ought to read the appendix (eventually). Chapter 3 then continues the project of laying out the core proposals of DMS.

5 Appendix: Precedent for DMS in the Literature

In this appendix we outline some of the details of previous proposals that are relevant to DMS. The chapter is structured in this way to avoid disrupting the introduction of the core ideas we are trying to communicate, but it's important to recognize the various ways that these ideas have strong precedent in the existing literature. This will also allow us to recognize the challenges that those ideas face (some of which are addressed by DMS, others faced just the same by DMS).

[18] We certainly don't want to obscure the fact that for any individual speaking any language, there are pertinent empirical questions to be explored: any adult grammatical hierarchy makes predictions about timelines of acquisition. For individual languages, there are individual language predictions. For universal or near-universal hierarchical patterns, there are cross-linguistic predictions.

[19] Speaking about Chomsky's (1981) Binding Theory, Reuland (2011) says, "[canonical binding theory] is too bad to be true, but too good to be false."

5.1 Introduction to Organic Grammar

In this section we briefly sketch the main conceptual claims of *Organic Grammar* (Vainikka and Young-Scholten, 2007, 2011, 2013), a proposal that shares many properties with our own and which supplies some necessary theoretical constructs that we ourselves will also adopt. As far as we can tell, these proposals have received limited attention in the acquisition literature and no attention in the syntactic literature, which we think to be a mistake. Importantly, our proposals for DMS maintain Minimalist syntactic theories; Organic Grammar has been proposed as a separate theory of language, which we believe to be an unnecessary step. Nonetheless, this shows that there is strong theoretical precedent for our proposals about Developmental Minimalist Syntax.

It has long been observed that a simplistic, highly specific theory of Universal Grammar makes much too restrictive predictions about children's acquisition pathways, which are highly variable and highly affected by input (Ibbotson and Tomasello 2016 and Tomasello 2003 offer some arguments to this effect). And the successes of statistical approaches to modeling child language acquisition are well known (Tomasello, 2003; Lidz and Gagliardi, 2015; Pearl and Goldwater, 2016).

> Children certainly vary in their pace of development, and they also vary in their vocabulary size, volubility and articulation. Yet when it comes to core grammar—to basic syntax—even though the paths which children take are indirect, numerous studies have pointed to stepping stones along these paths (children's early and non-adult grammars) which are predictable for a given language also share characteristics across languages. (Vainikka and Young-Scholten, 2011, 2)

> The basic idea of [Organic Grammar] is that the child … begins with the 'core' of the sentence, the VP (the verb phrase: the main/thematic verb and its arguments, e.g., a direct object). The child then acquires further segments of the tree during development. Once all of these have been acquired—around the age of three or so—the child's (subconscious) grammar can be said to represent the full adult structure. Since each segment of the tree (or technically, 'functional projection') that is acquired remains in the tree unchanged when the next piece is added, there is a straightforward connection between the child's acquisition process and the final tree. This connection is fundamental to Organic Grammar[.] (Vainikka and Young-Scholten, 2011, 9)

This approach shares many similarities with DMS, specifically the direct correlation between acquisition and bottom-up structure building in adult grammars. Vainikka and Young-Scholten nonetheless consistently present Organic Grammar as an alternative to Minimalism, rather than as compatible with it.

Part of why they do so is that they assume as a tenet of Minimalism some of the more extreme versions of the cartographic enterprise, i.e., that UG consists of a fixed, fully articulated syntactic structure that is innate. This is (perhaps most dramatically) realized in Cinque's functional hierarchy of the clause, which was proposed on the basis of a variety of strong evidence for a universal hierarchy of adverb positions cross-linguistically (see §2 of Chapter 3 for our own discussion of these facts). Cinque proposed that the structure in (27) represents a universal, innate set of syntactic structures.

(27) The universal hierarchy of clausal functional projections (Cinque, 1999, 106)
[*frankly* Mood$_{speech\ act}$ [*fortunately* Mood$_{evaluative}$ [*allegedly* Mood$_{evidential}$ [*probably* Mod$_{epistemic}$ [*once* T(Past) [*then* T(Future) [*perhaps* Mood$_{irrealis}$ [*necessarily* Mod$_{necessity}$ [*possibly* Mod$_{necessity}$ [*possibly* Mod$_{possibility}$ [*usually* Asp$_{habitual}$ [*again* Asp$_{repetitive(I)}$ [*often* Asp$_{frequentive(I)}$ [*intentionally* Mod$_{volitional}$ [*quickly* Asp$_{celerative(I)}$ [*already* T(anterior) [*no longer* Asp$_{terminative}$ [*still* Asp$_{continuative}$ [*always* Asp$_{perfect(?)}$ [*just* Asp$_{retrospective}$ [*soon* Asp$_{proximative}$ [*briefly* Asp$_{durative}$ [*characteristically(?)* Asp$_{generic/progressive}$ [*almost* Asp$_{prospective}$ [*completely* Asp$_{SgCompletive(I)}$ [*tutto* Asp$_{PlCompletive}$ [*well* Voice [*fast/early* Asp$_{celerative(II)}$ [*again* Asp$_{repetitive(II)}$ [*often* Asp$_{frequentative(II)}$ [*completely* Asp$_{SgCompletive(II)}$

Vainikka and Young-Scholten (2011) distinguish the approach of Organic Grammar from the proposal of universal innate structures like (27) specifically because they claim that syntactic structures are emergent and that children's non-adult-like stages of grammar can in fact represent partial stages of target-like grammaticalization, in just the way we propose for DMS.

Of course, the assumption that UG is extremely rich in content (as in (27)) in many ways runs directly counter to the core assumptions of the Minimalist Program. And in fact, a large number of adherents to Minimalist theories find a proposal like (27) (as a part of UG) to be troubling. Ernst (2014) suggests that these adverb hierarchies can be generated by the assumption that adverbs adjoin to points in the clause structure based on their semantics, with the cross-linguistic similarities in adverb ordering emerging on the basis of the relatively stable semantics of different clausal heights across languages. While itself reasonable, this raises the question of why there is such consistent clause structure across languages. We don't share the assumption of Vainikka and Young-Scholten (2011) that a Minimalist approach necessitates assumption of a content-rich Universal Grammar. Quite the opposite, many practicioners assume that a universal hierarchy similar to (27) is real, but emerges from more fundamental aspects of language (for similar kinds of reasoning, see Ritter and Wiltschko 2014, Wiltschko 2014, Ramchand and Svenonius 2014, Biberauer 2019b, Roberts 2019, among others).

5.2 Core Principles of Organic Grammar

Vainikka and Young-Scholten (2011) lay out 10 core assumptions of Organic Grammar that establish the major principles necessary to understand the framework. We overview the first 7 here, which focus on the core issues of concern for us.

(28) Organic Grammar Assumption 1
Each language has a Master Tree that includes all possible projections occurring in that language.

Organic Grammar assumes that when children are acquiring knowledge of their language, they are building a centralized repository of grammatical knowledge that makes clear the set of functional projections contained in their language.

(29) Organic Grammar Assumption 2
All and only those projections occur in the Master Tree for which there is evidence in the language.

As we mentioned above, while Vainikka and Young-Scholten (2011) considered this a departure from Minimalist assumptions, we suspect most Minimalist syntacticians assume something quite similar to this in their own work already (cf. Biberauer 2019b, Roberts 2019, Wiltschko 2014). We assume the same, as a part of DMS.

(30) Organic Grammar Assumption 3
Universal Grammar provides the tools for acquiring the Master Tree, based on input.

The point is that UG is essentially a grammar acquisition device rather than the structural hierarchy itself. Instead, UG provides the cognitive resources to generate structure, and that structure is built in acquisition. The bottom-up structure building of adult grammar is, per Organic Grammar, a developmental property.

(31) Organic Grammar Assumption 4
The Master Tree is acquired from the bottom up.

(32) Organic Grammar Assumption 5
The Acquisition-Syntax Correspondence: syntax mirrors acquisition.

Again, these concepts are familiar to the reader from our introduction to Developmental Minimalist Syntax. As we have articulated it, adult language knowledge specifically contains earlier stages of knowledge, precisely because of the nature of Merge that constrains the nature of generalizations that children make about syntactic structures.

(33) Organic Grammar Assumption 6
Actual instantiations of the tree are projected from the bottom up, based on the Master Tree.

This is essentially the claim that knowledge of individual sentences has the same grammatical properties as knowledge of the Master Tree. What an "instantiation" of a tree is is an important question (presumably, the knowledge a speaker constructs/references in offering an offline judgment of the acceptability/grammaticality of a sentence in their language).

(34) Organic Grammar Assumption 7
Partial trees may be projected for constructions which do not involve the full Master Tree structure.

This, again, is a quite common Minimalist assumption, including the presence of defective clauses, nonfinite clauses, ECM complements, small clauses, etc. In short, particular constructions within a language ought to be consistent with the Master Tree(s), but need not always include the entire Master Tree.[20]

[20]While we don't explore second language acquisition here, Vainikka and Young-Scholten (2011) specifically claim that UG functions the same across the lifespan of an organism and that Organic Grammar functions as a theory of (naturalistic, non-instructed) second language acquisition, in addition to first language acquisition.

5.3 (Brief) History of Generative Ideas About Acquisition of Syntax

There is a long history of ideas in the generative literature on language acquisition that share properties with our own proposals. We summarize the main relevant ideas here, albeit briefly.

The Small Clause Hypothesis (SCH) suggests that children's early grammars contain only maximal projections of lexical heads—that is, small clauses. Children then gradually add the functional categories DET, INFL, and COMP, which are subject to developmental maturation. In his conception of the SCH, Radford (1990, 1992) divides the acquisition process, at least for English-speaking children, into exactly two distinct periods: an earlier lexical stage and a later functional stage. During the lexical stage, children's grammars consist exclusively of maximal projections of lexical categories (e.g., noun, verb, preposition, adjective), whereas in the functional stage, children acquire all functional material essentially simultaneously (i.e., INFL is grammaticalized at the same time as COMP). Although Radford is the main proponent of the SCH, other interpretations of this theory exist (see Guilfoyle and Noonan 1989 and Lebeaux 1988), but they do not necessarily align with the claim that the grammaticalization of INFL and COMP occur simultaneously (see also Meisel and Müller 1992 and Clahsen et al. 1993/1994).

The Full Competence Hypothesis (FCH)—described and defended for child German in Poeppel and Wexler (1993)—holds that a child's grammar is in essence adult-like; production differences between child and adult language result from some type of underspecification of a functional projection.[21] In other words, children's developing grammars contain all the functional projections associated with adult grammar, but the features associated with each functional projection may not be fully acquired. For instance, a child's grammar might contain each and every adult-like functional category (e.g., VP, *v*P, TP, CP), but a child might not recognize all the features associated with these projections (e.g., a child might not realize that tense, subject-verb agreement, and nominative Case assignment are all associated with T).

The FCH has been pursued most extensively for early child German, a V2 language in which VP, *v*P, and TP are thought to be head-final and the verb is thought to raise to C (though the head-final status of TP in German has been questioned in, for example, Zwart 1997 and Vainikka and Young-Scholten 2011). The primary support presented in Poeppel and Wexler (1993) for the FCH arises from the early appearance of V2 patterns in child German. Under the assumption that verbs in second position have raised to C—if VP, *v*P, and TP are all head-final, C is the only possible verb landing site that generates V2—the appearance of V2 structure must entail that the CP level is operative. If the verb were not raising to C (i.e., if it remained in its original position in VP or raised to *v*P or TP), it would be expected to surface clause-finally. As this is not the case, Poeppel and Wexler conclude that children speaking early child German must therefore have "full knowledge of the universal principles and processes that underlie clause structure" (Poeppel and Wexler 1993: 29).

The Agreement Tense Omission Model (ATOM)—proposed by Schütze and Wexler (1996)—represents an analysis that falls between the SCH and the FCH, in that it involves the absence of only certain functional categories. Schütze and Wexler divide the inflectional projection into

[21] See Valian (2016) and work cited therein for the articulation of an argument along the lines of the Full Competence Hypothesis, with independent cognitive differences between adults and children explaining the performance differences in child speech vs. adult speech.

a series of sub-projections, thus separating issues of tense from issues of agreement. This model of children's early grammars was designed with a specific child language phenomenon in mind, namely the root default phenomenon (i.e., root infinitives). During the root default stage, children learning a variety of genetically diverse languages optionally mark finiteness and other adultlike forms of inflection on main verbs. Crucially, under an ATOM approach, a higher layer of grammatical structure can exist even if a lower layer is missing; that is to say, CP can still be present in a child's developing grammar, even if the AgrP or TP projection is underspecified (i.e., missing).

Also emerging from that time period was the Truncation Model proposed in Rizzi (1994), another prominent model of child grammar that likewise falls between the SCH and the FCH with respect to the amount of structure assumed to exist. Rizzi assumes that in adult language there is an operative principle that mandates that CP be the root of a clausal structure, ensuring that a sentential structure will always culminate with a CP layer.

The Truncation Model proposes that this root=CP principle is not fully operative in child language. Instead, children can truncate structures at any point below CP. In other words, any category below CP can serve as the root in early child grammar. One would then expect potential truncation sites at any level of structure: non-adult-like truncation can occur at VP, *v*P, TP, or any additional functional projection in between. As Rizzi explains, "[i]f CP is not the compulsory starting point in early grammars, we would expect children to use a much wider variety of root categories, i.e. simple NPs, PPs, APs, (nonfinite) VPs, different kinds of uninflected small clauses, etc." (Rizzi 1994: 165). This prediction is indeed upheld with respect to a variety of children's early linguistic behaviors (e.g., the root default stage, children's first one-word utterances, a.o.). Under the Truncation Model, functional projections cannot be omitted from the middle of a structure; rather, all syntactic structure that would surface above the truncation point in adult grammar must be omitted.

Perhaps the closest precedent to our claims is that advanced by Lebeaux (1988), which was later published as Lebeaux (2000) (we restrict our discussion to the published work). While published at the beginning of the Minimalist era, most of Lebeaux's (2000) theoretical structure is from the heart of the Government and Binding era.[22] Nonetheless, Lebeaux lays out a set of claims that are quite closely aligned with DMS as we've presented it here. Lebeaux (2000) proposes the *General Congruence Principle* in (35), which is quite conceptually similar to DMS.

(35) **General Congruence Principle**: Levels of grammatical representation correspond to (the output of) acquisitional stages.
(Lebeaux, 2000, 47)

"In acquisition, the grammar is arranged along the lines of *subgrammars*. These grammars are arranged so that the child passes from one to the next, and each succeeding grammar contains the last" (Lebeaux, 2000, xiii). Lebeaux (2000) specifically argues that the entire sentential grammar cannot be acquired bottom-up, however, requiring intermingling of structures: in this way,

[22] As we will discuss in §3 of Chapter 4, Lebeaux (2000) argues—erroneously, in our opinion—that his claims are incompatible with a Minimalist approach. However, that may partly be due to the development of those ideas in the earliest stages of the Minimalist Program: it was Chomsky (2001) that truly crystallized the Minimalist approach into the set of assumptions that are largely still used today.

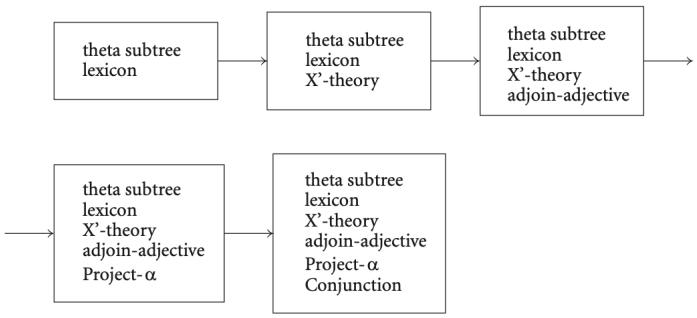


Figure 2.1: The Growth of Children's Grammar, adding operations (Lebeaux, 2003, 288)

Lebeaux argues that the then-incipient Minimalist approach to structure building (via Merge) would be insufficient, instead suggesting a collection of alternative operations in adult grammars that become operative in a child's grammar in a specific sequence, as illustrated in Figure 2.1. "The acquisition sequence is the addition of licensing relations modelled by generalized transformations, added to the grammar" (Lebeaux, 2003, 288). Our discussion of layering operations in Chapter 4 is itself presaged by Lebeaux's work as well.

While Lebeaux (2000) claims that Lebeaux (1988) "played a major role in the coming of the Minimalist Program" as conceived of in the early stages (Chomsky, 1993, 1995), those works abstract away from the acquisition discussion, simply engaging the resulting proposals about the structure of grammar as abstract questions about the theory (mainly around the relative non-cyclicity of adjuncts). And reference to Lebeaux's work is absent in the foundational documents of the contemporary Minimalist framework (Chomsky, 2000a, 2001). There are certainly some references to Lebeaux (2000) and Lebeaux (1988) in more recent acquisition work (e.g., Avram et al. 2015), but from what we can find this tends to reference his discussion of subgrammars, and it is not a full engagement with his General Congruence Principle.[23] Lebeaux (1988) is broadly cited in reference to questions of Late Merger (see Chapter 4), but certainly in broader syntactic theorizing the link between acquisition questions and the theoretical proposals of Lebeaux seems to have either been forgotten or largely set aside. In general, while Lebeaux's General Congruence Principle is conceptually highly similar to DMS, his assumptions about both syntactic acquisition and the structure of adult grammar were (and are) relatively non-standard, which may explain some degree of the lack of impact of the General Congruence Principle on syntactic theorizing. Our claim, however, is that advances in the Minimalist Program have fulfilled the promise of Lebeaux's General Congruence Principle, which can now be articulated relatively transparently as a principle like DMS.

A long history of work by Tom Roeper has drawn careful connections between Minimalist theoretic elements and acquisition as well: Yang and Roeper (2011) offers a good overview. The ideas proposed there include conceptualizing of (Asymmetric) Merge as an acquisition operation:

The important point here is that Asymmetric Merge allows an immediate represen-

[23] A search on Google Scholar for "General Congruence Principle" among papers citing either Lebeaux (1988) or Lebeaux (2000) yields two results, one of which was a paper from Lebeaux himself that was the published version of a chapter of his dissertation.

> tation of a child's first utterances and, more importantly, an abstract analytic instrument that enables a child to attack in a simple way what is a very complex set of inputs, before projecting the full array of functional categories (which is not to say that the capacity is absent). The significance of this point should be underlined: a virtue of the abstraction of minimalism is that it reduces the Primary Linguistic Data problem by giving the child representational tools that allow first-stage efforts to represent linguistic forms whose full feature system has not yet been identified. In that sense, minimalism predicts that Stages can exist. (Yang and Roeper, 2011, 565-566)

In a sense, DMS is the logical conclusion of a long line of reasoning from this basic foundation.[24]

5.4 An Evolutionary Parallel

Aside from Organic Grammar, one of the closest correlates to DMS is not actually found in the acquisitionist literature, but instead in the evolutionary linguistics literature. In her 2015 monograph, Progovac puts forth a gradualist analysis of the evolutionary development of human syntax, which operates on certain principles that are also central to DMS. This section outlines Progovac's argument, drawing attention to the parallels between her conception of the evolution of human syntax and the present developmental proposal.

Progovac divides the evolutionary history of human syntax into four rough stages: the one-word stage, the proto-syntax stage, the proto-coordination stage, and the specific functional category stage. Rather than adopting an all-of-a-sudden, single mutation-style analysis—in which human language sprung from a single genetic mutation—Progovac suggests that modern, hierarchically complex syntax is the result of a series of complementary evolutionary developments.

The one-word stage—as its name suggests—is characterized by single-word utterances such as *Run!*, *Snake*!, and *Out!*, which stand alone to convey a full communicative intention. In this way, there is no combinatorial power in language and therefore no bona fide syntax at this point in the evolution of human syntax. Although Progovac does not classify this period as a genuine stage in the development of syntax—as it is defined by its lack of syntactic structure—it nevertheless represents an important foundation for the development of more complex utterances.

The next stage in the evolution of human syntax (per Progovac) is the proto-syntax stage, in which the first sentences consisting of multiple linguistic elements surfaced. These multi-element structures were paratactic, meaning that they were non-hierarchical, non-headed combinations of two lexical items (e.g., a verb and a noun). In these proto-syntactic structures, the operation Conjoin—rather than the MP's Merge—combines constituents into a single utterance. Conjoin—unlike Merge—generates neither headedness nor hierarchy: Progovac posits both Conjoin and Merge to exist at this evolutionary stage.[25] Progovac cites exocentric (i.e., non-headed) verb-

[24] Though it's worth noting that we explicitly do not assume that a child's first utterances are based on a grammar represented via Merge; only the final grammaticalization is.

[25] Note the parallelism here between the constructions generated during Progovac's proto-syntax stage and the pivot schemas proposed in Tomasello (2003). Both sorts of constructions are non-hierarchical, non-headed combinations of two terms, which are representative of a relatively primitive stage in development (either evolutionary or ontogenetic development).

noun compounds like *cry-baby*, *hunch-back*, *rattle-snake*, etc. as present-day fossils of this stage in the evolution of human syntax. At this stage, only prosody indicates that two constituents or clauses are in fact Conjoined. This proto-syntactic—also known as paratactic—grammar, as well as the grammars of the following stages of language evolution, can operate both clause-internally and clause-externally. This means that during the paratactic proto-syntax stage, two words can be Conjoined or two (two-word) clauses can be Conjoined; for example, expressions like *Him worry?!* and *Easy come, easy go* were both possible at this stage in the development of human syntax. With respect to expressions like *Him worry?!*, Progovac holds that small clauses in the paratactic stage have no structural mechanism for subject Case assignment, causing the subject to surface in its default form (accusative in English). This explains why present-day fossils of the paratactic stage (e.g., *Him worry?!*) show accusative Case marking of the subject.

The next development in the evolution of human syntax was the appearance of proto-coordination. During this evolutionary stage, in addition to prosodic indicators, conjunctions or linkers provided the segmental glue to hold the utterance together. In this way, the evidence for the Conjoin operation is now dual: both prosodic (retained from the previous proto-syntax stage) and segmental (in the form of lexical linkers best approximated by the present-day *and*). Nevertheless, structure in this stage is still syntactically flat, meaning that it involves no hierarchical structure building. Therefore, Move cannot yet occur, since there is no higher structural position for Move to target. This is corroborated by the finding that even today coordination structures constitute islands for Move.

Finally, Progovac posits the the specific functional category stage, which represents the current state of syntactic evolution. It is in this stage that the structural hierarchy (i.e., VP < *v*P < TP < CP) emerges. In this hierarchical stage, functional categories become available, thus providing "specialized syntactic glue for constituent cohesion" (Progovac 2015: 13). The introduction of hierarchy allows for the activation of a wide array of syntactic phenomena including tense, syntactic embedding, movement, etc. all of which require layered structures. This functional category stage includes all the attainments of the previous stages but adds another: the ability to use the linker—whether prosodic or lexical—to identify the type of the constituent created by Conjoin (now comparable to the MP's Merge due to the introduction of structural hierarchy). In this way, then, Progovac proposes two distinct structure building mechanisms during the specific functional category stage: Conjoin and Merge.

The movement from one evolutionary stage to the next represents a progression from least to most syntactically elaborated (i.e., from no syntax, to paratactic syntax, to coordinated syntax, to hierarchical syntax). Crucially, though, "the advent of a new stage does not obliterate the previous stage(s), but rather … the older stages continue to co-exist, often in specialized or marginalized roles, in addition to being built into the very foundation of more complex structures" (Progovac 2015: 2). That is to say, structures developed and used during an earlier stage in the evolution of syntax are not simply discarded at the advent of a new stage; rather, these more antiquated structures are incorporated into the newer, more complex structures, both as foundational elements and in additional specialized roles. For instance, the verb-noun small-clause structures typical of the proto-syntax stage are not abandoned, but rather form the basis for future stages in the evolution of human syntax. Structures from earlier evolutionary stages, therefore, constitute syntactic foundation that later structures are built directly on. The notion of building

upon the work of previous evolutionary stages—which is central to Progovac's proposal—is in essence what DMS proposes on a developmental, rather than evolutionary timescale.

In this vein, Progovac remarks: "A modern sentence (TP) is built upon the foundation of a proto-syntactic small clause, as if the building of a modern sentence retraces its evolutionary steps" (Progovac 2015: 208). Since under Progovac's model evolutionarily newer structure is built directly onto evolutionarily older structure, one should therefore be able to see vestiges of these older syntactic stages in more recent developments. In Progovac's proposals, structurally lower (often unrealized) syntactic structures are older: vestiges of an earlier time in evolutionary history of language, which she refers to as *evolutionary fossils*. As we will discuss in Chapter 3, Progovac's evolutionary fossils are parallels to the ontogenetic fossils posited under DMS. We think it important to mention that we are not claiming substantive connections between child acquisition and evolutionary development of language: we have nothing to say about the evolution of language. But our work benefited from Progovac's parallel ideas (and Progovac herself suggests that acquisition pathways may be relevant to her claims), so we note these connections here.

5.5 Extending the Evolutionary Account

Progovac's central claims are the same notions that underlie DMS: 1) older syntactic constructions form the foundation for newer syntactic constructions, and 2) the building of a modern sentence retraces its developmental progression. Progovac mentions this parallelism between language evolution and language acquisition: "Let me also point out that in my proposal language evolved through scaffolding/layering, in such a way that the lowest layers served as necessary foundation for the higher layers. The prediction of this proposal is that child language, to the extent that it emerges in stages, has to observe the same scaffolding" (Progovac 2015: 50). In this way, DMS extends the underlying principles of Progovac's theory of the evolution of human syntax to the domain of language acquisition, which Progovac (2015) only comments on. DMS, therefore, offers a more thoroughly principled account of this potential ontogenetic "side effect" of Progovac's approach to human language evolution.

In more recent work, however, Progovac has explicitly extended these concepts more systematically to child language acquisition (Rakhlin and Progovac, 2017, 2021). That account assumes something similar to what we argue for directly here, that there is a systematic bottom-up sequence of syntactic acquisition. That work is less a systematic theory of acquisition-syntax correspondences, though, than an extensive investigation of the correlations between acquisition of levels of syntactic structure and the parallel development of relevant non-linguistic cognition. We discussed that work at various points in the main text of this chapter, but below we have included several of their main claims that are most relevant at this point in the discussion:

> The approach we advocate does not imply that syntactic development should be analyzed in terms of fully discrete stages, with children being limited to certain types of grammatical structures at each stage. Syntactic development does not seem to involve sharp qualitative shifts from the absolutive small clause to transitivity or finiteness. Rather it involves a gradual increase in complexity: first, with a progressively greater proportion of children's utterances containing VPs relative to single word utterances, with a gradual increase in argument structure, and greater and more

> consistent use of higher layers. Even during the earliest combinatorial stage, children's utterances are not limited to VPs or any two-word combinations, but contain many single-word utterances, along with some two-argument clauses. To account for this gradual nature of change, we conceptualize syntax acquisition as a sequence of partially overlapping phases, with the onset of each subsequent phase occurring during the earlier phase(s), allowing for the elements of more than one to coexist. Before a syntactic layer is fully established, the elements that are associated with that layer are used sparingly, inconsistently, and are error prone. Their frequency, consistency, and accuracy gradually increase. (Rakhlin and Progovac, 2021, 4-5)

> This approach can account for the inconsistent presence of functional categories in child language (e.g., a single functional projection in Clahsen et al., 1993). TP starts to emerge during the SC [small clause] phase, but does not get fully established until later on, its frequency and accuracy gradually increasing at the expense of SCs. This view also accounts for individual variation in the rate of syntactic acquisition: rapid progress through phases in some and prolonged in other children, particularly those with developmental language disorders. There may also exist cross-linguistic differences in how rapidly new functional layers are added–based on how robustly and consistently each layer is instantiated in the input. Thus, German-acquiring children may show evidence of finiteness earlier than English-acquiring peers, who are exposed to a profusion of bare stem finite forms, whereas in German, most verb forms (including infinitives) are overtly inflected, plus the finite/non-finite distinction is reflected in word order[.] (Rakhlin and Progovac, 2021, 5)

Rakhlin and Progovac (2021) lay out not only the clear argument for this developmental link between generative syntactic findings and language development, but also draw very direct correlations with corresponding non-verbal cognitive development as well. A similar approach is signaled in the work of Potts and Roeper (2006), emphasizing the initial role of small clauses (and discussing ways that childlike small clauses can persist into adulthood).

This volume contributes in several ways to the proposals of Rakhlin and Progovac (2021). In addition to expanding the empirical discussion in various ways, our proposals make a much more specific claim: rather than focusing solely on the core structural hierarchies, we make the stronger claim that acquisition timelines track with the Minimalist model of sentence grammar much more closely. This allows for a more systematic proposal of the links between derivations in syntax in Minimalist Syntax and acquisition processes and therefore for a more precise/falsifiable theory. For example, the specific formulation of (1) allows us to see what lessons can be learned from counter-cyclicity, both as an affirmation of the link between acquisition timelines and Minimalist syntactic derivations, and also as a potential explanation for the existence of counter-cyclicity at all (from the adult-syntactic perspective).

5.6 Intermediate Summary: Theoretical Precedent

There are a number of other works in recent years that have adopted proposals or assumptions that share perspectives with DMS in various ways. Friedmann et al. (2021) present what they call a *Growing Trees* account, for which the core claims are highly similar to our DMS proposals: structurally lower parts of trees are acquired before structurally higher ones. Their proposals cen-

ter the cartographic enterprise as a guide to investigating acquisition, and as such do not make the same claims as we do emphasizing Minimalist derivations themselves. Interestingly, their claims center on acquisition of the left periphery in a level of detail we don't address in our work. The core insights from Friedmann et al. (2021) are fundamentally the same as our own, suggesting a close correlation between adult syntactic structures and children's acquisition pathways. DMS is centered much more on Minimalist theory (and specifically factoring in derivations and countercyclicity), but overall the accounts share many of the same overall claims.[26] Estigarribia (2010) argues that yes-no questions are acquired in a similar trajectory of smaller structures before larger structures (though the specific proposals of that paper is incompatible with a broader Minimalist syntactic): we discuss that study in more depth in Chapter 4.

The summary provided in this appendix doesn't fully explore any of these existing works, but it does serve to show that many of the ideas of Developmental Minimalist Syntax find very strong parallels/precedents in the generative literature. This is especially true of work like Vainikka and Young-Scholten (2011), Rakhlin and Progovac (2021), Lebeaux (1988, 2000), Progovac (2015), and Rakhlin and Progovac (2017, 2021), all of which share many core insights with DMS. We believe these ideas deserve more attention than they have received, however, not just as a way of grounding and correlating Minimalist work to cognition outside adult grammar alone, but also as a way of addressing core theoretical issues in the Minimalist Program itself (as we discuss in the chapters that follow).

[26] De Lisser et al. (2021) suggests that the existence of root infinitives in Jamaican Creole accords well with the Growing Trees account as well).

Chapter 3

Theoretical and Empirical Consequences of DMS

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In the last chapter we sketched the core ideas of DMS and showed how (in the broadest strokes) it generally reflects acquisition pathways. We also made clear, however, that there are a host of unanswered questions and important empirical details that are not addressed there. This chapter begins (though does not finish) the task of filling in those gaps, addressing a variety of central implications/requirements of a DMS approach. Some of these are largely theoretical: for example, §1 tackles the point that knowledge of language must be composed of an inventory of constructions if DMS is taken seriously, and §3 discusses how adult grammatical knowledge contains records of developmental stages (so-called "movement").

The latter portion of this chapter (§4-§6) takes on empirical issues related to language acquisition. As is true of this entire monograph, this is a work of syntactic theory and not an empirical work on language acquisition. So we do not tackle the novel empirical work that is directly implicated by the discussions in this chapter. But what we hope to make clear is how we believe DMS *can* be tested, what assumptions there are in interpreting child language data, and what knowledge of language at in-progress developmental stages must look like in order for DMS to be true. The goal here is to move the core DMS idea towards a status of being sufficiently worked out to be adequately thorough, internally coherent, and empirically falsifiable.

1 Master Trees, aka Constructions

As pointed out by Vainikka and Young-Scholten (2011), systematically linking acquisition with derivations of adult grammatical structures raises a key question about the nature of the grammatical knowledge that is being "built" in acquisition. Surely it is not the derivation of each and every sentence a child has heard or can say—that is essentially a behaviorist view of language

(where every possible sentence is a component of language knowledge; on this approach, grammatical knowledge is not a productive, generative system). Instead, it is widely assumed that children are building a sufficiently general/abstract representation of what a sentence structure in their language looks like. Therefore, Vainikka and Young-Scholten (2011) propose that what is being gradually built bottom-up is a single, general representation of a canonical hierarchical tree structure. They refer to this as the **master tree**, something like the maximal clause structure of a language. On their Organic Grammar theory, a child builds a representation of their language's master tree, and other sentences are built in reference to that master tree.

Adjusting this notion slightly, we think it is reasonable to presume that in additional to a master tree for the maximal structure a sentence can have, that there are master trees for particular kinds of grammatical constructions. Therefore, we can say that adult grammatical knowledge is composed of a **master tree inventory** of various grammatical structures of a language: essentially an inventory of constructions, quite similar to how Tomasello (2003) and Goldberg (2006) discuss grammatical knowledge of adults as inventories of constructions.

DMS is neo-constructionist in this sense: a natural outcome of a DMS approach is that knowledge of a specific language is composed of grammatical constructions in a manner quite similar to that proposed by a variety of constructionist approaches to syntax (Tomasello, 2003; Goldberg, 2006, 2019; Culicover and Jackendoff, 2005; Culicover, 1999, among others). So there can be a maximally abstract construction identifying the maximal clause structure of the language (what Vainikka and Young-Scholten 2011 referred to as the master tree, what we might call the **grandmaster tree**). But there are likely more specific constructions that draw on the grandmaster tree, such as transitive constructions, ditransitive constructions, passive constructions, *wh*-constructions, etc. And this also allows for other kinds of language knowledge that are less abstract. On the extreme end are idioms, where phrasal structures have idiosyncratic interpretations, but this also readily allows for the kinds of constructions that constructionist grammarians devote a lot of energy to investigating, including abstract constructions of limited generality (e.g., *the Xer, the Yer*; *let alone*: see Fillmore et al. 1988, Culicover and Jackendoff 1999, and much subsequent work).

Importantly, there are many ways that DMS does not accord with constructionist approaches, especially some influential usage-based constructionist approaches. As pointed out by Goldberg (2013), many constructionist approaches eschew abstraction in grammatical knowledge, privileging an approach that theorizes that language knowledge hews very closely to surface structures of language. DMS argues that due to the additive property of grammatical acquisition (new knowledge adds to, rather than replacing, existing knowledge), language knowledge ends up *deeply* hierarchical and abstract. Another major point of debate that is similar (but not identical) has been whether language knowledge is purely representational or whether it has a derivational/transformational quality (Lasnik, 2001; Lohndal and Lasnik, 2017). Positing a master tree inventory presupposes a representational quality to those master trees, but at the same time, DMS retains the derivational/transformational aspects of Minimalist syntax as a central component of language knowledge, as those derivations are retained as part of language knowledge precisely because of how that language knowledge is acquired.

Another tendency of many (usage-based) constructionist approaches is to either claim that there are little (or no) constraints on the form that constructions can take, or to simply de-

emphasize the question entirely.[1] But DMS remains wholly rooted in the generative/Minimalist tradition in the sense that it assumes fine-grained constraints on the structure of constructions: what has traditionally been theorized about as "UG." We have posited that Minimalist Analytical Constructs (MACs) like Merge and Agree (among others) may not be domain-specific to language, but they are innate, and they are central to the form that grammar takes. Even if humans' knowledge of their languages is best-described as a structured inventory of constructions, these constructions are master trees that are highly constrained in the form that they can take due to the cognitive mechanisms that build syntactic structures. These constraints may arise from non-linguistic cognition or from specifically linguistic cognition: we don't have anything particularly informative to contribute about that question. But these limits on grammatical form are knowable and investigatable based on the structure of adult grammars, and generative linguists have been doing that work for many decades.

Therefore, the constructions that make up the so-called "constructicon" of usage-based constructionist approaches are, on a DMS approach, considered master trees that make up a master tree inventory. These master trees have fine-grained structure, as they are built using the Minimalist Analytical Constructs like Merge, Agree, and others. These MACs are universal but may not be domain-specific to language, so rather than calling them "UG," we can call them UCL (Universal Cognition for Language) in order to remain agnostic on the question of domain-specificity. But that makes them no less innate, and it makes their impact on the particulars of adult grammatical structures no less real.

As we've commented throughout, this view is relatively consistent with the way that many Minimalist theoreticians are viewing the nature of language knowledge: emergent based on a few core principles, which may or may not be specific to language within broader cognition (e.g., Wiltschko, 2014; Roberts, 2019; Biberauer, 2019b,a, among others).

2 Universal Hierarchical Structures

If DMS is on the right track, we might expect many universals and near-universals to have their foundation in developmental pathways. This section offers commentary in that direction, discussing how a DMS perspective interacts with some major cross-linguistic generalizations relating to clause hierarchy.

2.1 Adverb(ial) Hierarachies

As is well-known among generative syntacticians, there is astonishing similarity across languages in the hierarchy of functional projections that occurs (Cinque, 1999; Ernst, 2014; Ramchand and Svenonius, 2014, among many others). One way that this universal structural hierarchy emerges

[1] We offer this typification of the literature from a survey of relevant prominent work on usage-based construction grammar, e.g., Tomasello (2003), Goldberg (2006, 2013, 2019), Schmid (2020), Croft (2001), and Hoffmann and Trousdale (2013). This is not to downplay, of course, the range of literature that might be considered constructionist that is highly detailed about the formal structure of grammar: e.g., Head-Driven Phrase Structure Grammar and Sign-Based Construction Grammar, among others. We refer the reader to Hoffmann and Trousdale (2013) for a discussion and overview.

transparently is that there is a quite consistent cross-linguistic hierarchy of adverbials, organized according to their semantics.

(36) Discourse-Oriented > Evaluative > Epistemic > Subject-Oriented (> Neg) > Manner (Ernst, 2014, 109)

Taking an English example, an evaluative adverb like *unfortunately* necessarily precedes the epistemic adverb *probably*:

(37) a. Albert **unfortunately** has **probably/obviously** bought defective batteries.
b. *Albert **probably/obviously** has **unfortunately** bought defective batteries. (Ernst, 2014, 110)

More obvious distinctions appear for manner adverbs, which show up much farther right in an English sentence, structurally lower in the clause.

(38) a. This orchestra plays even the soft sections **loudly**.
b. The committee arranged all of our affairs **appropriately**.
c. She faced her fears **bravely**. (Ernst, 2014, 111)

As pointed out by Cinque (1999) and Ernst (2014), these patterns are familiar across a broad range of unrelated languages.[2] So in the Lubukusu examples below, for example, evaluative adverbs appear high (to the left of subjects or between subjects and verbs, as shown in (39)) and manner adverbials appear structurally low, at the right side of the sentence, as shown in (40).

(39) Bukusu *wakana* 'perhaps,' 'maybe'
a. **Wakana** Wafula a-lakat-a e-khafu
perhaps 1Wafula 1SM-will.slaughter-FV 9-cow
'Perhaps/maybe Wafula will slaughter a cow.'
b. Wafula **wakana** ?(,) alakata ekhafu
c. ??Wafula alakata **wakana** ekhafu
d. ??Wafula alakata ekhafu **wakana**
(Wasike and Diercks, 2016)

(40) Bukusu *kalaa* 'slowly'
a. Ba-a-sakhulu ba-nywe-changa ka-ma-lwa **kalaa** (preferred)
2-2-elder 2SM-drink-HAB 6-6-beer slowly
'Elders usually drink beer slowly.'
b. Basakhulu banywechanga **kalaa** kamalwa
c. *Basakhulu **kalaa** banywechanga kamalwa
d. ***Kalaa** basakhulu banywechanga kamalwa
(Wasike and Diercks, 2016)

[2]For another entirely genetically and typologically distinct example, see Pearson (2000); Malagasy adverbs don't display the same linear order, but they still reveal the same hierarchical effects.

As pointed out above in §5.1 of Chapter 2, one analysis for these generalizations is Cinque's (1999) hierarchy of functional projections: the proposal here is that adverbs sit in specifier positions of functional heads dedicated to the relevant semantics of that adverb. Crucially, on Cinque's account this functional structure is assumed to be a part of UG.

(41) The universal hierarchy of clausal functional projections (Cinque, 1999, 106)
[*frankly* Mood$_{speech\ act}$ [*fortunately* Mood$_{evaluative}$ [*allegedly* Mood$_{evidential}$ [*probably* Mod$_{epistemic}$ [*once* T(Past) [*then* T(Future) [*perhaps* Mood$_{irrealis}$ [*necessarily* Mod$_{necessity}$ [*possibly* Mod$_{necessity}$ [*possibly* Mod$_{possibility}$ [*usually* Asp$_{habitual}$ [*again* Asp$_{repetitive(I)}$ [*often* Asp$_{frequentive(I)}$ [*intentionally* Mod$_{volitional}$ [*quickly* Asp$_{celerative(I)}$ [*already* T(anterior) [*no longer* Asp$_{terminative}$ [*still* Asp$_{continuative}$ [*always* Asp$_{perfect(?)}$ [*just* Asp$_{retrospective}$ [*soon* Asp$_{proximative}$ [*briefly* Asp$_{durative}$ [*characteristically(?)* Asp$_{generic/progressive}$ [*almost* Asp$_{prospective}$ [*completely* Asp$_{SgCompletive(I)}$ [*tutto* Asp$_{PlCompletive}$ [*well* Voice [*fast/early* Asp$_{celerative(II)}$ [*again* Asp$_{repetitive(II)}$ [*often* Asp$_{frequentative(II)}$ [*completely* Asp$_{SgCompletive(II)}$

This kind of cartographic research has been hugely influential and has led to a lot of empirical discovery. But there are various empirical and theoretical critiques. First, as pointed out by Wiltschko (2014) and Ernst (2014), while the broad patterns reported in (36) are affirmed cross-linguistically, the finegrained predictions of (41) cannot be replicated with the same consistency. And as Ernst (2014) suggests, proposal of a rich innate structure of categories like in (41) is not necessary: if we expect certain semantic properties to be associated with different structural heights within a clause anyway, the locations of adverbs can derive from these independent facts without requiring this hierarchy of functional projections to be itself innately specified. That said, the broader generalization of the (apparently) universal functional hierarchy itself is something in need of explanation, as explored by Ramchand and Svenonius (2014), Ramchand (2018), Ritter and Wiltschko (2014), and Wiltschko (2014).

2.2 The Hierarchy of Projections

Thus far in this monograph we have been discussing the universal aspects of structural hierarchy in the clause as the cross-linguistic pattern of CP dominating TP and TP dominating VP. To most syntacticians, this is transparently obvious to the point of not being interesting. As Ramchand (2018) points out, however, such a structure is not a logical necessity:

> Consider a hypothetical language spoken on the planet Zog. The planet Zog is a world very different from our own, inhabited by many strange creatures, one species of which has acquired symbolic thought and speaks its own form of language: Zoggian, which has properties found in no human language. In particular, Zoggian displays the bound morpheme /fub/, which denotes roughly 'the process of dissolving into a green slimy puddle.' In addition, it includes the bound morpheme -ax-, which has the semantics of PAST, and the bound morpheme ilka, which has the semantics of CAUSE. Like human languages, Zoggian works by generating hierarchical symbolic structures with predictable interpretations. However, unlike the Human PAST morpheme, the Zoggian PAST morpheme always occurs hierarchically closer to the conceptually rich part of the verbal meaning than the CAUSE morpheme does ... Suppose further that there are many Zoggian language families but that, with very

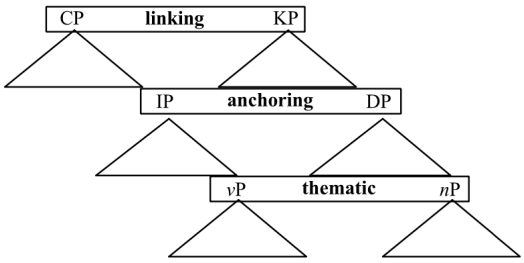


Figure 3.1: The "Universal Spine," defined by functional domains rather than grammatical categories (Ritter and Wiltschko, 2014, (5)). Images are screenshots for draft monograph, will be redrawn in final work.

> few exceptions, CAUSE appears external to temporal information. This is no problem for a compositional semantics. Indeed, it is no problem for the semantics developed for Human languages either. (Ramchand, 2018, 4)

Ramchand's point, of course, is that human languages don't work like Zoggian. So "[w]e could imagine things to be otherwise, but they never are" (Ramchand, 2018, 6). She uses this observation to argue for an alternative approach to the compositional semantics of the clause that captures this generalization (CP>TP>VP). Here we simply want to observe that it's not a logical necessity that languages work like this. But they do.

There are persistent distinctions in hierarchical structures across languages with respect to the fine-grained details, but what appears to be consistent is that there are zones/domains in every language where similar kinds of linguistic functions are carried out, and which are always in the same hierarchical relationship with one another. (42) describes those domains, going from structurally-lowest to structurally-highest.

(42) Domains of the clause (Wiltschko, 2014, 62)

a. the thematic domain, where lexical categories introduce thematic arguments such as agent and theme
b. the A(rgument)-domain, where functional categories such as INFL and ASPECT license the thematic arguments via grammatical relations such as subject and object, which are typically marked by case and/or agreement
c. the A'-domain, where functional categories such as C license discourse relations such as topic or focus

Grohmann (2003) referred to these as "prolific domains" and used them to motivate a theory of anti-locality (more thoughts on that below, as well as in §1 of Chapter 5). Wiltschko (2014) argues that UG contains a "Universal Spine," which contains this hierarchy and underlies the structure of both clauses and nominals, as illustrated in Figure 3.1.

The idea behind these proposals is that a fine-grained universal hierarchy is not well founded empirically (i.e., the hierarchy in (41) of functional projections motivated by adverbs is not universal, nor is it directly innate). But what *is* well founded crosslinguistically are these domains that are relatively well-defined by their syntactic/semantic functions: a thematic domain that

details the core components of an event (predicate and arguments),[3] an anchoring domain that situates that event in time and space, and a linking domain that links the proposition to the discourse.

Ramchand and Svenonius (2014) make the point that there are logical dependencies with respect to these broader domains, however: for example, tense and aspect situate an event in time. Ramchand and Svenonius (2014) refer to an event(uality) that is elaborated with time parameters and world parameters in this way as a *situation*.[4] But a tensed event presupposes the existence of an event in the first place. In the same way, full CPs (what Ramchand and Svenonius 2014 refer to as *propositions*) anchor a situation in the utterance context; again, this presupposes the existence of a situation. Ramchand (2018) takes this farther, sketching an approach to the semantics of the clause that builds this hierarchy into the semantic formalisms themselves.

DMS raises the prospect that these broad, universal generalizations may be fundamentally developmental. That is, part of why a bottom-up syntactic derivation of sentential phrase structures in adult grammar is attested universally (with these different domains of the clause) is due to universal human developmental sequences.

A DMS approach to the discussions engaged by Ramchand and Svenonius (2014) and Ramchand (2018) suggests developmental parallels to these grammatical properties. For ud Deen and Becker (2020), the so-called "Principle of Reference" describes the idea that children's main job is to identify what things mean. For any particular unit of language at any point in acquisition, children's goal is to establish a referent. At the pretheoretic word level, the word can equal the referent (whether concrete/discrete entities in the world, basic verbal descriptions of relations between arguments, etc.). But once abstract syntactic structures become a target of acquisition, what is being referred to is also more abstract. Addressing these domains, this would suggest that children are first "solving" for an event(uality), after which they are solving for a situation, after which they are solving for a proposition. The suggestion is that these functional domains in adult grammar (thematic, anchoring, and linking domains) have direct correlations with stages that a child proceeds through in acquisition: essentially, the stage at which they are acquiring representations for events, situations, and propositions.

This does suggest, however, that referring to a strict bottom-up acquisition sequence is an oversimplification: whereas we might expect to see clear sequencing between grammatical elements in distinct domains, within a domain we might expect to see less clear sequencing. In this monograph, we focus our attention on where the clearest evidence is, as well as detailing approaches to testing these proposals that have potential for sorting out some of the more fine-grained predictions that DMS may make. The main takeaway here is that while aspects of functional hierarchy in clauses are universal (the discourse-linking domain contains the anchoring domain, which contains the thematic domain), there are many fine-grained details that vary between languages. So what we expect to be developmentally universal is the sequence of these domains in acquisition (thematic preceding anchoring preceding linking), not necessarily

[3] The term *eventuality* is more appropriate because it is often used to refer to both stative and eventive predications, but we use the term "event" in a slightly less formal sense here because of its transparency apart from formal semantic considerations.

[4] See Ramchand (2018) for a similar line of reasoning.

the fine-grained details within domains.[5] Friedmann et al. (2021) reach fundamentally the same conclusion:

> Whereas it would be imaginable that children would gradually increase their ability to hold more and more layers, head after head, this is not what we have seen. Our data crucially indicate that the functional heads are acquired in "zones" or "fields", where several hierarchically ordered sets of functional heads are acquired together. This empirical finding supports the view that the left periphery is organized into subfields (see Benincà & Poletto 2004). Similarly to the no-layer skipping, there can also be no zone-skipping – a higher zone cannot be acquired before all lower ones are acquired. (Friedmann et al., 2021, 30)

We go into more detail in Chapter 4 regarding additional ways in which the sequences of derivational steps in adult grammars parallels the developmental trajectory of child language. And a major way that Minimalist theory captures the facts related to these grammatical domains is via the mechanism of the *phase*; we discuss potential approaches to phases from a DMS perspective in §1 of Chapter 5, building on the comments here.

3 Movement is Re-analysis: Ontogenetic Fossils

A central component of adult grammar is what can be called the property of **displacement**: constituents are often pronounced in positions that are separate from where they are interpreted. In Minimalist syntax, this is captured by a theory of *movement*, which on current approaches assumes that copies of the same constituent can be present in multiple positions within a single sentence. While these conclusions were arrived at on the basis of the properties of adult grammar, we will suggest that adults' grammatical knowledge contains multiple positions for constituents precisely because as children's grammatical knowledge grows, they at times will determine that a constituent is hierarchically positioned higher than where they first grammaticalized a position for it. Therefore, we propose that movement in adult grammar is also a result of developmental processes.

The canonical position of a transitive theme object in English is following the verb: e.g., *the rice* in (43).

(43) Maisha ate the rice.

In English questions, however, the question word is canonically displaced at the left edge of the sentence, despite the fact that it is still interpreted as the theme object of the sentence: so in (44) possible answers to "what" will always be things that Maisha ate. Thus, elements in grammar can be displaced from their canonical positions.

(44) What did Maisha eat ~~what~~ ?

[5] It does raise a question about what is innate or not: do humans have innate representational biases regarding events/eventualities, situations, and propositions? Or are those elements themselves emergent properties of some more basic cognitive bias/ability, which are universal in their structure because of the logical dependencies between them? We don't have anything of substance to contribute on that question.

Generative grammar has generally modeled this as movement of the *wh*-word from its base position (the struck out position in (44)) to its surface position. But it is non-trivial to ponder why movement like this exists in language. Another way of saying this is to say that the generative approach suggests that our grammatical knowledge contains representations of some elements in multiple positions, a low position and (a) higher position(s) (see Pesetsky 2013 for an overview).

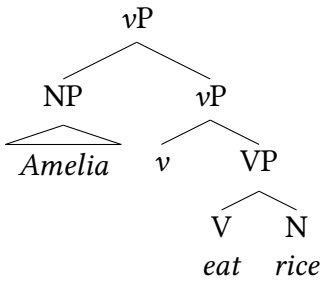
What is movement, on a DMS approach? A natural extension of the DMS reasoning is to conceive of movement as the child's re-analysis of the position of a constituent. That is to say, these are instances where a child has an early generalization of a constituent in one position, which they then re-analyze as they learn more. In our simple example from (44), this would suggest that children have an early generalization of transitive objects low in the structure, but as children grammaticalize *wh*-questions, they locate a position of a *wh*-phrase high in the grammatical structure. (This is an oversimplification of *wh*-sentences; see Chapter 4 for more extensive discussion.)

To take another example of a well-researched phenomenon, consider the *v*P-internal subject hypothesis: the claim that (cross-linguistically), the initial starting position of subject arguments is a structurally low position inside the verb phrase (*v*P). Our example sentence is given in (45):

(45) Amelia will eat rice.

The broadly-accepted analysis is that the agentive subject *Amelia* is first merged into the structure as the specifier of the *v*P projection, as illustrated in (46):[6]

(46)



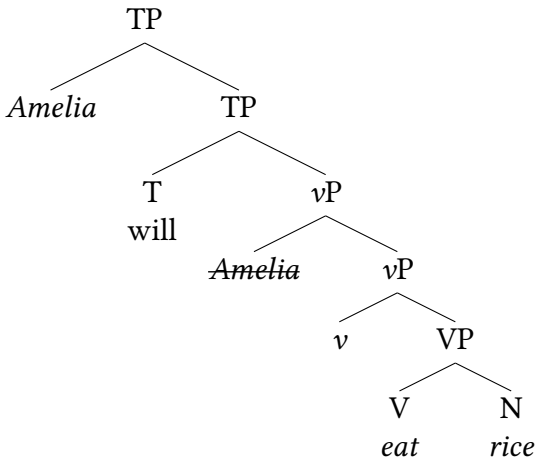
On the DMS approach, this is interpreted as there being a point in acquisition where the structures in (46) have been acquired by the child in a relatively adult-like state, but higher structures are either not yet learned, or are comparatively immature and will continue to undergo development.[7] Consider what happens as a child's knowledge of TP approaches an adult-like state: they posit and grammaticalize a TP structure atop *v*P, which hosts tense information, modals, etc. (in English). Simultaneously, however, they are receiving transparent language input that shows that subjects linearly precede that T° position, and they appropriately conclude that agentive subjects (among others) are located in a position preceding T° (the position for tensed auxiliaries

[6]To simplify the structures, we don't show movement of verbs in the trees, although we assume that (in English) verbs raise to *v*, and of course in other languages verbs may raise higher.

[7]That is to say, a child will continue to test hypotheses about the best analyses of those higher structures in the language.

and modals). Therefore, their acquisition of TP includes acquisition of a position where subjects canonically appear overtly, which we call Spec,TP.

(47)



Again, earlier stages of knowledge are not lost, replaced, or reformed: they are retained. In our illustrative example in (47), the Spec,*v*P position of agentive subjects reflects children's appropriately-adult-like conclusions regarding predicates and argument structure: transitive verbs canonically take agentive subjects, which are structurally higher than theme/patient objects. But subsequent acquisition demonstrates to children that (in English) there is a structurally higher position for those subjects, and therefore they re-analyze the position of a subject, Merging a representation of the subject in that higher position. Therefore, **syntactic movement is reanalysis**; that is to say, syntactic movement is the result of a child grammaticalizing (i.e., positing a new grammatical generalization for) a structurally higher position of a constituent that the child had previously grammaticalized in a lower position. Here, the lower position of subjects is established because children acquire agentive subjects in Spec,*v*P (in the sense of acquiring a productive syntactic generalization that subjects are a component of events, structurally higher than other objects) before later acquiring tense and the relevant generalizations about subjects in the inflectional domains.

So, during acquisition agentive subjects are originally grammaticalized by children in Spec,*v*P; later (in many languages), as children grammaticalize more structure in their language, they conclude from the evidence that subjects reside in another position. Adjusting a term from Progovac (2015), unpronounced copies of moved elements can therefore be thought of as **ontogenetic fossils**: remnants of developmentally-earlier stages of a child's knowledge. In fact, in many constructions in many languages, every *v*P constituent moves out of the *v*P: subjects, objects, and verbs often all reside in structurally higher positions in these instances. In situations like this, the existence of *v*P itself can be thought of as an ontogenetic fossil. Analysts of adult language grammar conclude that the existence of *v*P is reasonable both language-internally and theoretically, to account for cross-linguistic patterns, but for many particular utterances their analysis may contain no overt constituents in *v*P. Nonetheless, Minimalist syntacticians have found the existence of *v*P to be analytically useful: for example, English subjects are canonically structurally high, but sometimes overtly appear structurally low, such as in a locative inversion construction (48a) or an expletive construction (48b).

(48) a. Into the yard walk three bears.
b. There are three bears in the yard.

Patterns like these occur across languages way too often to be a coincidence, and they motivate researchers to posit low positions of subjects, even when (in some languages, including English) subjects do not canonically appear in those positions.

Again, the DMS perspective is that proposals like the *v*P-internal subject hypothesis hold up precisely because adult grammatical knowledge contains ontogenetic fossils: syntactic structures that represent developmentally-earlier stages of language knowledge. Those fossilized structures (e.g., so-called movement "traces") sometimes emerge overtly in particular syntactic constructions or are evidenced in indirect manners. And an approach to syntactic structure that embraces only surface structures and does not adopt the derivational, abstract qualities of adult grammar risks missing these properties.

Movement, and specifically traces of movement, are just one example of syntactic properties that can reasonably be thought of as ontogenetic fossils: as we comment on throughout this monograph, others include phases and successive-cyclic movement. This does raise questions about how we interpret various kinds of empirical properties of child language. Given that children demonstrate statistical learning of many elements of language (see the next section), it does raise a question of how we can say that a child has reached an adult-like conclusion about some portion of grammar. We expect an ontogenetic fossil to emerge in instances where a particular portion of grammar is target-like for the child, though the overall grammar has not yet matured. For the *v*P-internal position of subjects, the base position of a subject reflects target-like (i.e., adult-like) knowledge of predicate argument structure, but *not* target-like knowledge of tense, case, agreement, and the final structural position of subjects. So for this kind of pattern to emerge, argument structure must effectively be viewed as a distinct acquisition task for a child from tense/case/agreement and additional word order questions that emerge as acquisition proceeds.

So, what defines the "portions of grammar" that can count as a measure of target-like behavior/knowledge? That is, what delineates instances where a child can acquire a representation of an element that is adult-like in its more narrow scope (e.g., agentive subjects in Spec,*v*P) but not adult-like overall (e.g., agentive subjects are canonically in Spec,TP in English)? We suggest that these properties arise due to the stages of acquisition corresponding to the grammatical domains in the preceding section. That is, children first "solve for" the properties of events (the argument structure of predicates). Because this is the puzzle they are solving at early stages, they can be fundamentally correct about the structure of the event(uality) like the canonical argument structure of predicates, while not yet having precisely formulated the structure of higher properties of the clause.

Therefore, we expect to see the ontogentic fossils left by movement only when they cross these domains. We wouldn't typically see hyper-local movement in syntax (i.e., movement within these grammatical domains) precisely because domain-internal structures are being sorted out by a child contemporaneously, and syntactic movement only occurs once a structure is fully grammaticalized in one position only to later be required to be grammaticalized in another position. The target of children's referential problem-solving is less about any particular structure as it is

the functional/semantic domains: events/eventualities, situations, and propositions. A theoretical benefit here is that this approach can derive not only movement across domains, but also the relative dearth of movement operations analyzed as occurring *within* domains, the so-called anti-locality property of syntax: movements must be local, but not *too* local (Abels, 2003; Grohmann, 2003; Schneider-Zioga, 2007; Cheng, 2006; Erlewine, 2020). These comments are not nearly sufficient on these topics: we comment in a bit in more depth in §1 of Chapter 5. A full discussion of the topic is beyond what this monograph can address, but a DMS approach to locality and anti-locality strikes us as highly promising.

4 UG Paired with Statistical Learning

Consider the now-classic description of children's acquisition pathways described by Tomasello (2003), summarized in (49).

(49) **Tomasellian acquisition pathway** (Tomasello, 2003)

holophrases	a one-word utterance that "conveys a holistic, undifferentiated communicative intention"	*I-wanna-do-it*; *lemme-see*; *where-the-bottle*; *go-away*; *where-go*; *bye-bye*
pivot schemas/ small clauses	simple construction with a stable element and a variable element	*more x*; *allgone x* ; *go x* ; *see x*; *x gone*
item-specific construction	abstract constructions that include reference to particular lexical elements (verb island hypothesis)	HIT-SUBJ's *hitting* HIT-OBJ; BREAK-SUBJ's *broken*
abstract syntactic constructions	adult-like abstract grammar	SUBJ V_{trans} OBJ; SUBJ $V_{intrans}$

If we set aside pivot schemas as another instance of item-specific constructions (as we suggested in Chapter 2), Tomasello captures a general hierarchy of productivity related to the degree (or not) that a pattern necessarily refers to specific lexical items. That is to say, at the earliest stage, children's productions are copied/mimicked from input, and eventually most researchers assume that children reach a state of generalization over linguistic patterns where their knowledge is composed of rules/structures, rather than individual (copied) lexical items and phrases. But it is now quite commonly held that children have intermediate stages of knowledge—partial generalizations—where they do have some rule-based/structure-based grammatical patterns, but those patterns nonetheless reference specific lexical items or non-adult-like classes of items. So Tomasello's developmental pathway (above the line in (50)) can be restated as described below the line in (50).

(50) **Descriptors of "stages" of knowledge in acquisition**

holophrases	>	item-specific constructions	>	abstract syntactic constructions
mimicry	>	statistical associations including particular lexical elements	>	fully adult-like abstract/category-based grammatical rules

Many acquisitionists either implicitly or explicitly hold this to be true: children gradually approach adult-like grammatical abstractions (see Pearl 2021a, Pearl 2021b, Lidz and Gagliardi 2015, Wang and Mintz 2008, and Mintz et al. 2002, for example). Children encounter data, remember specific data points, and generalize from that data.

On this approach, it is possible to conceive of the components of UCL (the so-called "Universal Grammar," i.e., UG) as a description/formalization of children's cognitive toolkit for grammaticalizing (i.e., arriving at and encoding generalizations for) the language input they receive. Remaining intentionally vague at this point, what makes up a child's toolkit in this sense may include representational biases regarding how to mentally represent pieces of grammatical knowledge, it could include the learning mechanisms, and/or it could include other cognitive biases; the distinction between these possibilities is important but beyond our current concerns.

All of this is a relatively uncontroversial stance on the intersection of innate cognitive biases (whether domain-specific to language or domain-general) with statistical learning. Lidz and Gagliardi (2015) sketch a model that illustrates how these are compatible, shown in Figure 3.2. On this approach, various extralinguistic systems play a central role (on the left side of the chart) in determining what children process from their input and therefore what perceptual intake results from their input. The idea, then, is that UG is part of the inference engine (on the right side of the chart), which influences what kinds of grammatical generalizations are formed from this perceptual intake. And extralinguistic aspects of inference/learning, not simply UG, may well influence this stage as well. The result is a degree of grammatical knowledge which is relied on by children as they continue to acquire more aspects of their language (the long line from the right side of the chart to the left).

It is well documented that children use statistical reasoning to learn, including to learn language (see the discussions in Pearl in press, Pearl 2021a, Pearl 2021b, Lidz and Gagliardi 2015, Ambridge et al. 2015, and Aslin 2017, among others). Pearl (in press) argues that there is no incompatibility with assuming innate cognitive biases alongside statistical learning mechanisms and that children may learn gradually from input in statistically-driven kinds of ways while there are nonetheless biases about how generalizations may or may not be mentally represented, or constraints on what hypotheses children entertain while generalizing over data. Similarly, the precise learning mechanisms that children use may themselves generate a specific range of outcomes. All of this is to say that assuming that children learn specific data points and gradually build generalizations is not at all incompatible with an approach that assumes innate cognitive constraints and biases regarding the ultimate form that language takes.

DMS is essentially a proposal that two empirical domains are systematically correlated. The analytical approach posited by the Minimalist Program for adult grammar—of a derivation that proceeds bottom-up—serves to capture sequences of logical dependencies among various grammatical properties of language (e.g., the presence of tense and aspect presupposes the existence

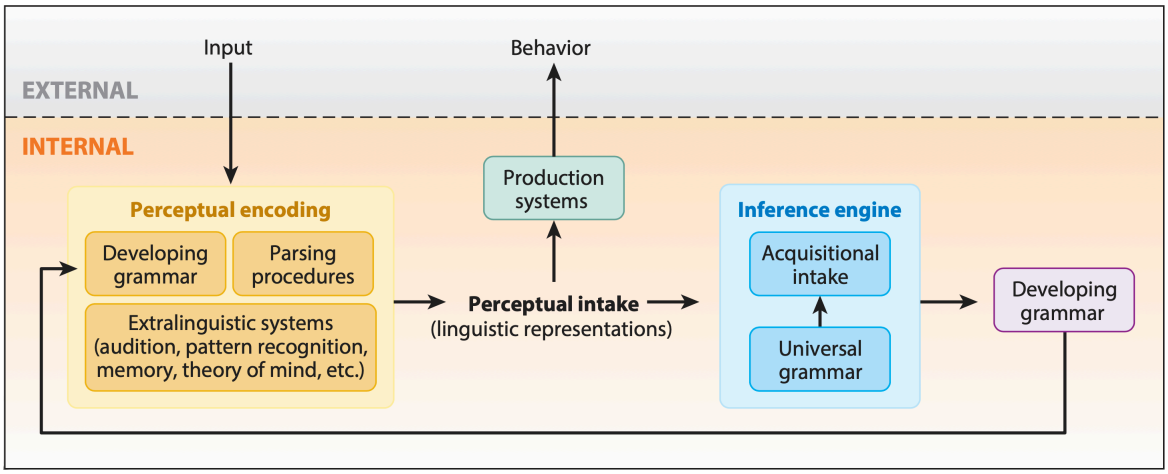


Figure 3.2: Inside the language acquisition device. The dashed line represents the division between what happens in the external world and what happens within the child's learning mechanism. The arrow from Universal Grammar to acquisitional intake represents the predictive process about what the learner should expect to find in the environment. Chart and caption from Lidz and Gagliardi (2015, 336).

of an event to be placed in time, and in a sense tense and aspect contain that event). The DMS proposal is that there is a correlation between this adult hierarchical knowledge and the timeline of child acquisition, which (we argue) reflect similar sequences.

5 On the Empirical Prospects of DMS

Empirically engaging with and testing the predictions of DMS presents significant challenges. In one sense, the empirical predictions are expansive. The claim in (1) (repeated below as (51)) makes acquisition-related predictions about essentially every construction in every language. This is an effectively infinite data set. Therefore, it is impossible to empirically prove (51) to be true. The best we can do is show it is plausible in light of what is known about acquisition.

(51) **Developmental Minimalist Syntax**
The Minimalist derivation of adult language structures recapitulates the ontogenetic development of those same syntactic structures.

But, as pointed out by a reviewer, the DMS proposal is only viable to the degree that it is testable, and it is only testable (on the acquisition side) if there is some specificity about what can be measured that might demonstrate the acquisition timeline that we repeatedly reference. So DMS (as presented to this point) would make too *few* predictions without clear and precise measures of children's grammatical knowledge. This is a non-trivial issue for a wide variety of reasons that are familiar to researchers who work on child language. First, children are skilled mimickers and will frequently produce adult-like utterances that don't reflect grammatical knowledge, but instead are the result of copying what adults say (as parents know, one has to be careful what they say around a child, because the child will certainly repeat it). Second, children are acquiring

many different aspects of language simultaneously, so it is no simple task to identify what they do or do not know at any point (see Pearl and Goldwater 2016, Johnson 2008, and Feldman et al. 2009, to name just a few). Additionally, it is well documented that children's receptive knowledge outpaces their expressed/uttered language knowledge (Bloom 1974, Naigles 2002, Fisher 2002a, Fisher 2002b, Bernal et al. 2010, among much other work). So when we refer to a timeline of acquisition, what are we referring to? In specific, measurable senses, what does it mean for a child to have "acquired" a piece of grammar?

An additional challenge is that even when children are creatively producing novel utterances, the categories/rules that their utterances are built on may be productive but not adult-like, even though those non-adult-like categories may often manage to successfully produce an adult-like grammatical pattern. It has been well documented that children can create generative rules/structures that they employ for productive language, that nonetheless don't necessarily isomorphically match adults' grammatical structures (see Wang and Mintz 2008, for example).

Given all of these reasons, the question of when children have acquired a grammatical pattern in an adult-like fashion is often extraordinarily difficult to answer. So it is far from obvious that (51) is empirically true. Nonetheless, our read of the empirical situation is that (51) is highly plausible, and therefore it is worth pursuing the core ideas. Informally, DMS as sketched in (51) makes sense on a number of levels and is consistent with a broad range of empirical evidence. We believe it has the potential to offer a new level of explanation for many apparently-anomalous properties of adult language while simultaneously building a bridge for generative grammar out of its intellectual silo. Because of the scope of DMS's implications and the well-known challenges in understanding what children know at any particular point, it will not be transparent and obvious that DMS's claims are true. But we nonetheless find (51) compelling, given the breadth of data that it is consistent with (in both child and adult language).

In our opinion, the clearest correlations with Minimalist syntactic derivations are from children's productive utterances of grammatical structures: we propose that there is a systematic correlation between Minimalist derivations of adult grammatical knowledge and children's productive use of those same grammatical structures. As was discussed in Chapter 2, the most transparent form of evidence of a child's acquisition of a productive grammatical pattern is **overgeneralization**: when a child takes an (accurate) grammatical generalization and extends it to instances where it doesn't apply. But this raises a large question, especially given that children are skilled mimickers and also consistently display instances of incomplete and/or non-adult-like grammatical generalizations. How do we know when children's utterances are simply mimicry (skilled copies of their input; memorized amalgams), as opposed to grammar-driven productive utterances? Because a child directly copying their input will, of course, tend to produce adult-like grammatical utterances. This has always been a central problem for the study of acquisition, and (51) presupposes some clarity in knowing what children know.

So, a child might say *We goed to the store* or *Please reach me the crackers* (if they want the listener to help them reach the crackers). Both show productive grammatical patterns that simply don't apply to the predicates that the children apply them to. Here, these mistakes are clear evidence that a productive pattern has been acquired, but such evidence requires irregularity: it is only evident when a general rule/structure is applied by a child in places where it doesn't apply in adult-like grammatical knowledge, which presupposes irregular forms/patterns where

a rule doesn't apply. In English, for example, we frequently see this with limited application of verbal alternations (e.g., some predicates can optionally occur with or without an agent, while others cannot: see, for example, Bowerman and Croft 2008 and Ambridge 2020), with irregular pluralization (e.g., Marcus 1995 and subsequent work), or with irregular verbal inflection (e.g., Marchman et al. 1997 and Maslen et al. 2004, among many others), all of which have been extensively researched in English. But when a pattern/structure is sufficiently regular (e.g., the existence of CP in adult-like grammatical knowledge) it can be much harder to discern when a child has moved from mimicry to productivity.

5.1 Evaluating Children's Grammatical Productivity

On some level, it is broadly agreed that children eventually reach flexible and creative productivity with language: few or no current researchers would accept a completely behaviorist account of adult language production. Most linguists agree that adult language allows for creative production of novel utterances based on a set of rules/abstract structures constraining the possible (grammatical) utterances in a given language. So we do expect that children eventually reach that stage of productivity. But it can be difficult to discern the difference between a child's successful mimicry of adult utterances and their (eventual) creative productions, as it is clear that children do both. So how does one know with precision when a child's grammatical knowledge has become rule-based and productive? There is a long history of measuring "productivity" in grammar. We won't offer new ideas about how to do this here, but instead will describe relevant research that serves to sketch a pathway towards testing DMS in detailed and falsifiable ways on the acquisition side.

A standing question is whether grammatical productivity is a categorical distinction or a continuum. And even on the assumption of a gradual cline of productivity, there could be a threshold for any particular measure of productivity where a construction can be considered grammatically productive. For our concerns, these questions are relatively tangential, as we are less concerned with labeling any particular piece of grammar as "productive" as we are saying that by whatever measure is employed, children's productivity with a structurally lower piece of grammar will approach adult-like measures before productivity with structurally higher pieces of grammar will do so.[8] More concretely, by whatever measure, we are suggesting the following. Take any two elements in adult grammar (X and Y), where X is derivationally earlier than Y in a Minimalist analysis of adult grammar. The DMS claim is that X will become productive in adult-like ways for children before Y does. It doesn't matter for our purposes whether productivity is a categorical property, a threshold property, or even a pure continuum: our prediction is that the approach to adult-like measures will happen for X (for a child) before it does for Y.

This is not to suggest that measuring productivity is straightforward: it is anything but. Some approaches have been relatively simplistic: for example, Brown (1973) considers a piece of grammar productive once a child uses a grammatical morpheme in 90% of obligatory instances, but there are any number of reasons why a child might produce a given form in an adult-like way or in a non-adult-like way, so more precise measures are desirable. Theakston et al. (2015)

[8] More precisely, a *derivationally early* piece of grammar (in a Minimalist analysis) will approach adult-like grammatical productivity before derivationally later pieces of grammar do. In canonical instances, structurally low elements are derivationally early, though Chapters 4 and 5 discuss exceptions.

describe two broad diagnostics of productivity: flexibility of use, and creativity of use. A number of prior researchers have suggested that flexibility is a useful measure of productivity (Bybee, 1985, 2001; Naigles et al., 2009), where flexibility can be thought of as "type frequency of a particular slot" (Theakston et al., 2015). So in an instance of a phrase like "I want _," type frequency refers to how many different elements appear in the empty slot. In this sense, variable use of different lexical elements in the same grammatical frame is a measure of the degree to which the grammatical frame is a memorized amalgam vs. an abstraction that can be employed to create new utterances.

As Theakston et al. (2015) point out, however, measuring this kind of flexibility of use doesn't actually show whether a child is generating creative/novel utterances using an abstraction, or if they have simply been exposed to that same range of flexible use in their input and are simply replicating that input. To address this, Theakston et al. (2015) treat child-directed speech (CDS) as a baseline against which to evaluate child speech (CS). "For the child to be 'creatively productive' in this sense is to use a word in a particular slot that is not evidenced in his or her CDS sample" (Theakston et al., 2015, 1372). Yang (2011) uses a similar kind of approach, where productivity is evaluated by a measure quantifying the combinatorial diversity of nouns with determiners, namely if category members are interchangeable with other members of another category (such as any nominal being able to freely combine with any determiner), as measured by the evidence child's input and productions (Pine and Lieven, 1997; Pine et al., 2013; Bates et al., 2018).

5.2 A Model: Theakston et. al. (2015)

In this subsection we discuss the measures that Theakston et al. (2015) use in some more detail, showing how they employ them to probe a question that is highly relevant to DMS predictions. Our point is not to argue that their measures are the correct measures of productivity, per se, but rather to use their study as a model of how the claim we advance here can be evaluated in the future. Theakston et al. (2015) investigate the relative productivity of subjects vs. objects in children's transitive (NVN) sentences, concluding that objects become productive in adult-like ways before subjects do. Their conception of productivity is built on the creativity and flexibility of child speech as compared to the child-directed speech of adults.

They consider three children's speech across two distinct age rages, termed $T1$ and $T2$. These age ranges are selected to be far enough apart that differences in learning and productivity between $T1$ and $T2$ should be apparent. $T1$ begins around age 2;0 and consists of the first 300-500 recorded NVN utterances. $T2$ does not directly correlate to an age and is instead comprised of the second half of the NVN utterances after $T1$. $T2$ ends around 3;1 or 3;2, depending on the child. Children's productivity is compared between $T1$ and $T2$, and it is also compared to child-directed speech (CDS) at these same two timeframes.

The study applies a large range of controls and necessarily makes a number of decisions about how to process different sorts of data (e.g., treating different forms of verbs as separate lexical items rather than a single lexical item). Those details are less pressing for our current purposes. In general, they omit functional material from the analysis and consider noun-verb-noun (NVN) transitive verb sequences (frames like *_want_* and *_hit_*), evaluating the productivity of the nominal slots in those frames. We won't summarize every measure of flexibility or creativity

		Object Type Frequency	
		want	*see*
Child	I want **some**, I see **her**	1	2
	I want **some**, I see **her**		
	I want **some**, I see **him**		
CDS	I want **some**, I see **her**	2	3
	I want **her**, I see **some**		
	I want **some**, I see **cake**		

Table 3.1: Example of relative flexibility of the object slot according to verb (Theakston et al., 2015, 1382, Table 3)

that Theakston et al. (2015) use, instead focusing on a couple that can be explained reasonably straightforwardly in service of illustration.

As for **flexibility**, Theakston et al. (2015) "compare measures of flexibility in CS [child speech] at two developmental time points with the flexibility observed in the matched sample of CDS, both in absolute and relative terms. Absolute flexibility simply means we compare the average type frequency of noun slots in verb frames between CDS and the CS. Relative frequency measures whether the type frequency (flexibility) of noun slots tied to a particular verb frame in CDS is predictive of the same noun slots in the CS" (1373).

Table 3.1 shows an example of the *relative* flexibility of object counts for two verbs, *want* and *see*, in both CS and CDS. (For the purpose of illustration, this is for an extremely small sample of just three uses of each verb.) In CS, because *want* only appears with the object *some*, the object type frequency of *want* is 1. *See* appears with two different lexical objects in CS, so the object type frequency of *see* is 2. CDS exhibits slightly more flexibility, with *want* appearing with 2 different objects and *see* appearing with 3. Relative flexibility takes into account the fact that, while *want* only has an object type frequency of 1 in CS, it also does not have a high object type frequency in CDS. The intuition is that low type frequencies alone are not necessarily indicative of non-adult-like speech. Instead, CS is evaluated to be non-adult-like if its flexibility is much lower than the flexibility of CDS, regardless of the absolute flexibility.

Theakston et al. use two additional measures to assess **creativity** in CS relative to CDS. "One measure looks at the degree of overlap in the lexical items used with specific verbs between a child and their input. The second measure looks at how verb specific a particular noun use is. Overall, the four measures of flexibility and creativity give us a more methodologically rigorous way to test the theoretically important question of whether early on the child shows adult-like productivity" (1373).

The first measure of creativity, which looks at overlap between CS and CDS, is illustrated in Table 3.2. The first CS-CDS pair (first two lines of the table) shows a scenario in which the child speech is not creative: while object flexibility is high (the type frequency of *want* is 3), all three child utterances are repetitions of CDS. In contrast, the second CS-CDS pair shows more creative child speech. While the object type frequencies in CS and CDS are the same as they were in the first pair, note that there is only one shared form (utterance) between CS and CDS; the other two utterances are novel utterances that were not attested in the CDS. This illustrates

		Object Type Frequency	Shared Forms
Child	I want **it**, I want **her**, I want **cake**	3	3
CDS	I want **it**, I want **her**, I want **cake**	3	
Child	I want **it**, I want **more**, I want **cake**	3	1
CDS	I want **him**, I want **more**, I want **dogs**	3	

Table 3.2: Example of creativity (overlap) in two CS–CDS scenarios (Theakston et al., 2015, 1382, Table 4)

the child's creativity.

We don't talk through the detailed results for any of the measures in Theakston et al.'s study, as it takes us outside the scope of our current concerns, which is instead focused on demonstrating that grammatical productivity in children can be evaluated in systematic ways. Their conclusions, however, also are highly interesting for our current purposes. "Overall, these results paint a fairly clear picture. Children's use of subject forms is more restricted, when measured in a number of different ways, than their CDS, even by T2. In contrast, their use of object forms is more adult-like from the beginning, and we only detect developmental change with some measures" (Theakston et al., 2015, 1390). There is a lot of interesting variation between verbs and between speakers that is outside the scope of the current discussion, but the overall finding is that objects showed relatively adult-like flexibility and creativity even at T1 (the developmentally early point) in this study. Subjects, on the other hand, were less adult-like than objects even at T2 (the developmentally latter point in the study). This accords with the DMS prediction that objects ought to become productive in adult-like ways before subjects.

A robust defense of DMS requires many additional studies confirming these results (both in English and in a wide variety of languages). These kinds of approaches to measuring creativity and flexibility provide baseline metrics that could be adopted or adapted to study different areas of grammar, as relevant to test DMS; structurally lower components of grammar should become creative and flexible in adult-like ways for children before structurally higher components of grammar do. We don't outline all the ways this could be tested; the main point of this discussion is simply to show that the main claims of DMS are empirically falsifiable. But the next section does provide some relevant commentary in this regard.

5.3 Predictions (a few comments)

If the link between productive grammatical knowledge in children and Minimalist derivations can be demonstrated in multiple domains moving forward, this would corroborate the core proposals of DMS. But what domains can this be tested in? There are a multitude. In any language, in any construction in adult grammar that shows clear hierarchical distinctions between two grammatical elements, we expect a particular sequence of acquisition where the structurally lower element becomes productive in children's utterances before the structurally higher one (this prediction is most definitive when the structural elements are in distinct domains, as described in §2.2). Likewise, when there clear distinctions in the derivational sequence by which the structure is built (irrespective of structural height—see Chapter 4), DMS also makes clear predictions.

Many of the predictions are quite straightforward. In English, for example, do-support in questions is a structurally *high* phenomenon, involving CP. DMS predicts that tense and subject agreement (which centrally involve TP) should become productive in adult-like ways *before* do-support in questions becomes productive in adult-like ways. This is just one example of many: we generally expect structural height to correlate with acquisition timelines (in all non-countercyclic contexts, see Chapter 4). Per DMS, we also expect countercyclic processes, where a structurally lower grammatical element is nonetheless acquired later than higher structures, as we will detail in Chapter 4. For example, in §3 of Chapter 5 we describe a set of phenomena in Bantu languages where structurally low verbal inflections related to object marking and focus behave as if they are derivationally late, merged into the structure after other structurally higher elements (like tense and subject agreement) are added. A DMS approach predicts that tense and subject agreement should become productive in adult-like ways in child speech before these object markers do. These are selected examples of an effectively infinite number of specific predictions. Anywhere that we have relatively high confidence about the structure and derivational process generating a grammatical construction in Minimalist analyses of adult grammar, DMS makes a prediction about acquisition.

The same kinds of predictions can be constructed based on any instances of clear structural hierarchy and/or derivational sequencing in adult grammar. For example, it has been established that progressive aspect in (at least) English (*is V-ing*) is inside the lower phase of the derivation—that is, internal to the *v*P phase (Harwood, 2015; Ramchand, 2018). Perfective aspect in English (*has V-en*), on the other hand, clearly behaves structurally higher, in the inflectional domain (outside the *v*P phase). Given the assumptions of DMS, this predicts that English-learning children should become productive in adult-like ways with progressive aspect before perfective aspect becomes productive for them. While there is a range of research on acquisition of aspect (Shirai and Andersen, 1995; Andersen and Yasuhiro, 1996; Li and Shirai, 2000), from what we can tell the question that we've posed here has not been investigated in precisely these terms. But this is an example of a clear prediction of DMS that can be investigated to test these claims: children learning English (and any language with a similar structure of progressive vs. perfective aspect) should produce progressive aspect in adult-like ways before they produce perfective aspect in adult-like ways.

There are also broader cross-linguistic predictions: anytime there is a cross-linguistically viable generalization regarding structural hierachy and/or derivational sequencing (in Minimalist analyses), a DMS approach predicts a parallel sequence in acquisition. That is, if X is derivationally earlier than Y in the analysis of adult grammar, children should become productive in adult-like ways with X before they do with Y. For example, the broad findings of Minimalist enterprise have held that agentive subjects are structurally higher (in their base position) than internal arguments in their base position (a robust crosslinguistic generalization). Based on this, DMS predicts that internal arguments of verbs (thematic objects) should become productive in adult-like ways before agentive subjects do. This is consistent with the findings of Theakston et al. (2015) for English-learning children, and we would expect additional evidence for English to confirm this, but per DMS, this generalization should also hold up crosslinguistically.

Likewise, as we discussed in §2.2, cross-linguistically, tense/TP is universally structurally higher than the components of *v*P (base positions of predicates and arguments). We would there-

fore expect, cross-linguistically, for children to become productive in adult-like ways with core aspects of argument structure before become productive with tense marking. This makes the prediction that the proposed root infinitive (root default, optional infinitive) stage of acquisition should in fact be universal in the same way. This has been a point of contention in the literature, but as we've noted above there is good reason to think that this is the case even in languages where it is not as morphologically obvious as it is in English/German. Specifically, it has been claimed that children learning some languages do not go through such a stage, with the claim centered on null subject languages (Wexler, 2011, 1994, 1998, 2000). There is fairly robust resulting literature from null subject languages, however, that children use default forms that are language specific (common in their input): these forms are simply less morphologically marked than morphological root infinitives are and therefore less obviously non-adult-like (Austin 2010; Perales et al. 2005; Avram and Coene 2007; Georgiou et al. 2016; Avram and Coene 2011; Pratt and Grinstead 2007, 2008, as well as others noted below). Because of the centrality of the root default stage to DMS claims, we give some additional detail on relevant studies below.

For example, Pratt and Grinstead (2007) point out that Spanish, Catalan, and Italian-learning children frequently produce verbs in a form that is ambiguous between a non-finite imperative form and a third-person singular present tense form. These languages allow null subjects, so there is often no overt subject to distinguish between a correctly-inflected third-person form and a non-finite default form. They refer to these kinds of forms as "bare stem" forms, as the verb appears only with the verb root and the theme vowel.

(52) a. Corr-e. [Spanish]
Run-2nd,sg.,imperative
"Run."

b. Corr-e.
Run-3rd, sg., indicative
"(He, she, it) is running./(He/she/it) runs."

The challenge of analyzing such forms is that, in a null subject language, the subject is often not pronounced and therefore the pronounced form in child speech remains ambiguous as to whether it is an adult-like use of a verbal form or not. "[B]y virtue of lacking overt subjects, roughly 80% of all child verbs do not allow for the possibility of judging directly whether or not there is a mismatch in agreement between a 3rd person or bare stem verb and its subject, which we take to be an example of a nonfinite verb in Spanish" (Pratt and Grinstead, 2007, 352). As noted by Pratt and Grinstead (2007), Grinstead (1998) does identify some examples of null subjects that nonetheless seem clear to be non-adultlike use of tense/aspect, illustrated in (53).

(53) Eduardo - 2;5 [Spanish]
No puede.
not can.3rd.sg
"(S/he) cannot."
responds to the investigators' question of whether he can put two pieces of a puzzle together.
(Pratt and Grinstead, 2007, 353)

What we see in examples like this is that the verbal form employed is itself a possible verb form in the language, but it is used in the wrong context. Pratt and Grinstead (2007) cite a broad

range of studies that demonstrate that such default verb forms are overused in child speech, gradually replaced by more adult-like forms (see, for example, Grinstead 1994, Grinstead 1998, Grinstead 2000, Radford and Ploennig-Pacheco 1995, Davidiak and Grinstead 2004, Clahsen et al. 2002, Liceras et al. 2006, and Davidson and Goldrick 2003).[9] This is an instance of what Hyams (2005) refers to as a Root Infinitive Analogue (RIA); i.e. a verbal form in child speech that is not an ungrammatical form in adult speech, but is co-opted by children for more general use as a default verb form, and as such is overused in non-adult-like ways in child speech during the Root Infinitive stage of acquisition.

There are a host of studies arguing for RIAs in both related and unrelated languages: verbal forms used by children that are grammatical verb forms in adult language, but which are overgeneralized and overused by children during this stage of acquisition. This claim has been advanced for Greek-learning children employing a bare perfective form (Varlokosta et al., 1996; Hyams, 2002, 2005), Tamil-learning children employing bare verb stems, infinitives, and participle forms (Murasugi, 2017; T. and Vainikka, 1994; Lakshmanan, 2006), Japanese-learning children employing several verb forms as root infinitive analogues, including a past-marked form of verb verb, a bare verb form, and a mood-marked form (Sugiura et al., 2016; Murasugi, 2017; Murasugi and Nakatani, 2013), Korean-learning children employing a default mood-marked form (Murasugi, 2017; Kim and Phillips, 1998), and Italian-learning children employing imperative forms (Salustri and Hyams, 2003, 2006). The presence of these root infinitive analogues is consistent with the DMS prediction that there is a universal stage where children's use of predicates and arguments is more adult-like than their use of tense/aspect/agreement is: there is nothing special about infinitive morphological forms of verbs, *per se*: instead we would expect children to co-opt underspecified and frequent verbal forms in their input as default verb forms in their own utterances, with the particular details about what those verb forms are varying from language to language (as the choice is driven by the input). All of this is to say that the long-standing question in the acquisition literature (does a root infinitive stage exist?) is just as pressing for DMS; the state of the literature at present does appear to support the conclusion that it does, and future research on the question will continue to be a central way to test the viability of DMS.

Another parallel point that we mentioned in §2.2 is that there is a cross-linguistically stable hierarchy of adverbials. In the DMS context, this would predict that children are productive in adult-like ways with structurally low adverbials before structurally higher ones. This is much more difficult to investigate with respect to productivity, however: the broad optionalty of adverbs and adverbial modifiers more generally makes it challenging to investigate their grammatical productivity. But if a measure could be devised that is viable for optional elements, the hierarchy of adverbials cross-linguistically suggests a parallel sequence of acquisition.

To be clear: we do not mean to imply that errors will be absent at later stages of development. For DMS to be viable, however, we would expect the errors to be instances of lexical knowledge, for example, learning which class/category a particular verb belongs to (e.g., errors of the *don't giggle me!* sort). As we discussed at various points above, overregularization errors are themselves evidence demonstrating the acquisition of grammatical generalization. In these instances, acquiring the appropriate grammatical generalization can result in children making

[9] Pratt and Grinstead (2007) also report the results of a grammaticality judgment task that show that children at the root infinitive stage are also non-adult-like in their evaluation of finite verb forms.

the error of applying that generalization in places where it doesn't apply in adult grammar (e.g., in instances of irregular inflection or derivational processes). What we don't expect, however, is for some structurally higher (and, specifically, derivationally-late) component of syntax to be acquired by children in adultlike ways before derivationally-earlier components of syntax are acquired.

5.4 Conclusion: DMS can be Investigated Empirically

This manuscript is not an attempt to argue from the ground up that DMS is true—that task is too large. Instead, we attempt to show that 1) it is empirically plausible based on what we do know about acquisition, and 2) there are clear avenues to future investigation that can confirm or falsify the claims advanced here.

In this section, we've given some initial directions that we think are most promising for evaluating the claims of DMS. The most consistent correlation we see in the literature between Minimalist derivations and acquisition is with children's productive utterances of grammatical structures. In some instances, this is relatively clear, as in the case of over-regularization errors. But there are many times when language properties are not conducive to such errors occurring, in which case the conclusion of child's productivity (or not) with a component of language grammar is left to more nuanced measures.

Hopefully it is clear that DMS as articulated in (51) can itself be correct, while the hypothesis posited here (that it is correlated with expressive productivity) can be incorrect. In our survey of the literature, it has seemed to us that the strongest correlations are always in children's productive utterances. That said, these could in fact be lagging indicators, and perhaps there is evidence that someday can be adduced that the correlation is at a level of knowledge that precedes production.

6 Mixed-status Utterances

Before ending this chapter, there are some limited comments to add on the degree of grammaticalization of children's utterances. The account presented here recognizes that children actively express language knowledge that is not (yet) fully grammaticalized (i.e., that is the result of mimicry or immature grammatical representations rather than robust adult-like generalizations). But in the context of the kind of incremental structure-building that DMS posits, this entails that any utterance from a child is partially the result of adult-like grammatical knowledge and is partially the result of not-yet-grammaticalized language knowledge.

In the case of early small clauses uttered by children, on the approach described here the item-specific constructions in (54) eventually become abstract generalizations for children, combining a predicate with an argument.

(54) *more X*; *allgone X* ; *go X* ; *see X*; *X gone*; etc.

(55) Abstract small clause: [Predicate X] (X = THEME thematic role)

Stages of acquisition overlap, and children are never learning just one thing at a given point

in time; likewise, it is well-established that children's grammatical knowledge is much richer than their productions reveal (Soderstrom, 2003; Gerken et al., 1990; Shi et al., 2020; Shi and Melançon, 2010; Bernal et al., 2010; Lukyanenko and Fisher, 2016; Kim and Sundara, 2021; Legendre et al., 2010; Bernal et al., 2007; Fisher, 2002a,b; Akhtar, 1999, among others). But around the time that children are acquiring a fully abstract pivot schema/small clause, they are also using subjects in a variety of constructions. Considering an oversimplified sample utterance of a child at this stage like in (56a), we can see that there are (at least) two analyses of their grammatical knowledge at this point. One is the item-specific construction following Tomasello, which is a so-called "flat" structure in (56b), where each element is equally connected to each other (as proposed by Tomasello 2003). The other is the hierarchical structure in (56c), where the predicate "eat" and the theme object ' rice" are more closely related to each other than they are to the subject, because the utterance in (56a) is based on an abstract construction ([Predicate X]) which is being combined with an item-specific subject in this instance.

(56) a. Alex eat rice
b. SUBJ-EAT eat OBJ-EAT **flat structure**
c. Alex [eat rice]
SUBJ-EAT [Predicate THEME] **hierarchical structure**

There are many reasons from adult grammars and from child language to think that the hierarchical structure in (56c) is appropriate, rather than the flat structure in (56b). There is a wealth of empirical evidence from adult languages that theme objects are more closely related to verbs than agentive subjects are, suggesting that such hierarchy should be a reasonable analysis of child language as well (see Baker 2009 for discussion). And, similarly, Theakston et al. (2015) argue that at early stages of development, English-learning children around age 2 show flexible and creative (i.e., productive) use of objects, whereas subjects are much more restricted in their distribution until closer to age 3. Theakston et al. (2015) conclude that objects approach adult-like usage earlier than subjects do. This is highly suggestive that a flat structure (even for apparently item-specific transitive constructions) is not appropriate even at these early stages of grammatical knowledge. Instead, a hierarchical structure like (56c) is more appropriate: an item-specific subject generalization (SUBJ-EAT), but a verb-object sequence based on an abstract generalization, the small clause abstraction ([Predicate THEME]).

We can refer to such structures as **mixed-status utterances**, i.e., instances of utterances that are partially composed based on abstract grammatical knowledge, and partially composed based material that is either non-grammatical (i.e., memorized strings) or immaturely-grammatical (i.e., item-specific constructions).[10] We would expect, in principle, that there can be two sorts of mixed-status utterance: one which combines an abstract construction with a holophrase (a memorized amalgam), and one which combines an abstract construction with an item-specific

[10]While the formulation here is quite different, as are many theoretical conclusions, the idea of mixed-status utterances that we adopt here is essentially directly parallel to the *juxtaposition* and *superimposition* operations proposed by Ambridge and Rowland (2009). The approach to wh-question acquisition from Rowland et al. (2005) requires a similar approach, as we discuss in Chapter 4. And the idea of multiple structure-building mechanisms is frequently invoked in both descriptive grammars and also theoretical work: a paratactic, non-subordinating mechanism of associating two phrases (Progovac 2015 calls it Conjoin) and the subordinating, hierarchy-inducing structure building mechanism (Progovac 2015 adopts Chomsky's Merge operation for this).

construction.

(57) Two kinds of mixed-status utterances
  a. holophrase + [abstract construction]
  b. item-specific construction + [abstract construction]

The idea of mixed-status utterances is quite familiar, both from usage-based researchers (Dąbrowska, 2008; Rowland et al., 2005; Dąbrowska and Lieven, 2005; Dąbrowska et al., 2009) as well as from generative researchers who have advanced proposals sharing similarities, such as the use of underspecified/underdeveloped functional projections like a non-categorial functional projection (Clahsen, 1990/1991). One example is Rowland et al.'s (2005) analysis of children's acquisition of simple *wh*-questions as utilizing a frame of a *wh*-word and an auxiliary (e.g., *who did...*, *what did ...*) combined with some previously-grammaticalized sentential structure. The existence of mixed-status utterances is also a fairly strong necessity in general, as children are well known to develop productive knowledge in some areas of grammar (e.g., argument structure of predicates) while remaining decidedly non-target-like in other areas (like tense/aspect, use of complement clauses, etc.).

Another example is the root default/root infinitive stage of acquisition as an example.[11] We expect largely target-like use of argument structure that is productive in novel contexts, but which is paired with non-target-like use of grammar other than argument structure (including tense, agreement, and aspect, among other things).

(58) a. holophrase + [AGENT [Predicate THEME]]
  b. item-specific construction + [AGENT [Predicate THEME]]

Children, of course, eventually arrive at target-like knowledge of tense and thus grammaticalize a representation of tense. According to DMS, the tense generalization is grammaticalized on the foundation of the previous generalizations, retaining the earlier knowledge.

(59) [TENSE [AGENT [predicate THEME]]]

The point is that we expect that during acquisition, children utter mixed-status sentences: portions of their utterances are built on grammatical abstractions, whereas others are formulaic (i.e., less creative and flexible, and more directly copied from the input).

7 Intermediate Summary and Looking Forward

This chapter has explored the various empirical and theoretical consequences of the core DMS proposals. In §1, we explored the idea that language knowledge is an inventory of master trees for various constructions, a parallel of the long-posited "constructicon" from usage-based construction grammar. In §2, we discussed the well-established Hierarchy of Projections and related phenomena like adverb hierarchies, proposing that they may be considered reflective of stages

[11] See Grinstead (2016) and Vainikka and Young-Scholten (2011) for overviews and discussion. The "root default" term is due to Vainikka and Young-Scholten (2011).

of acquisition: similar reasoning is pursued in the discussion of phases in §1 of Chapter 5. And in §3, we discussed the idea of *ontogenetic fossils*: some aspects of adult grammatical knowledge are relics of earlier stages of development. In that section, we considered the idea that movement operations are the result of children grammaticalizing a structural position of a phrase and later grammaticalizing a new position of that phrase. This is because (on a DMS perspective) acquisition of more complex stages of grammar adds to instead of replaces early stages of grammatical knowledge. The result is that some constituents are represented in multiple structural positions in adult grammatical knowledge, with the lower positions describable with the metaphor of a fossil, a remnant of an earlier stage of knowledge.

The remaining portions of this chapter tackled empirical questions, with the main goal of clarifying the stances that a DMS perspective must take on interpreting child language data. Consistent with the stance we take throughout this volume, we consider an emergent approach to theories of UG (which we can call UCL, Universal Cognition for Language) wherein little specific syntactic structure is attributed to innate mechanisms, and instead a limited number of cognitive mechanisms for mentally representing gramars (like Merge or Agree) cooperate with domain-general learning processes like statistical learning to produce adult grammatical constructions. In §4, we briefly surveyed a range of work arguing for this kind of integration of statistical learning in language acquisition, work that suggests that many aspects of children's grammatical knowledge arise as they make generalizations based on their language input. Of course, this raises a hard question: if DMS proposes a correlation between derivations of adult grammatical constructions and acquisition sequences, what point in acquisition does DMS purport to correlate with Minimalist derivations?

In §5, we suggested that the most promising correlation is with children's productive use of various elements of grammar. We discussed various approaches to measuring children's grammatical productivity and offered Theakston et al. (2015) as a model of investigating the kinds of predictions that DMS makes. And §6 explored a particular consequence of this view of grammar that is relatively familiar: children's utterances necessarily simultaneously include components generated by abstract rules and components that are more item-specific.

As §5 makes clear, there are a host of empirical questions to be explored from the perspective of DMS, and DMS is by no means an empirical certainty. But it is plausible based on a large range of existing knowledge about acquisition of syntax, and its predictions are testable, although testing grammatical productivity is no simple matter. However, because this work is primarily a work of theory, we will mostly set aside the task of testing DMS's empirical predictions and continue with various theoretical consequences of DMS in the chapters that follow.

In Chapter 4, we explore a particularly notable component of DMS: namely, instances of countercyclic or otherwise non-canonical derivational timing may be taken at face value. That is to say, countercyclicity—instances where a syntactic derivation does not proceed bottom-up in a strict monotonic fashion—is often viewed as an anomaly that should be explained away. A DMS view that links derivational timing with timelines of child language acquisition, however, opens the door to recognizing countercyclic constructions as empirically real, but as instances where components of the syntactic construction were acquired in a noncanonical sequence.

Chapter 5 is somewhat similar to this chapter: it offers thoughts on how the core DMS proposal can be extended into various aspects of syntactic/grammatical knowledge. In that chapter,

however, we have collected those extensions that are more speculative and less central to the main claims of DMS. All pose very interesting questions, however, which would be excellent domains for future research.

Chapter 4

Lessons from the Timing of Derivations

Michael Diercks
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There are important caveats to the description of DMS in Chapters 2 and 3; these caveats are the topic of this chapter. The preceding claims are novel in the sense that they themselves have not been articulated in this manner (to our knowledge), nor has there been made such an explicit, pervasive link between Minimalist derivations and acquisition timelines as we have articulated as part of DMS in (1) (repeated below as (60)). That said, what we've argued for so far can be considered (to some extent) a modernization and refinement of previous proposals for syntax-acquisition correspondences (see §5.3 of Chapter 2). It is our claim, however, that there is an *additional* syntax-acquisition correspondence that has not been previously noted in this discussion: countercyclic processes.[1] Recall the formulation of DMS:

(60) **Developmental Minimalist Syntax**
The Minimalist derivation of adult language structures recapitulates the ontogenetic (i.e., organism-internal) development of those same syntactic structures.

DMS does not directly associate structural hierarchy with acquisition timelines.[2] Instead, DMS correlates the Minimalist *derivation* with acquisition timelines. Of course, in many instances such a correlation is the same as one between structural hierarchy and acquisition. However, this distinction also allows for mismatches between hierarchy and derivational timelines. We explore two such analyses that deviate from strict bottom-up derivations in this way. First is Late Merger, where a head or phrase is Merged into existing structure in violation of the Extension Condition

[1] As we mention in §5.3 of Chapter 2, Lebeaux (1988, 2000) does propose that countercyclicity has relevance in this kind of way, but many of those proposals predated Minimalism as currently practiced and thus did not connect to the broader range of theoretical work as we can now. Furthermore, that discussion appears to have been largely overlooked by the field.

[2] See Rizzi (1994) and Vainikka and Young-Scholten (2011) for ideas along these lines.

(see §1 below for details).[3] Likewise, the field is familiar with look-ahead problems (discussed in §2), where an operation (often movement) happens derivationally preceding the point that the supposed trigger of the operation has been Merged into the structure (Bošković 2007, Epstein and Seely 2006, among others). In this manuscript, we use the term "countercyclic" to refer to a step in the Minimalist derivation that does not proceed in line with strict bottom-up structure building, so we refer to both Late Merger and look-ahead as countercyclic processes. This chapter also tackles a relatively novel analysis of the construction of DPs ("layering," Thoms 2019) which is not countercyclic by this definition but is nonetheless an instance of non-traditional derivational timing (as will be explained in §3).

We have titled this chapter "Lessons from the timing of derivations" to highlight the tight link between derivational sequences in Minimalist analyses and acquisition timelines. To be clear, however, the terms "timing of derivations," "derivational timelines," and "derivational sequences" all refer to properties of Minimalist analyses and not directly (in any way) to real-world chronology. That is to say, the "timing of a derivation" refers to the ways in which operations are sequenced in the syntactic analysis. This terminology will be familiar to some Minimalist syntacticians, but in this context it is easy to conflate references to "timing" (or "early" and "late" with real world-chronology. So we don't mean to refer to the chronology of acquisition (younger ages vs. older ages of children), or comparing different children's developmental sequences (e.g. some children doing something later than others): those terms *do* refer to real-world chronology. Timelines of derivations in adult grammar are about the sequence of operations in a derivation that are analytically necessary to explain the adult grammatical structure, and "early" and "late" in this context refer to the idea that countercylic operations purportedly allow operations to occur earlier or later than they should have based on canonical strict Merge-based structure-building. Of course, the core claim of DMS is that there is an inherent link between derivational timing and sequences of acquisition, so our claim is that derivational timeline and real-world chronology are in fact related, but it's important to keep the terms conceptually distinct in order for the argumentation to make sense.

Countercyclic operations are generally thought to be illicit in Minimalist theory. Late Merger violates the Extension Condition by tampering with the root structure rather than extending it, and look-ahead "presume[s] that it is somehow possible to look ahead and 'see' that there will be a trigger for movement later in the derivation. … However, such look-ahead is at best computationally costly and at worst unimplementable" (Epstein and Seely, 2006, 123). Chomsky has similarly argued against countercyclic analyses:

> *[Countercyclicity is] completely unacceptable, because it involves operations that are complex, unmotivated, they have nothing to do with the goal we think we ought to obtain, something like the Strong Minimalist Thesis (SMT) … A lot of these proposals about Late Merge give very interesting descriptive results, … [but] what are apparently solutions are in fact problems, problems that now have to be addressed.* (Chomsky, 2019, 267)

Nonetheless, countercyclic analyses do appear to be well-motivated for certain empirical

[3] There is a broad range of relevant work on these issues (Takahashi and Hulsey, 2009; Lebeaux, 1988, 2000; Fox, 1999; Stepanov, 2001; Nissenbaum, 1998; Sauerland, 1998; Abe, 2018; Haddad, 2019; Zyman, 2021; Bhatt and Pancheva, 2004).

phenomena, and analyses dependent on countercyclic proposals can be found again and again in the literature.[4] We suggest that DMS offers a different approach to countercyclicity. Rather than analyses like Late Merger and look-ahead being problematic for Minimalist theory, we claim that they should be accepted as part of Minimalist theories of structure-building and that they further demonstrate DMS: deviations from strict bottom-up structure building in adult structures arise because of parallel "deviations" from bottom-up structure building in acquisition which (on DMS assumptions) are therefore necessarily a component of adult grammatical knowledge. So constructions that are acquired "earlier" or "later" than their immediate grammatical surroundings are expected to behave as derivationally "early" or "late" in adult syntactic structures.[5]

To be clear, we are not saying that "early/late" means "early/late" in a child's age in a direct sense or "early/late" on some direct chronological timeline. Rather, "early/late" in this discussion specifically means "earlier/later than should occur on a strict bottom-up approach to structure building." So in any instance of an operation occurring "early" in our discussion (whether in adult syntax or as part of acquisition in a DMS context), we mean that a child has acquired a piece of grammatical knowledge earlier than we would expect if grammatical structures are built only bottom-up. In the same fashion, acquiring something "late" in this discussion is also relative: it means a piece of grammar was acquired later than expected if all structures were built strictly bottom-up. In a Minimalist theory that outlaws all countercyclic operations (as canonical approaches would), an element's structural height is directly correlated with its sequence in the derivation building the structure. But in approaches that allow countercyclic operations (as many empirical phenomena seem to demand), a grammatical element can be added to a structure derivationally late but structurally low (so-called Late Merger). On a DMS approach that associates adult derivational analyses with acquisition timelines, this of course does equate indirectly with sequences of time over a child's acquisition of grammar. But we use the terms "early" and "late" specifically to be relative to a sequence of analytical/acquisition events (structure-building), rather than requiring a link with real-world chronological time. These issues will also become clearer as we discuss specific examples below.

In addition to our discussion of processes that we define as specifically countercyclic, we also devote some time to an analysis of atypical derivational timing that has interesting implications for a DMS approach, what Thoms (2019) calls a "layering" approach. On this approach, nominal constituents are not first-merged into a syntactic structure in their final form, but rather the construction of the nominal constituent is distributed over the course of the construction of the clause. As we will see, layering analyses are not countercyclic in the same way that Late Merger and look-ahead are, but they are non-canonical and critically rely on sequences of derivational timing that make clear predictions for acquisition.

In §1.1, we outline the properties of Late Merger in adult grammar, and in §1.2 we introduce

[4] In addition to the major examples discussed here, other instances of countercyclic analyses in Minimalist theorizing include upward-probing Agree (Baker 2008, Bjorkman and Zeijlstra 2019), delayed probing (Zeller, 2015), Structure Removal (Müller, 2017), and Exfoliation (Pesetsky, 2021), among others.

[5] A central point to many critiques of countercyclicity (see Sportiche 2019 in particular) is that it's not clear how countercyclic processes are constrained: clearly there is some sense that extending the root is the typical/canonical method of structure-building, so what limits the application of countercyclic processes to the instances where we see them? This is a crucial question, but we don't explore it here. See §6 for additional discussion, but this important theoretical question is one that we don't answer in this monograph.

evidence from the acquisition of relative clauses (which are frequently analyzed as undergoing Late Merger) to argue that derivationally countercyclic processes in adult grammar are in fact correlated with parallel sequences of acquisition.

Then, in §2, we introduce look-ahead problems, demonstrating that children at times can acquire partial generalizations about some components of grammar before they have acquired (what seem to be) necessary prerequisite components of the grammar. We argue, again, that this is well-founded in the acquisition data: when children have robust overt evidence of some grammatical pattern in their input, they can acquire that pattern, even if they don't yet have the full grammatical properties those structures will eventually take on in adult grammar. We will show that these situations are encoded in adult grammar as look-ahead problems.

§3 introduces layering derivations, providing relevant empirical evidence from adult grammars and then discussing how a layering approach to construction of nominals predicts that in their lowest position nominals are nPs instead of full DPs; full DPs only enter structures later. We argue that this correlates straightforwardly with children's earliest productive constructions, the so-called telegraphic stage of acquisition where children's productive utterances include only lexical categories and lack functional categories.

The point of this chapter is essentially to demonstrate that there are a number of instances where the particulars of derivational sequences in adult grammars still correlate directly with acquisition timelines despite them not fitting the traditional/canonical sequence of "bottom-to-top." We take these as strong evidence for the viability of a DMS approach in general, and we expect that these conclusions can be informative for Minimalist syntacticians of adult grammars: given that the existence of countercyclic operations in our theories is contentious, what we provide here is a rationale for why we ought to allow countercyclicity to remain in our theories of syntax.

1 Late Merger as "Late" Acquisition

1.1 Introduction to Late Merger

Late Merger analyses have primarily been prompted by anti-reconstruction effects, so we first offer a brief summary of reconstruction and anti-reconstruction before turning to Late Merger and, in §1.2, the relevant ties to acquisition. First, reconstruction effects—when an A'-moved phrase is interpreted in its base (pre-movement) position—are widely recognized among syntacticians. Anti-reconstruction effects also exist, wherein a phrase that would be expected to exhibit a reconstruction effect does not.[6]

(61) is an instance of reconstruction, when a moved phrase is interpreted in its base position. The relevant data considered here are the available interpretations of the pronoun *he*: the pronoun may refer to some other referent, but cannot corefer with *Picasso*.

(61) [Which pictures of Picasso$_i$] did he$_{k/*i}$ sell ~~which pictures of Picasso~~?
(Adapted from Sportiche 2019, 416)

[6]The discussion that follows presupposes familiarity with Chomsky's (1981) Binding Theory: see Truswell (2014) for a relatively recent overview.

In (61), the R-expression *Picasso* is embedded inside a PP, so in its overt position it neither c-commands nor is c-commanded by *he*. If the R-expression were interpreted in this position, we would expect both readings of the sentence to be grammatical, because Principle C of binding theory ("R-expressions can never be bound") would be satisfied regardless of whether *Picasso* and *he* co-refer. This is illustrated in (62), where coreference between the R-expression and the pronoun is perfectly acceptable; this is not an instance of *wh*-movement, so the subject phrase *friends of Picasso* c-commands the object pronoun *him*. But notably, the R-expression *Picasso* itself does not c-command the pronoun (or vice versa), so coreference is unproblematic.

(62) [Friends of Picasso$_i$] always visit him$_i$ when they are in town.

But (61) above is ungrammatical on the coreference reading. To explain this ungrammaticality, the entire phrase *which pictures of Picasso* is analyzed as "reconstructing:" it is interpreted in its base position, where it first Merged as a complement of *sell*. With the phrase interpreted in this lower position, *he* c-commands *Picasso*; this c-command relationship leads to a clear violation of Principle C on the coreference reading. Thus, reconstruction offers an explanation for why sentences like (61) are ungrammatical when there is coreference between the R-expression and the pronoun. Reconstruction phenomena are well-documented in adult syntax (Lebeaux, 1991; Romero, 1998; Fox, 1999; Fox and Nissenbaum, 2004; Sportiche, 2005; Richards, 2013, among many others).

While reconstruction effects account for many empirical patterns, a puzzle arises when considering highly similar sentences that do not have the same patterns of grammaticality. Consider example (63), where we show the gap in the lower clause with empty underlining.

(63) [Which villages near Picasso$_i$'s estate] did he$_{k/i}$ visit __?
(Adapted from Sportiche 2019, 416)

On the account described for (61), in (63) we would expect the entire phrase *which villages near Picasso's estate* to reconstruct, being interpreted in its base position as a complement of *visit* and thus yielding a Principle C effect in the same way that the coreference reading of (61) does. But, contrary to this expectation, (63) is grammatical even with a coreference reading between the pronoun *he* and *Picasso*. This is an antireconstruction effect, that is, an instance where reconstruction would perhaps be expected to occur, but does not.

The key difference between (61), which shows reconstruction, and (63), which shows antireconstruction, is that *of Picasso* is a complement of *pictures* in (61), while *near Picasso's estate* is adjunct to *villages* in (63). So why do complements in *wh*-phrases seem to reconstruct while adjuncts do not?

This leads us to Late Merger, an analysis that has been used to account for a wide variety of empirical phenomena, most prominently for anti-reconstruction effects (Lebeaux, 1988, 2000; Takahashi and Hulsey, 2009; Stepanov, 2000; Zyman, 2021). The proposal is as follows: when the *wh*-phrase is first Merged with *visit* in the derivation of (63), it doesn't yet include the adjunct *near Picasso's estate*. The PP *near Picasso's estate* is Merged into the structure only after the *wh*-phrase moves to its overt position in Spec,CP. This is illustrated in (64), where the lower copy of the *wh*-phrase does not yet contain its adjunct.

(64) [Which villages near Picasso$_i$'s estate] did he$_{k/i}$ visit ~~which villages~~?
(Adapted from Sportiche 2019, 417)

On many accounts of Late Merger, it has been suggested that it applies to adjuncts but not to complements (Lebeaux, 2000; Stepanov, 2001; Zyman, 2021).[7] Thus, Late Merger offers an explanation for why a reconstruction effect is observed in (61), with *Picasso* in the complement of the *wh*-phrase, but an anti-reconstruction effect appears when *near Picasso's estate* is an adjunct to the *wh*-phrase in (63).

In a more general sense, Late Merger can be schematized as in (65).

(65) a. $[_{XP}\ X\ [_{YP}\ Y\ [_{ZP}\ \ldots\ Z \ldots\ ]\ ]\ ] \rightarrow$
b. $[_{XP}\ X\ [_{YP}\ Y\ \boxed{[_{LP}\ L}\ \ [_{ZP}\ \ldots\ Z \ldots\ ]\ ]\ ]\ ]$

The structure in (65a) is built first, and only after that is L Merged into the structure. Instead of extending the root (i.e., L Merging with XP), L/LP Merges with ZP lower in the existing structure. Such operations are frequently assumed (or explicitly argued) to be illicit. Chomsky (2008, 138) claims that "Merge is invariably 'to the edge,"' building on a history of claims from Chomsky (1995, 2001) that structure-building via Merge necessarily follows what is usually referred to as the "Extension Condition," a requirement that applications of Merge extend the root of the structure. We will comment on some of these critiques in §4, but we set them aside for the moment.

1.2 Acquisition of Relative Clauses

The original proposals about Late Merger centered on the (anti-)reconstruction effects of complement clauses as opposed to relative clauses (Lebeaux, 1988). Several examples are given in (66) and (67), where in the (a) examples the *wh*-moved phrase contains a complement clause, and the (b) examples contain a relative clause.

(66) a. *[Which report [that Tre$_k$ was incompetent]]$_i$ did they$_k$ submit t_i? **Comp. Clause**
b. [Which report [that Tre$_k$ revised]]$_i$ did they$_k$ submit t_i? **Rel. Clause**
(adapted from Freidin, 1986, 179)

(67) a. *[Which argument [that Ayesha$_k$ is a genius]]$_i$ did she$_k$ believe t_i ? **Comp. Clause**
b. [Which argument [that Ayesha$_k$ made]]$_i$ did she$_k$ believe t_i? **Rel. Clause**
(Fox, 1999)[adapted from][164]

As the (a) examples above show, when an R-expression is included in the complement clause of a *wh*-moved object, that R-expression cannot be coreferent with a pronominal subject lower in the clause. There is no c-command relationship in the surface position of the R-expression and the pronoun, so the surface positions don't rule out this coreference. Instead, as

[7] There are debates about whether Late Merger applies to some or all adjuncts (see Lebeaux 2000, Stepanov 2001, and Zyman 2021 for discussion), and Takahashi and Hulsey (2009) argue that complements may also be late merged, contingent on additional licensing properties for the relevant nominals. Both of these issues are relevant to a comprehensive theory of Late Merger as an acquisition phenomenon, but at present we are simply building the initial argument.

discussed above, this is an instance of the *wh*-phrase (which contains the R-expression inside the complement clause) *reconstructing* to its base position (the position of the trace), and binding is calculated based on that position. In that position, the pronoun *does* c-command the R-expression, explaining the lack of coreference.

The (b) examples in (66) and (67) are parallel in every way except that the R-expression in the *wh*-phrase is inside a relative clause instead of a complement clause. Based on standard assumptions, we would expect the *wh*-phrase to reconstruct, and as such we would expect Principle C to also render coreference ungrammatical in these constructions … but it does not. The anti-reconstruction effects of relative clauses were the first to motivate a Late Merger analysis (Lebeaux, 1988).

As Late Merged elements, relative clauses are added to the structure quite late in the derivation. It is not crucial exactly when they are late merged, but as seen in §1.1 *wh*-elements move to Spec,CP before relative clauses are Late Merged, so relative clauses must be Merged after CP is added to the derivation. More to the point of our examples here, despite the relative clauses being contained in noun phrases that enter the derivation structurally low (complement of the verb in the relevant instances in (66b) and (67b)), the Late Merger analysis claims that the relative clauses themselves don't merge with the DP until the DP has moved to Spec,CP: relative clauses join the structure after the point where *wh*-phrases have moved to their surface position. This particular articulation of derivational timing creates predictions from a DMS perspective. Recall that the DMS claim is that derivational sequences in Minimalist analyses recapitulate the sequence in which children acquire those structures. The DMS-based prediction, therefore, is that because relative clauses enter the derivation later than adult-like CP structure (and *wh*-movement) does, adult-like productivity with relative clauses will onset for children later than adult-like productivity with *wh*-movement/CP-structure does. This prediction is largely borne out, based on the existing research on these issues.

There is a rich history of work on the acquisition of relative clauses, though there tends to be an emphasis on comprehension as opposed to production (see discussion in Diessel 2004, 116ff). Given the hypothesis that we advance as part of DMS (a correlation between Minimalist derivations and children's productive, expressive use of structures), the relevant question is what the timeline is of children's productive, adult-like use of relative clause structures. This question is a subject of a growing amount of research (Diessel and Tomasello, 2005; Diessel, 2004; Brandt et al., 2008).

"Compared to complement clause constructions[—both nonfinite and finite—]relative clauses are infrequent in early child speech" (Diessel, 2004, 129). Diessel (2004) observes the earliest relative clauses at 1;9 years of age, but these early relative clauses almost always take the form of predicate nominative relatives containing a single proposition, a presentational construction as in (68).

(68) a. This is the sugar [that goes in there] . [Nina 3;0]
b. Here's a tiger [that's gonna scare him] . [Nina 3;1]
c. It's something [that you eat] . [Adam 4;0]
d. What is [that he has around his back] ? [Adam 3;8]
(Diessel, 2004, 131)

This is a notably simplified relative clause usage compared to those where the main clause and the embedded clause represent two distinct propositions. So an example like (69) is an example of a typical sort of adult-like relative clause that is missing in early child language.

(69) The children can see the tiger that is going to scare the zookeeper.
   a. Proposition 1, approx: the children can see the tiger.
   b. Proposition 2, approx: the tiger is going to scare zookeeper.

In fact, over 75% of children's early relative clauses are this type of presentational relative construction as in (68) (Tomasello, 2003). And Diessel (2004) notes minimal development in relative clause structure (i.e., these structures do not become any less formulaic) up through roughly 5;1 years of age, by which point children are quite advanced in their syntactic development. Around that time, relative constructions including two distinct propositions (as in (69)) begin to account for a higher proportion of the data.

So Diessel (2004) reports that, as is common in acquisition processes, children will use limited/immature versions of the relative clause construction relatively early, but full adult-like use of the construction lags behind the first uses of simple versions of those constructions (and in the case of relative clauses, lags far behind).

"Research on the production of relative clauses (RCs) in English has shown that although children start using intransitive RCs at an early age, more complex object RCs appear later (Hamburger and Crain, 1982; Diessel and Tomasello, 2005), and children use avoidance strategies, such as conjoined clauses and resumptive pronouns (Crain et al., 1990; McKee et al., 1998; McKee and McDaniel, 2001)" (Özge et al., 2010, 1). Furthermore, although early relative clauses are not frequent in English-learning children, the ones that do occur differ from the adult targets in two primary respects: pied-piping is absent, and resumptive pronouns are common. Because spoken English does not necessarily require pied-piping of prepositions with relative clauses (e.g., *The man to whom I sent the letter lives in Canada*), it is not shocking that pied-piping is avoided in production and rejected in comprehension by three to six year old English-speaking children (McDaniel et al. 1998). However, certain languages (e.g., Italian, French, and other Romance languages) mandate this type of pied-piping. Nevertheless, it is rarely found in the early speech of learners of these languages; instead, children replace the preposition-relative pronoun complex with the complementizer (Guasti 2016: 298). The problem with pied-piping in relative clause constructions does not reside in an inability to pied-pipe *per se*, since children at this age produce pied-piped interrogatives (Labelle 1990). On the other hand, resumptive pronouns are abundant in early relative clauses (e.g., *The one that he lifted it*) even though these constructions are not grammatical in the target language. This observation holds cross-linguistically at least for continental French, European Portuguese, Spanish, Serbo-Croatian, and English (Guasti 2016).[8] These non-adult-like patterns (i.e., the avoidance of pied-piping and the use of resumptive pronouns) persist until around nine years of age, at least for children acquiring Romance languages (Guasti 2016).[9]

[8] That is not to say that resumptive pronouns in relative clauses are a unique feature of child language; many languages including Irish, Palestinian Arabic, Welsh, nonstandard English, and certain colloquial varieties of Romance allow for resumptive relatives.

[9] This discussion undersells the range of interesting questions about developmental pathways for relative clauses.

Interestingly, studies that probe children's knowledge of relative clauses demonstrate that these types of structures are difficult for children to comprehend even after six years of age (Guasti 2016), a point at which most core grammatical structures like canonical declarative sentences and questions are comfortably productive for typical children (Thornton, 2016; Diessel, 2004; Ambridge and Rowland, 2009; Rowland et al., 2005; Rowland, 2007; Roeper and de Villiers, 2011; de Villiers, 2007). In this way, then, the acquisition of adult-like relative clause constructions occurs significantly later in acquisition than most other core grammatical structure, even compared to other relatively late linguistic acquisitions like finite complement clauses.

Recall that the anti-reconstruction effects of relative clauses appear in instances of *wh*-movement: *wh*-moved phrases are interpreted (for the purposes of binding) in their base position, but relative clauses fail to reconstruct in the same way: the Late Merger analysis is that relative clauses are Merged into the moved phrase *after* *wh*-movement has occurred. In §5.1 of Chapter 3, we outlined our proposal that, for DMS purposes, the relevant reference point in an acquisition sequence is when children are productive with a piece of grammar in an adult-like way. The relevant sequence of operations on a DMS analysis, then, is that *wh*-movement to CP is acquired by children in a productive manner before relative clauses. As we will discuss in §2, *wh*-movement to the left edge of the sentence is actually acquired *earlier* than CP structures generally, and relative clauses also lag behind acquisition of adult-like questions and core CP structure as well. If children don't become adult-like with relative clauses until after their other core grammatical structures are acquired—particularly for our concerns here, *wh*-movement—then their resulting adult grammar will show relative clauses joining their grammatical structures relatively late: that is, the Late Merger analysis of relative clauses and other adjuncts that we reference above.

We conclude that that the predictions from DMS are upheld in this instance: relative clauses appear late in Minimalist derivations, being Late Merged sometime after CP is added to the derivation and *wh*-movement has occurred. And similarly, children seem to learn relative clauses productively significantly after showing productive knowledge of CP.

1.3 Intermediate Summary: Late Merger

We have not attempted a systematic argument here that all instances of Late Merger (in derivational sequences in adult grammar) correlate to a similar sequences of in acquisition; there are enough Late Merger analyses in adult grammars that the predictions are too expansive to make such an argument possible in a volume like this one. Instead, we have shown an illustration of a countercyclic process that appears to be countercyclic in both adult and child grammar. Relative clauses are Late Merged in adult grammar (e.g., when they modify a *wh*-phrase, they Merge to that *wh*-phrase after it has moved to Spec,CP). Likewise, relative clauses are acquired late in the relevant respects: later than the DP structures they are contained in, and later than *wh*-movement constructions.

There is variation across languages with respect to what the simplest relative clause strategies are, and which structures lag behind in acquisition (behind those simpler structures) (Chen and Shirai, 2015; Hu et al., 2016, and references in both). Likewise, there is a host of research on comprehension of relative clauses that we don't engage here in any depth, given that our claims are about productive utterances and not comprehension (Eisenberg 2002, Kidd and Bavin 2002, and Labelle 1996, among others; see references in Diessel 2004, 116ff). All of this goes beyond our core questions here, however.

Even if we accept the conclusion that relative clauses are acquired relatively late compared to both other components of the noun phrase as well as *wh*-movement to CP, this does not address *why* relative clauses are acquired comparatively later. On the whole, we do not attempt to give such kinds of explanations in this volume (we are focused on showing relevant sequences rather then exploring learning mechanisms themselves); we can nonetheless offer some thoughts on why it is not entirely surprising. First, somewhat transparently, adult-like relative clauses require knowledge of whole-clause structures (as a relative clause itself is/contains a CP), so a child cannot have adult-like knowledge of relative clauses until they also have adult-like knowledge of full clause structures. Similarly, the relative semantic complexity of utterances that contain multiple distinct propositions (the asserted matrix proposition and the backgrounded proposition inside the relative clause) may also contribute to their delayed acquisition.

One final point that is worth making clear is that nothing about Late Merger requires that the Late Merged element be merged to a *wh*-phrase or be merged high in the grammatical structure. For example, take our sentence from above where the relative clause modifies the object in a declarative sentence:

(70) The children can see the tiger that is going to scare the zookeeper.

The DMS perspective on relative clauses implies that relative clauses are merged late in all instances, even in a sentence like (70). This is no problem: Late Merger as an operation need not target structurally high positions, as (somewhat by definition) it need not extend the root of the clause. Because of the lack of intersecting scope-sensitive operations in a sentence like (70), a sentence like (70) is unlikely to uncover evidence for the Late Merger of relative clauses (e.g., anti-reconstruction evidence): if the sentence doesn't create a context where reconstruction would be expected, we aren't going to uncover anti-reconstruction effects. But there's also no argument here against a Late Merger analysis of the relative clause in (70)—it is simply harder to diagnose in this instance.

This point is important, because it highlights the difference between structural height and derivational lateness. These two concepts are frequently overlapping in adult grammar, but the claim of countercyclic analyses is that they are not *always* overlapping, and DMS embraces countercyclicity wholeheartedly. For a more morphosyntactically transparent example of Late Merger adding structure to a structurally low position, see §3 in Chapter 5.

There are a large number of relevant patterns that we don't engage here, for the sake of continuing to offer a holistic perspective of DMS in this manuscript. For example, it has been claimed that adjuncts always Late Merge, as a general rule that is not restricted to relative clauses (Stepanov, 2001; Zyman, 2021; Abe, 2018). The acquisition work on adverbs/adjuncts more generally is relatively sparse, making it harder to evaluate the DMS predictions without novel empirical work.[10] Another example is that a prominent analysis of degree clauses in comparatives posits that the degree clauses are late merged to degree heads in comparative constructions like the underlined phrase in *Maisha ate more rice than Alex (did)* (Bhatt and Pancheva, 2004). As Syrett (2016) lays out, comparatives are quite semantically and syntactically complex, and "given all of these conceptual and linguistic components, it is perhaps not surprising that children are known

[10]Our research team has been working on the question of acquisition of adverbials, but it is an ongoing project to identify when grammatically optional elements are being used by children in an adult-like fashion.

to produce comparatives that differ markedly from the adult form up through at least six years of age" (464). Therefore, even at later stages of syntactic development, various kinds of errors are still present in children's comparative constructions. This requires detailed attention, of course, but it is promising that another domain where Late Merger has been invoked for adult grammars and likewise correlates to relatively late productive, targetlike acquisition of those constructions by children.

Similarly, Late Merger and other countercyclic analyses have been invoked for a fair number of constructions cross-linguistically, which have been researched to varying degrees of depth. Both the limited degree of work on those issues and the limited degree of acquisition research on many languages limit our ability to invoke many such constructions as evidence for DMS. We do discuss a significant relevant family of examples from Bantu languages in §3 of Chapter 5, however.

2 Look-ahead as "Early" Acquisition

Late Merger is countercyclic because an element is Merged *late* in the derivation, breaking the cyclical application of bottom-up Merge (which creates a structure that then itself participates in Merge) and violating the Extension Condition by not extending the structure's root. But we also consider look-ahead problems to be countercyclic, because a derivational operation happens *earlier* than would be predicted based on strict cyclic Merge. Look-ahead problems happen specifically when an operation occurs in the derivation that we analytically expect to be triggered by an element that is not yet Merged into the structure. The derivation seems to be able to literally look ahead to see what will happen later in the derivation (i.e., to see the desired final outcome), and this look-ahead triggers an operation (like movement) based on that desired outcome. As we will see in §2.2, these countercyclic puzzles are also readily explained by ties to children's language acquisition.

2.1 Introduction to Look-ahead Problems

A prominent example of a look-ahead problem is that *wh*-movement raises through lower phase edges before the target position of movement has been Merged into the structure (Spec,CP). Here, we mostly focus on matrix *wh*-object questions to simplify the discussion, although the same issues arise in embedded *wh*-questions, as we will show. (71) shows the derivation of a *wh*-object question:

(71) [$_{CP}$ Who do you ~~do~~ [$_{vP}$ ~~who~~ [$_{vP}$ ~~you~~ like ~~who~~]]]?

The look-ahead problem arises in (71) because (per the requirements of cyclic spell-out, i.e., derivation by phase), the *wh*-word moves Spec,*v*P before the rest of the derivation proceeds (Chomsky, 2001). However, at that point in the derivation, the [+WH] C is not yet part of the structure, so there is no clear immediate motivation for *who* to move to the edge of *v*P. This appears to require the computational system to "look ahead" in the derivation, foreseeing the eventual need for *who* to raise to Spec,CP, and ensuring its exit from *v*P to avoid being trapped in the spelled-out lower phase.

The same issue arises in long-distance *wh*-extraction, as illustrated in (72):

(72) [$_{\text{CP[WH]}}$ What$_k$ do [$_{\text{TP}}$ you ~~do~~ think [$_{\text{CP}}$ ~~what$_k$~~] [$_{\text{CP}}$ that Alex ate ~~what$_k$~~]]]]?

The problem here for a Minimalist derivation (on standard assumptions) is that on the bottom-up derivation of a sentence, the embedded *wh*-object *what* must raise to Spec,CP of the embedded clause (the circled copy) in order to escape spellout in the embedded clause and to be accessible to move to the higher clause. But there is no clear motivation for the *wh*-phrase to make its initial movements, as at the time that it must move, the matrix CP has not yet been merged. It is the matrix C head that is the one with the relevant Q/WH features to motivate movement: the embedded CP is plausibly neither *wh*-marked nor marked as a question.

There are various proposed solutions to these kinds of look-ahead problems: one commonly assumed solution is that there is an EPP feature on the intermediate movement positions (*v*P/CP). This is in many ways a non-explanation, however, when EPP features themselves have no principled explanation for why they appear in a position (or don't) in Minimalist theoretical approaches. That is to say, to posit that the intermediate CP in (72) or the intermediate *v*P in (71) bears an EPP feature simply moves the question to a different theoretical domain: instead of asking why movement occurs there, we have to ask why only in instances of a matrix *wh*-object construction do the embedded CPs and *v*Ps bear EPP features? That is to say, positing an EPP feature does make the computation proceed successfully, but it lacks depth of explanatory value and creates a different kind of problem akin to look-ahead: what requires the presence of intermediate CP and *v*P projections bearing EPP features just in the event that the matrix CP is a *wh*-CP that triggers movement? Another approach that poses many of the same issues is to posit a [+WH] feature on the intermediate CP (Van Urk, 2015, for example). But without an explanation of why the only intermediate CPs bearing *wh*-features are those that happen to be part of a *wh*-construction again poses the same kind of look-ahead problem, just shifting the burden of explanation from the domain of movement to the domain of selection, the same question that arises with an EPP-feature analysis.

Bošković (2007) (and various work built on it) suggests that such movement can be initiated by the featural requirements of the moving element itself. That is, with derivations proceeding by phase, when a phase boundary is reached a matrix *wh*-object (for example) will have *wh*-features that are not valued/checked, and such elements may move to a position from which their features can be checked (see Carstens 2016 for discussion of this idea extended to other domains, e.g., case valuation and complementizer agreement). This approach does limit the look-ahead problem, but it also adds operations to the syntax, wherein there is either a process of a phrase evaluating its likelihood of being valued, or another operation of "movement to the edge" for valuation, both of which would mitigate the countercyclicity of look-ahead problems but also enrich the computational abilities of the grammatical system in a theoretical context where we are aiming to limit those abilities.

A DMS approach offers an alternative: look-ahead "problems" related to movement may actually be instances where children's input provides sufficient data for the child to learn that a lexical element moves, even when they have not yet acquired the requisite grammatical structure to incorporate it into an adult-like structure. In a sense, this is because the child literally can "look ahead" to see what the final structure is supposed to be, because they are in fact constructing

their internal grammar based on those final structures, and are reverse-engineering the grammar based on the output of the grammars of the people surrounding them. Our theory posits "blind" computational mechanisms that build structures sensitive only to particular (local) components of grammar, but the children implementing them to acquire structures are certainly not blind to the linguistic input they are receiving.

In what follows, we turn to children's acquisition of *wh*-movement and show that it is well-aligned with this DMS-motivated hypothesis that links look-ahead "problems" to the (relatively) "early" acquisition of those same elements.

2.2 Acquisition of *Wh*-movement

Wh-questions emerge quite early in English-speaking children, long before they would be expected to if acquisition proceeded in a strict bottom-up fashion and CPs were prerequisites to *wh*-questions. English-speaking children begin producing questions around 1;6 years, meaning that *wh*-questions appear frequently during the root default stage of acquisition, before even the TP domain is grammaticalized, let alone the full range of productive CP-level structures. This is evidenced in the representative child utterances in (73)-(75).

(73) a. Where daddy go? (Adam 2;3)
b. What I doing? (Eve 2;0)
(Thornton 2016, (3), attributed to Guasti 2002)

(74) a. where go?
b. what hit?
c. what watch huh?
d. where go bye bye?
e. where zip it, huh?
f. where waving?
(Roeper and Rohrbacher 1994; MacWhinney 2000, via Roeper and de Villiers 2011).

(75) German (Spinner and Grinstead 2006, via Roeper and de Villiers 2011)
a. was das denn?
what that then
'What's that, then?'
b. Wo ist?
Where is
'Where is (it)?'

If we assume at this point in (73) that children either have (or are currently generalizing into grammatical structures) a *v*P domain, what limited *wh*-generalization children have acquired here would necessarily place the *wh*-phrase at the left edge of *v*P (perhaps, in a specifier of *v*P).

A reviewer asks why constructions like (73) would not be considered evidence for the presence of CP in a child's grammar. This of course is not unreasonable as a response to the pattern illustrated in (73), and it has been the approach historically taken by some researchers (Rizzi,

1994; Schütze and Wexler, 1996). The approach that we've adopted in this monograph is that the relevant acquisition point in the DMS correlation (between derivational sequences and acquisition) is when children are productive in adult-like ways with whatever piece of grammar is under consideration. We do not consider occasional or partial use of a piece of grammar to indicate that children have learned the adult-like syntactic structure in a general sense; in this instance, the use of *wh*-phrases in sentence-initial position does not alone indicate the presence of a CP. We would consider a full, adult-like CP to be present when the full range of its adult-like properties are present in the child's speech.

This follows naturally from the emergentist approach that we have adopted throughout the manuscript: children are hypothesizing and generalizing from the data and positing structures. So their early non-adult-like, less-productive utterances are, in this view, instances where they have immature generalizations or are simply using memorized amalgams. To be clear, this is not just about *wh*-questions alone alone. Rather, we have adopted an approach where for any grammatical element, children first produce things directly from their input, followed by (probably immature) generalizations, followed eventually by adult-like grammatical generalizations. So initial use of a grammatical element is not indicative of adult-like knowledge (see §4 of Chapter 3).

In this particular instance, children do seem to show productive use of a partial generalization about *wh*-questions in English: the left-edge position of the *wh*-phrase. We discuss some representational possibilities with respect to children's knowledge and adult knowledge below, but the relevant points here are that children have acquired a partial, immature generalization (*wh*-phrases at the left edge) and that a full adult-like CP has not yet been acquired by the children. Crucially to this point, this latter claim is supported by a range of acquisition evidence. Full subordinate clauses (which would signal full grammaticalization of CP, given our assumptions) are some of the latest constructions acquired (especially those containing complementizers and containing an independent proposition from the main clause) (Diessel, 2004).

Acquisition of CP

Of course, in order for it to be clear that acquisition of wh-movement is "early" compared to the acquisition of other CP-level properties, it's necessary to make clear what acquisition of other CP-level properties looks like. Work from Diessel (2004) sets the stage for understanding the transition to full CP structures. Diessel argues that the first (apparent) embedded clauses are not truly embedded at all. That is, they do not represent a distinct proposition from the matrix clause. Instead, the apparent "matrix clause" in early productions of clause-embedding verbs is highly restricted: it only occurs with a few predicates at first, is extremely short, occurs with either no overt subject or a pronominal subject (it is often first person), and shows little-to-no evidence that the "matrix clause" is a distinct proposition from the lower clause. That is to say, the matrix clause of initial apparent clause-embedding structures will be short, present tense, and will not serve to communicate any separate proposition. Instead, what is found is a high frequency of a small number of identical or highly similar clause-introducing formulaic statements:

(76) Sarah (first 15 utterances including *think* plus CP-complement)

I think I'm go in here.	3;1
And I think (pause) we need dishes.	3;2

Think some toys over here too.	3;3
I think I play jingle bells . . . with the record player.	3;5
I think he's gone.	3;5
Oh (pause) I think it's a ball.	3;5
It's a crazy bone (pause) I think.	3;5
I think it's in here.	3;5
I think it's in here . . . Mommy.	3;5
Think it's in there.	3;5
I think I don't know that one.	3;6
I'm get my carriage (pause) I think.	3;6
Think it's in this.	3;6
I think that your hands are dirty.	3;6
I think my daddy took it.	3;7

(Diessel, 2004, 92)

Diessel (2004) takes the "matrix" clause of utterances as in (76) to be formulaic: that is, the true main clause that the child is uttering (the main point of their utterance) is the lower clause.

Even as clausal embedding develops further, there appears to be a successive stage where the "matrix" clause is less formulaic and more substantial, but still does not appear to communicate an entirely separate proposition. It instead simply serves as an evidential-like statement: "rather than denoting a mental state or an act of perception, they function as epistemic markers, attention getters, or markers of illocutionary force" (Diessel, 2004, 77).

(77) Development of Sarah's matrix clauses including *think*, with the number of instances in the corpus in parentheses (adapted from Diessel 2004, Table 5.4)

3;1	I think _ (68)
3;7	Do you think _ (5)
4;0	I thought _ (7)
4;2	I'm thinking _ (1)
4;3	They think _ (1)
4;4	What do you think _ (2)
4;8	I don't think _ (2)
4;10	I'll think _ (1)

Diessel (2004) makes a plausible case that earlier appearances of apparent "embedded" clauses in child language are not instances where clausal embedding is fully productive. The pathway that he proposes is shown in (78), where a formulaic matrix clause precedes a pattern where true subordinate clauses (paired with a true subordinating clause) only appear later.

(78) formulaic matrix clause → performative matrix clause → assertive matrix clause (Diessel, 2004, 112)

In this case, the first productions of "embedded" structures are not really embedded at all. Instead, they are instances of a formulaic (potentially multi-word) sequence combining with a lower grammaticalized structure (presumably a TP-level structure at the points being considered

here). So, assuming that brackets demarcate grammaticalized constituents, we will see utterances looking like (79), where we use the logical connective "∧" to annotate this kind of agrammatical combination of structures in an utterance:

(79) *formulaic "matrix clause"* ∧ [$_{\text{TP}}$ *sentence*]

In a structure like (79), the clause that is embedded in the target is plausibly analyzed as the "main" clause, as it is the only grammar-based content asserted in the utterance.

As for the final stages of development, as Diessel (2004, 114) also notes, "the child must be able to understand that reality and mental representation do not always match and that different people might have different beliefs about the same state of affairs in order to use mental verbs in performative and assertive matrix clauses." But children don't fully pass false belief Theory of Mind tasks until around the age of 4: de Villiers (2007) argues that the development of theory of mind and the final grammaticalization of embedded complement clauses are linked. The causal relations are not our concern here; our point is that these structures are grammaticalized much later than children are actively using (apparent) embedding structures. Diessel doesn't claim that every lexical item moves along this pathway: lexical items acquired later, building on the generalizations built from earlier constructions, can be acquired more directly in their target-like grammars. But he does claim that this is the pathway to acquiring clausal embedding in the first place.

The relevant point at the present moment is that the developmental stage when a child is approaching adult-like CP structures is well after the initial generalization of *wh*-phrases being sentence-initial. That is to say: children know that *wh*-phrases occur at the left edge of sentences well before they have fully (adult-like) grammatical CP structures.

Acquisition Pathways for *wh*-Constructions

This is directly parallel to what is proposed by Rowland et al. (2005) for simple matrix questions at the point that children are still making errors with subject-auxiliary inversion (e.g., *what can he can do?*, *what does he likes?*). They propose that children learn lexically-based frames—rote constructions—that assist with acquiring *wh*-questions. On this analysis, children utilize a relatively small number of high-frequency sequences of *wh*-phrase + auxiliary (e.g., *what did …*, *who does…*, etc.), which they combine with some sentential element (X in (80)) that they have already grammaticalized.

(80) WH-AUX ∧ [X]

These schemas share a lot of similarities with children's earliest grammatical constructions, what Tomasello (2003) referred to as *pivot schemas*, such as *more X* and *allgone X*. The difference here is that the variable slot in the pivot schema is filled with already-grammaticalized syntactic structures rather than simple nominals as at earlier stages.

(81) WH-AUX ∧ [$_{\text{TP}}$ *sentence*]

Both (79) and (81) are instances of the mixed-status utterances that we discussion in §6 of Chapter 3. And of course, the fixed/formulaic portions of the structures in (79) and (81) will eventually be

decomposed (compositionally analyzed), but at the earliest productions of these structures they do not appear to be productive in adult-like ways.

Therefore, though children will produce surface forms that are quite similar to adult-like utterances, they will continue to make errors in *wh*-questions for quite a long time after they are producing questions in general. A common trend in these errors is a lack of subject-auxiliary inversion where it would be expected:

(82) a. Where daddy is going?
b. What mommy can do?
c. Why me can't do that?
(Brown 1973; Tornyova and Valian 2009, via Roeper and de Villiers 2011, 195)

Other errors include doubling of auxiliaries, doubling of tense-marking, and agreement errors, as illustrated in (83):

(83) a. where does he does go?
b. where does he goes?
c. where does you go?
d. where do he go?
(Rowland et al., 2005; Rowland, 2007)

In general, these errors occur at relatively low rates. Stromswold (1990) evaluated 12 children from ages 1;2-5;5 and found that the overall inversion rate for non-negative questions was 93.4%. And, according to Thornton (2016), "error rates above 10 percent are rarely reported in the literature." The conclusions that researchers draw from this can be starkly different: Thornton (2016) concludes "the fact that the rate of I to C movement is over 90 percent makes it unlikely that children lack any linguistic knowledge, at least in the view of generative linguists," whereas usage-based researchers like Rowland et al. (2005) and Rowland (2007) emphasize the limited variety in the earliest *wh*-aux sequences (as noted above), suggesting instead that creative and flexible *wh*-constructions lag behind. And while researchers may adopt different approaches to explaining explaining those rates, Roeper and de Villiers (2011) note that "the adult rate of 100% inversion [does not become] fixed until at least age 5" (198). Insofar as the development of core syntactic structures goes, this is relatively late, roughly commensurate with the development of embedded CPs and relative clause structures.

Returning to the initial question: children appear to have learned an initial generalization (*wh*-phrases are sentence-initial) much earlier than a strict bottom-up acquisition process would predict: as the examples in (73) illustrate, children produce *wh*-questions with regularity when they are still in the root default stage of acquisition and long before they have adult-like *wh*-questions and adult-like CPs in general (including embedded clauses and relative clauses). This is not terribly surprising, given their frequency in children's linguistic input and the surface-salience of the relevant aspects of word order: as Cameron-Faulkner et al. (2003) show in two separate studies, questions make up significant proportions of child-directed speech: 21% (Wells, 1981) and 32% (Cameron-Faulkner et al., 2003), respectively. Wells (1981) found that yes/no questions appeared more frequently (13% of utterances) than *wh*-questions (8%), whereas Cameron-Faulkner et al. (2003) found that yes/no questions and *wh*-questions appear at roughly the same

rate (15% and 16%, respectively).[11] In both studies, questions were more frequent in child-directed speech than SV(O) declaratives (18% in both studies). It is clear, then, that children are exposed to questions at very high rates.

As a final comment, Estigarribia (2010) argues for a highly similar kind of acquisition process for yes/no-questions, which is directly compatible with the proposals here.[12] Children ask yes/no-questions quite early in their development. If we assume that question-asking requires CP structure (since adult interrogative grammar invariably involves CP structures cross-linguistically), we might assume that the availability of questions is evidence for the presence of CP structures, but Estigarribia takes a different approach. Focused on children's productive grammar, Estigarribia (2010) concludes that there are three periods of children's acquisition of yes/no-questions: one in which subjectless VP-level structures are dominant, one in which full *v*Ps (including subjects) emerge and become frequent, and finally one in which auxiliary-initial (adult-like) questions develop.[13] Estigarribia (2010) offers the particularly notable sequence in (84) as an illustration of this pathway.

(84) a. Cold? (Sarah 2;3)
b. You cold? (Sarah 2;4)
c. Are you cold? (Sarah 3;11)

As Estigarribia (2010) notes, even at the more advanced stages, the simpler forms are also used, even persisting into adulthood: Estigarribia emphasizes that child-directed speech contains all of these forms as well.

(85) a. Hear it popping? (Abe's mother, 2;8.1)
b. You think he's in the garage? (Shem's mother, 2;3.2)

Estigarribia argues that there is a "facilitation path" to acquiring yes/no-questions, wherein less complex questions are acquired before more complex questions, and the less complex structures scaffold the acquisition of more complex structures. The point here again accords with what preceded: despite questions in adult grammar involving CP, children's earliest productions tend to involve lower structures with higher frequencies before higher structures are the norm.

2.3 Intermediate Summary: DMS approach to acquisition of questions

Our suggestion is that the "early" acquisition of sentence-initial *wh*-words by children is in fact reflected in adult grammar in the fact that adult derivations appear to be able to "look ahead" to the ultimate outcome. Where wh-phrases are at the left edge of sentences; this results in in moving *wh*-phrases to the left edge of intermediate phases. How do children manage to learn *wh*-movement so "early," compared to other properties that typically belong to CP? Their input

[11] Cameron-Faulkner et al. (2003) suggest that the relatively high rate of questions in their study was an artifact of the design.

[12] That work argues for a "right-to-left" acquisition sequence, attending only to the English linear order, but the findings are directly in line with our discussion here.

[13] For ease of exposition in this short summary, we adapt the terminology/descriptors from that work to the terminology we have been using in this volume.

makes it completely clear where *wh*-elements are supposed to go—they are asked questions all the time, and the *wh*-question generalization is apparent from the input: *wh*-elements go at the beginning of an utterance. Thus, children's input allows them to "look ahead" to the position that such an element should be in, so they know to utter the *wh*-element in whatever their sentence-initial position is. This reflects a core distinction between the work of a Minimalist syntactician analyzing adult grammar and a child acquiring their language. Minimalist theory posits a purely computational system that generates outputs without reference to what the output should be (or else it would be a circular analysis). But a child, of course, isn't generating sentences without reference to the outcomes: quite the opposite, they are reverse engineering the utterances of the people around them. So even if the mechanisms they use to form grammatical structures are ones of basic (Minimalist) computation of structure like Merge and Agree, children implement them in service of arriving at structures that generate the data that they already have access to. So while it may seem circular from a theory-internal Minimalist perspective, it's not circular at all from a DMS perspective that assumes that MACs are put to use by children in forming grammatical structures for the input they are receiving.

An important point here is that the main evidence we invoke focuses on children's productive utterances, rather than on their comprehension. This is not a point of minimal contention, especially as there is a stark divide in the acquisitionist literature between constructionist researchers who tend to focus on children's *productions* and generative researchers whose work has revealed a large amount of language knowledge in children long before they overtly and productively express that knowledge in their utterances (see Thornton 2016 for an overview of work relevant to our concerns about *wh*-questions here). Recall from our discussion from §5.1 of Chapter 3 that we propose that in the DMS correlation between Minimalist derivations and acquisition, the relevant stage of acquisition for the comparison is when children are productive in adult-like ways with each piece of grammar under consideration. At no point do we mean to imply that the entirety of children's grammatical knowledge is composed of what they are producing. What we do claim, however, is that there is a correlation between the sequence in which children are producing different sorts of adult-like grammatical structures and the sequences that make up the Minimalist derivations that generate sentence structures in Minimalist analyses of adult grammar.

This does raise the specific question of what children's representations are at the relatively "early" stages of learning *wh*-questions, and how this correlates to the relevant adult grammatical structures. There are multiple possibilities here, and the distinctions aren't crucial for our concerns. It is possible, for example, to posit a *wh*-feature at the intermediate phase (i.e., perhaps intermediate movement positions have *wh*-features, as suggested by Van Urk 2015). Alternatively, it could be that *v*Ps containing *wh*-phrases actually are themselves structured differently, with *wh*-phrases necessarily at the left edge: Newman (2021) builds an interesting argument based on locality puzzles in extraction (in adult grammar crosslinguistically) that suggests that this may in fact be what happens. Either of these, or other analyses, are viable ways to address look-ahead problems from a DMS perspective. The key for our purposes is that not only is children's relatively early use of *wh*-questions (compared to other full-clause structures) not problematic from a DMS perspective, but in fact it directly explains persistent parallel puzzles in adult grammar.

3 Layering Approaches

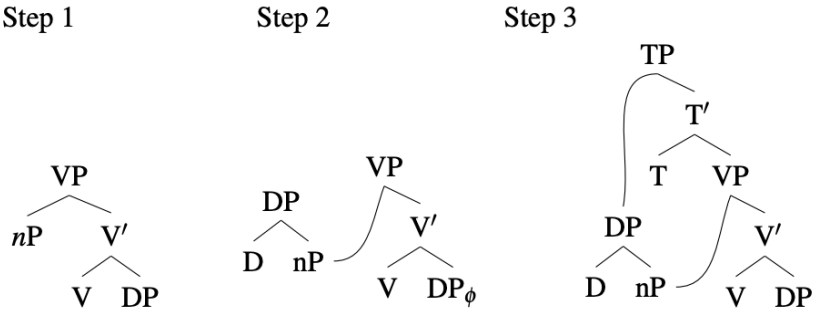
In this section we show that "layering" approaches to a variety of puzzles in adult grammar have strong parallels with children's early "telegraphic" speech in a way that is consistent with the DMS perspective. We first explain Thoms's layering approach to some apparently-countercyclic puzzles in §3.1, we then introduce additional data that can also be explained via layering in §3.2, and finally, in §3.3, we suggest that in addition to accounting for a range of data in adult syntactic knowledge, layering also captures the acquistion patterns from children's early telegraphic stage of speech.[14]

3.1 Layering Derivations (Thoms and Heycock forthcoming)

Thoms (2019) proposes a **layering** derivation, in which additional structure is layered on top of a nominal phrase during the Minimalist derivation of a sentence's structure. Thoms argues that layering can capture (anti-)reconstruction effects that have previously been left unexplained or have required analyses like Late Merger. Here we address follow-up work from Thoms and Heycock (forthcoming) that introduces additional puzzles that can also be explained by layering.

In a most basic sense, Thoms (2019) and Thoms and Heycock (forthcoming) argue that when subject nominals are in Spec,*v*P, they are noun phrases (nPs) and that D° gets layered on as the nominal moves up to Spec,TP.[15] In the examples in (86), the first merge position of the nominal is a bare *n*P, the lexical noun itself. In a Parallel Merge operation (Citko, 2005; Citko and Gračanin-Yuksek, 2021), a D head is merged with the *n*P to form a DP, but, crucially, that DP node is not subordinated to the main clause structure when it is first merged. When the nominal is merged into its structurally higher position, it is the the DP node that is merged with TP. The result in Step 3 in (86) is a structure where *n*P has representations in two positions (Spec,VP and Spec,TP) but D/DP are only in one position (Spec,TP).[16]

(86)



(Thoms and Heycock, forthcoming, (10)) Images are screenshots for draft monograph, will be redrawn in final work.

[14] Full credit for this observation goes to Gary Thoms, who suggested the connection between DMS and layering and pointed us to this literature. This section represents our work outlining how his insight plays out.

[15] Thoms and Heycock adopt a multidominant representation of layering; we believe that this or a comparable approach with sideward movement are equally reasonable; the multidominant aspect of their analysis is tangential to our concerns.

[16] Thoms and Heycock represent the object as a DP for the sake of simplicity—in actuality, the object DP should be derived via layering as well: we discuss evidence for a layering approach to objects below in §3.2.

Thoms (2019), Thoms (2022), and Thoms and Heycock (forthcoming) use this approach to explain various (anti-)reconstruction phenomena. For example, Thoms (2019) discusses the fact that British English allows either singular or plural verbal agreement with group nouns (e.g., *team*, *committee*). Notably, the non-specific reading of the indefinite DP is unavailable when the plural agreement occurs.

(87) a. A Spanish team is likely to win the Champions League. **likely** > ∃
b. A Spanish team are likely to win the Champions League. ***likely** > ∃

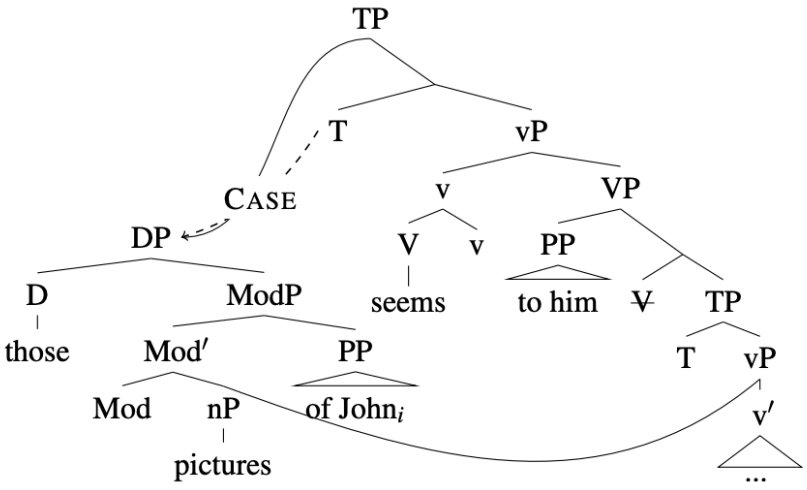
In broad strokes, such layering derivations can account for (anti-)reconstruction effects. Something cannot reconstruct into a position that it never occupied, so for example if D° is only layered on as a nominal moves from Spec,*v*P to Spec,TP, then the nP can be interpreted in either position while the DP can only be interpreted in Spec,TP. Thoms assumes that plural agreement with group nouns results from agreement with nP itself, so in those instances DP is not layered on until Spec,TP (as the structures in (86) show). If that's the case, however, and the DP is the scope-taking element, then agreement with nP necessitates a layering derivation of the DP.

We can see the same effect in some apparent paradoxes in binding and A-movement. Consider the example in (88):

(88) Those pictures of John$_i$ seem to him$_i$ to have been doctored.
(Thoms and Heycock, forthcoming, (4))

In principle, *those pictures of John* would be expected to reconstruct to its base position in the embedded clause. This would make coreference of *him* and *John* in (88) ungrammatical, because *John* would be bound by *him* in a violation of Principle C.[17] However, no Principle C violation occurs in (88). Thoms and Heycock propose that this is because the PP *of John* (and the structurally higher D° *those*) can be layered on when the nominal moves to matrix Spec,TP—simply a more elaborate form of the same layering seen in (86). Such a structure is shown in (89):

(89)



[17] It has long been noted that experiencers can c-command out of their PPs: e.g., **It seems to him$_k$ that John$_k$ is happy.*

(Thoms and Heycock, forthcoming, (14))
Images are screenshots for draft monograph, will be redrawn in final work.

In (89), the PP *of John* only occurs in the higher position of the nominal (in the matrix clause) and therefore cannot be interpreted in the lower clause.

This analysis seems to wrongly also allow for coreference in a sentence such as (90): arguably, the DP could be layered onto the nominal in Spec,CP (the final landing spot of a *wh*-element). But (90) is a standard instance of reconstruction for Principle C; coreference between the R-expression *John* and the pronoun *he* is ruled out, because the R-expression reconstructs below the pronoun, resulting in the R-expression being bound in that position. So why is a layering derivation available for an example like (88), but unavailable for (90)?

(90) [Which picture of John$_i$]$_k$ did he$_{*i/m}$ buy t_k ?
(Thoms and Heycock, forthcoming, (2))

Thoms and Heycock turn to Case assignment to rule out the possibility of a layering derivation for (90) that would yield an anti-reconstruction effect, an approach that draws much inspiration from a similar analysis by Takahashi and Hulsey (2009). They argue that D° (and all structure below it) must be layered onto the nominal before it moves out of the position where Case is assigned to it, because D° itself must get assigned Case. In (90), *which picture of John* must get accusative Case inside *v*P, so the D° *which* (and thus the structurally lower PP *of John*) must be present inside *v*P.[18] Therefore, *which picture of John* reconstructs, and coreference in (90) yields ungrammaticality via a Principle C violation.

As an aside, Thoms and Heycock suggest that layering can account for the classic instances of anti-reconstruction with adjuncts and relative clauses discussed in §1. They note that "adding an adjunct to the DP would not require anything other than adding one layer at the very top of the DP (another DP segment with a PP adjoined) in its last stage of movement, so the core cases of Late Merge ought to be easy to derive" (Thoms and Heycock, forthcoming, 7). While this may be the case, it's not clear to us that all apparent instances of Late Merger can be explained by layering: see §3 of Chapter 5.

3.2 Bruening et. al. (2018)

Bruening et al.'s (2018) work provides a wealth of data that can also be explained by Thoms's layering account, as suggested to us by Gary Thoms. Bruening et al. highlight differences between DPs and CPs, which are commonly considered to have parallel structures. We will show that the coming-apart of certain supposed parallels between DP and CP can be accounted for on a layering account, providing further evidence for such an approach and continuing to align with predictions from DMS.[19] These data also serves as evidence that *objects* are first merged as nPs,

[18] *of*-PPs like *of John* are suggested to be in the specifier of a "ModP" projection directly above nP instead of being a complement of nP.

[19] Bruening et al. argue that the disparities between DPs and CPs are evidence against the DP hypothesis itself—they instead claim that nominals are headed by N°. We do not follow their analysis here, instead taking the stance that Thoms's layering can explain the data while also preserving the DP hypothesis, as suggested to us by Gary Thoms.

while the argumentation in §3.1 focused on layering with subjects.

First, Bruening et al. explore the different features that verb heads select for in clausal vs. nominal complements. They show that verbs select for features high in their CP complements, but verbs select for features that are arguably low in their nominal complements. Bruening et al. hold that if DP dominates nP, then verbs would be able to select for features that are structurally high in DP in the same way that they select for features that are structurally high in CP. For example, in (91), the matrix verb selects for features that are high in the complement clause (plausibly in CP): *thinks* requires a declarative clause, while *wonders* requires an interrogative clause.

(91) *Questions vs. declaratives:*
   a. Sue thinks that/*whether the world is flat.
   b. Sue wonders whether/*that the world is flat.
   (Bruening et al., 2018, 4)

Similar patterns emerge with some verbs requiring (non-)finite complements as in (92) and some verbs selecting for subjunctive vs. indicative clausal complements as in (93). Such features are high in CP, so verbs select for high features when taking a clausal complement.

(92) *Finite vs. nonfinite:*
   a. Bertrand wants the world to be flat.
   b. b. *Bertrand wants that the world is flat.
   (Bruening et al., 2018, 4)

(93) *Subjunctive vs. indicative:*
   a. Sue asked that the answer be/*is two.
   b. Sue thinks that the answer *be/is two.
   (Bruening et al., 2018, 4)

In contrast, it is a quite general pattern that verbs do not select for particular features of DP projections specifically: languages do not have predicates that select only for nominal objects with a particular demonstrative, or only for possessive objects. There are certainly selectional requirements placed on nominal objects by verbs, but they tend to be properties of the lexical nominal itself, not properties of the functional structure atop the nominal. Consider the examples in (94):

(94) a. I gathered the students.
   b. *I gathered the student.
   (Bruening et al., 2018, 5)

The verb *gather* selects for a plural object. So we can see that a plural object is acceptable (94a), but a singular object is not (94b). Inherently-plural nominals show interesting properties, however. A semantically plural nominal like "French club" can be an object of *gather*, but an instance of pluralia tantum like *scissors* cannot.

(95) a. I gathered the French club.
b. *I gathered the scissors. (where there's only one pair of scissors)
(Bruening et al., 2018, 5)

Syntactically, *French Club* is singular (in Standardized American English) and *scissors* is plural.

(96) a. The French club **is**/*are in the classroom.
b. The scissors **are**/*is on the desk.

Nonetheless, the predicate *gather* selects for a plural object; it takes as an object the semantically-plural-but-grammatically-singular *French Club*, but cannot take as an object the semantically-singular-but-grammatically-plural *scissors*. On the assumption that semantic number is a low feature in nominals, associated with nPrather than DP, this suggests that verbs select for nominals that are nPs, rather than DPs. Following the suggestion of Thoms, we can take this asymmetry to indicate that nPis not (yet) a daughter of DP when a nominal is merged with the verb that selects it; instead, DP is layered onto the nominal later in the derivation. Bruening et al. (2018) provide evidence from Korean (and state that classifier languages like Vietnamese show the same patterns) that verbs select for properties of NP, not of determiners and other (relatively) high structure within a nominal.

Bruening et al. (2018) also introduce evidence centered on idioms in English, Vietnamese, and Korean. Here we present the data from English idioms; Vietnamese and Korean show the same patterns. Note that in idioms that contain PPs, the specific preposition is typically a crucial part of the idiom. Some such idioms are shown in (97).

(97) a. bark up the wrong tree
b. beat around the bush
c. knock on wood
d. take X to task
e. do a number on X
(Bruening et al., 2018, 17)

In each of these idioms, the preposition cannot vary (e.g., **bark at the wrong tree*, **do a number with X*). It is even possible for the nominal to vary in some of these idioms, as in (97d-e), but the preposition is always fixed. So it appears that the preposition itself is crucial, and if it does change then the idiomatic meaning is lost. In contrast, idioms which contain a determiner do not seem to rely on a specific determiner for their idiomatic meaning. Consider the examples in (98):

(98) a. cut X some slack
b. foot the bill
c. rock the boat
(Bruening et al., 2018, 23)

While these idioms may have a canonical determiner—e.g., *the* seems to be the most standard determiner in the idiom *rock the boat*—the determiners are not fixed in the same way that the prepositions in (97) are fixed. In a corpus study of online idiom use, Bruening et al. found that the determiners can vary in most idioms like those in (98) without changing the idiomatic meaning (e.g., *let's not cut him too much slack*, *foot another bill*, *rock some boats*). In idioms that appeared to have a fixed determiner, such as *kick the bucket*, the nominal object is also fixed. Crucially, Bruening et al. found no evidence of idioms in which the verb and determiner are fixed but the nominal varies. In contrast, there are idioms (such as (97d) and (97e)) in which the verb and preposition are fixed while the nominal varies.

On the assumption that idiomatic interpretation of structures requires a selectional relationship between the elements involved, Bruening et al. suggest that this asymmetry is evidence that PPs and nominals have different structures. Therefore, while PPs are clearly headed by P°, the authors continue their argument against the DP hypothesis, claiming that nominals cannot be headed by D°. If nominals were DPs, then they claim that we would find evidence of idioms in which the verb and determiner are fixed but the nominal varies, in the same way that we do with verb-preposition idioms like (97d) and (97e). Bruening et al. claim that this asymmetry supports the broader argument that nominals are headed by N° rather than by D°. We do take Bruening et al.'s findings at face value, but again suggest (following Thoms) that the DP hypothesis can be retained; the evidence instead shows that nominals are nPs *when they are first merged*, only later getting D° layered on.

3.3 Layering and Children's Telegraphic Speech

In §3.1, we illustrated arguments for layering derivations of DPs, wherein at the structurally lowest level a verb's arguments are nPs, and D° is layered on later in the derivation. §3.1 showed Thoms and Heycock's arguments from the adult grammar of English that this is true for subjects, and §3.2 presented evidence from Bruening et al. that it also holds for objects (in English and in several other languages). Thus, at early stages of a derivation, a transitive structure looks like (99):

(99) $[_{vP}$ nP$[_{VP}$ V nP]]

D° is then layered on at a later point in the derivation. There are of course significant outlying questions regarding the details of when this layering occurs. The extended details of implementation fall outside the scope of this manuscript, but the generalization seems clear: Thoms and Heycock showed that subjects are initially Merged as nPs, and Bruening et al.'s evidence shows the same for objects.

Based on this generalization in adult syntax structures, a DMS approach predicts that when children first acquire subjects and objects, they should be nPs rather than DPs. Only later should children learn to productively use DP arguments. On the productivity-related hypothesis we consider here, that means in children's first productive expressions of verb phrases, the nominal arguments are expected to be nP-like and lack the extended functional structure of complete nominals. And the child data support this hypothesis, as seen in (100): one of the earliest stages when children produce syntactically complex utterances is commonly referred to as a "telegraphic" stage because of its similarity with the language of telegrams and newspaper headlines, includ-

ing lexical categories and omitting many functional categories like determiners. At this stage, children regularly produce subjects and objects as bare nominals rather than as complete DPs; consistent adult-like DPs come later.

(100) Man drive truck. Baby drive truck. Baby doll ride truck. Pig ride. Baby Allison comb hair. Baby eat cookies. Baby open door. Mommy open. Horse tumble. Get Mommy cookie. Eat apple juice. Open can. Open box. Get diaper. Open box. Help cow in table. Build tower. Wiping baby chin. Peeking lady. (selection from Allison Bloom at age 22 months) (Radford, 1990, 2)

Again, we don't mean to imply that the entirety of children's grammatical knowledge is composed of these telegraphic utterances: as we have described at multiple points, there is strong evidence suggesting that children have robust receptive knowledge of a broad range of grammatical properties of language, even at early stages. Our claim here is simply that the DMS correlation is with children's productive utterances, and it is clear that at early stages their utterances lack full DP structure.

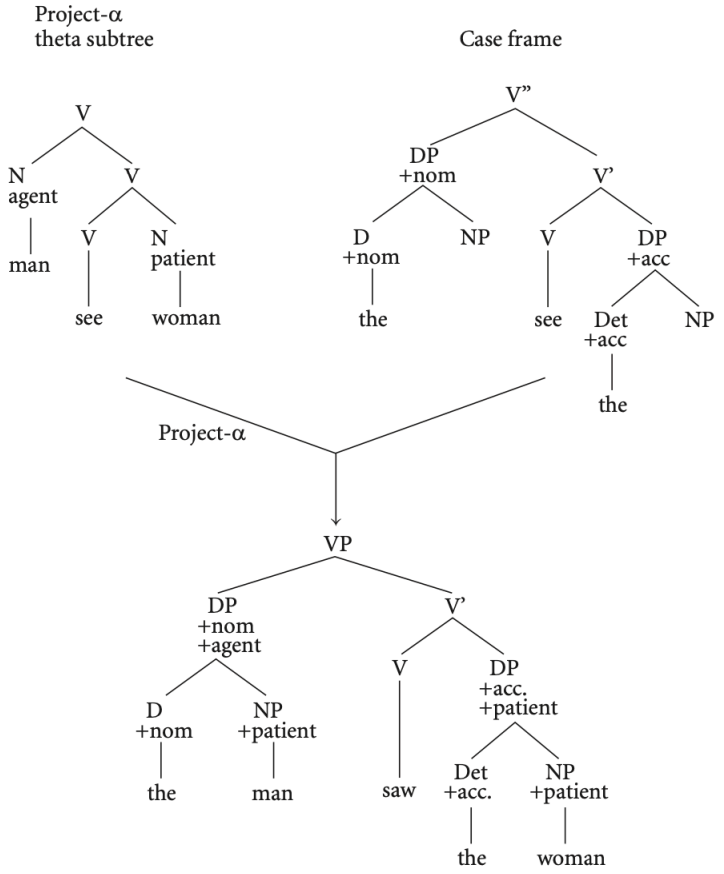
In sum, if we adopt a layering account—which §3.1 and §3.2 seem to necessitate—then DMS predicts a "telegraphic" stage of child speech wherein children produce verbs with nParguments but do not yet productively use DPs. And indeed such period in acquisition appears to exist, as has been observed by numerous acquisition researchers. Again, there are numerous additional questions regarding the kind of systematic layering analyses that this conclusion would necessitate: in most (or all) constructions, we would expect the DP layer of a nominal to be layered onto the nominal in the course of the derivation, with the nominal first-merging as an nP. This is precisely the project that some researchers are taking up (Colley, 2021; Thoms and Heycock, forthcoming; Thoms, 2022). The extended details of implementation fall outside the scope of this manuscript, but the compatibility of these ideas seems to be robust.

One final point worth noting is that this idea (like many others in this manuscript) finds precedent in Lebeaux's General Congruence Principle (we first discussed this in the appendix of Chapter 2), which proposed direct correlations between acquisition and adult grammatical representations.

(101) **General Congruence Principle**: Levels of grammatical representation correspond to (the output of) acquisitional stages.
(Lebeaux, 2000, 47)

Specifically for our point here, Lebeaux (2003, 2000) claimed that the outer elements of a nominal (D, etc) are added to a structure after noun arguments are merged with verbs, motivated by the same acquisition parallels noted here. Lebeaux (2003) suggests that predicates and their arguments first project in a "theta subtree," which is combined with a "case frame" that includes determiners and case markers and a slot-holder for NPs, as illustrated in (102).

(102)



Images are screenshots for draft monograph, will be redrawn in final work.

A full verb phrase (on Lebeaux's account) was constructed once the theta subtree was fused into the case frame, resulting in a more familiar DP structure.

This was a fairly atypical proposal for adult grammatical structures, and at the time it was not well-motivated from the perspective of adult grammatical knowledge. The layering approaches being developed by Gary Thoms, on the other hand, offer a contemporary and Minimalist-compatible approach that solves multiple puzzles about adult grammar, while simultaneously mirroring the telegraphic stage of language acquisition. This is precisely what is predicted by DMS, if the layering analyses are on the right track as analyses of adult grammar (and it does appear that they are): in both child language and adult grammar, the full functional structure of DPs is not available in the structurally-lowest positions of nominals.

3.4 Wholesale Layering

If the reader will allow us a moment of speculation, we think that the proposed correlation between acquisition and layering of DP structure has potential implications for an expanded application of layering, we might call it **wholesale layering**. That is to say, perhaps all movement operations in syntax involve layering on a level of functional structure onto the moved element.

This kind of approach has a reasonable foundation in ongoing theoretical work on adult grammar. Thoms (2019) has proposed that nominals may be first merged as nPs and layer DP structure on later in the derivation (further developed in Thoms and Heycock forthcoming,f). Independently, Safir (2019) has proposed that A/A'-distinctions may be derived by a similar operation that "insulates" A'-moved elements inside additional functional structure. Colley (2021) represents ongoing work to expand Thoms' layering operation more broadly in exactly this way, such that all A/A'-distinctions in movements are derived specifically from those movements involving layering of DP and QP projections on the moved element.

A similar situation is familiar from head movement: head movement in syntax has always been problematic for a view of syntax that requires Merge to extend the root of the structure, since moved heads are incorporated into the subordinating heads that they move into. Bobaljik and Brown (1997) suggested an approach to head movement that is essentially layering: a moving head merges with its movement target before that movement target is merged into the main clause structure: only after a complex head has been built is that complex head merged into the structure, a layering analysis.[20]

This is certainly in the realm of the speculative, but if it can be shown that wholesale layering is a viable approach to movement operations in adult grammar, the acquisition perspective of DMS has implications. The approach suggested in this monograph is that the content of UCL (i.e. "UG") can be viewed as a child's innate cognitive toolkit for grammaticalizing the linguistic input that they take in. If wholesale layering turns out to be viable, a DMS perspective allows us to describe all acquisition of additional grammatical structure by a child as adding new functional projections to a structure (whether this involves movement of a projection or not). That is to say, a wholesale layering analysis says that all Merge operations involve External Merge operations. Traditional External Merge adds a functional structure to the root. Movement operations involve layering: external merging (in a parallel merge operation) functional structure to a non-root element, and then externally merging the resulting element back into the main structure. A wholesale layering analysis from a DMS perspective, then, provides a more unified analysis of children's representation of new grammatical structures. But, as we've said, this is largely speculation, as the work on the viability of layering approaches to movement in adult grammar is currently ongoing.

4 Reflections on the SMT

Recall from our introduction some of the critiques of countercyclic analyses: recently both Sportiche (2019) and Chomsky (2019) offered fairly direct critiques of Late Merger (and other countercyclic operations). The critiques against Late Merger leveled by Chomsky (2019) and Sportiche (2019) are entirely reasonable based on Chomsky's Strong Minimalist Thesis (SMT): allowing countercyclic operations *does* expand the the generative capacity of UG, and the model resulting from DMS is not the simplest possible model of syntax as could be deduced based on the interface conditions of language (i.e., the need for syntax to interface with both sensory-motor articulation and interpretation). On this account, however, we recall Chomsky's (2001) comments on this issue:

[20] Our thanks to Gary Thoms for pointing us to this paper and for discussions on these connections.

> The strongest minimalist thesis SMT would hold that language is an optimal solution to such [interface] conditions. The SMT, or a weaker version, becomes an empirical thesis insofar as we are able to determine interface conditions and to clarify notions of "good design." While the SMT cannot be seriously entertained, there is by now reason to believe that in nontrivial respects some such thesis holds, a surprising conclusion insofar as it is true, with broad implications for the study of language, and well beyond.
>
> Tenable or not, the SMT sets an appropriate standard for true explanation: anything that falls short is to that extent descriptive, introducing mechanisms that would not be found in a "more perfect" system satisfying only legibility conditions. If empirical evidence requires mechanisms that are "imperfections," they call for some independent account: perhaps path-dependent evolutionary history, properties of the brain, or some other source. It is worthwhile to keep this standard of explanation in mind whether or not some version of a minimalist thesis turns out to be valid. (Chomsky, 2001, 2)

It's important to note that the SMT is a theoretical heuristic, a philosophical stance, and not (as Chomsky points out) a necessary truth. And we agree: given the extent of achievements of Minimalist syntax in providing a framework for discovering, describing, and analyzing grammatical constructions across the world's languages, there is good reason to think that the framework developed (driven by the SMT) is a reasonable result. But what we have claimed in this work is that there is in fact a strong and reasonable independent account (as Chomsky insists upon) of the diversions from the SMT-inspired UG mechanisms of Merge and Agree (and perhaps phases) alone. These may well be "imperfections" from the perspective of an optimal mapping between the PF/SM and LF/CI interfaces, but by now it should be more than clear (on moral, biological, social, and cognitive bases) that humans are composed of little that is perfect. So we find it unsurprising that the SMT as articulated (i.e. as a theoretical heuristic) may not hold in its strictest sense in actual human cognition.

Now, we are not equipped to say whether these "imperfections" arose from the evolution of language or instead are simply a necessity of the maturational processes involved in cognitive development (we suspect it is the latter). But wherever they are found, the strong developmental correlates of countercyclic processes in adult grammars are sufficient, in our minds, to motivate the evaluation of DMS on a much broader scale.

The major question, of course, is how to constrain countercyclic operations, and specifically how to constrain Late Merger. (The same concern is not there for look-ahead: presumably look-ahead is simply constrained by input, in the sense that look-ahead problems only arise when the input drives a look-ahead-type movement by making a long-distance dependency apparent in the input.) One of the largest complaints about Late Merger is that it is too computationally complex (Epstein et al., 2015). The potential for over-generation by a theory that allows for Late Merger is certainly real (as pointed out by Sportiche 2019), and it requires clarification. One possible approach to a constraint is that it is a maturational property: only once a child's cognitive abilities have matured to a certain degree could Late Merger occur (this is essentially Lebeaux's 2000 approach).

An accurately constrained Late Merger is necessary to make a theory of UG/UCL appro-

priately falsifiable (see Zyman 2021 for relevant discussion). However, it goes beyond the scope of our task here to offer appropriate constraints on a Late Merger operation. Our goal in this volume is to motivate and make relatively precise the claim that there is a systematic correlation between sequences of acquisition and derivational sequences in Minimalist analyses of adult grammar. So we leave a fully specified theory of Late Merger for future work, though we believe the most fruitful direction is to consider whether the root of the explanation may be developmental/maturational.

Chapter 5

Extensions of a DMS Approach

Michael Diercks
Katherine Johnson

If it turns out that the main idea behind DMS is on the right track, it will inevitably lead to rethinking and reimagining a broad range of properties of adult syntax. We initiate that work here, discussing several major theoretical consequences (and potential theoretical extensions) of a DMS approach. All of these are more speculative and less developed than what we have discussed previously in the volume, but all have a significant enough impact on approaches to syntactic theorizing that we found them worth exploring. In §1, we explore phases from a DMS perspective. §2 addresses interactions of prosody and syntax, specifically examining ways in which DMS predicts more interactions/interleaving between phonology and syntax than has typically been assumed. Finally, §3 comments on a particular cluster of countercyclic properties across a range of Bantu languages that again suggest that a focus on derivational earliness/lateness can reveal generalizations in adult syntax that may otherwise be missed.

1 Phases

In this section we sketch an extension of DMS reasoning that gives a new perspective on phases. The main suggestion here is that phases could be thought of as ontogenetic fossils in the same way that syntactic movement is: a structural remnant of a developmental process that is diagnosable in adult grammar. This section builds on the suggestions advanced in §2.2 of Chapter 3.

The core idea that we set forward here is that the domain that is modeled as a *phase* in minimalist syntax, and the empirical effects that it captures, are the direct effect of a domain effect in acquisition as well. Specifically, we suggest that phases correspond to stages in children's acquisition processes: periods in time where children are working on the acquisition of particular subsets of syntactic/semantic properties. The intuition here is that the "freezing" effects of phases (encoded originally in Chomsky's Phase Impenetrability Condition), wherein an already-completed phase is less accessible to later syntactic operations, are the encoding of the fact that a child has completed grammaticalization processes on that domain of the grammar. The "syn-

tactic activity" that occurs within each phase that is being constructed in a syntactic derivation corresponds to the active acquisition/grammaticalization activity that a child is undergoing as they analyze units of language within specific domains.

If this proposed correlation can hold, it has many benefits. First, it can provide some clarity to the metaphor of "computational efficiency" that is often attributed to phases, which we discuss in §1.4. Second, it can also provide some substance to the idea of a phase apart from the syntactic effects that it derives (successive cyclicity, phase impenetrability, (anti-)locality, etc.). Essentially, distinct phases restrict the hypothesis space of what a child is investigating at any given point in the language acquisition process. It also has promise to explain some puzzling properties of phases themselves, such as the fact that it can be difficult to pin down a specific head as the trigger for spellout of a phase.

1.1 Basic Introduction to Phases

We briefly introduce the idea of a phase in Minimalist theory here, but a reader who wants a more thorough background is recommended to the cited literature: Citko (2014) is a good starting point. Minimalist syntacticians can easily skip to the next subsection.

Chomsky (2000a, 2001) argues that the derivation of a sentence is not as simple as cyclic Merge operations: rather, there is good evidence that the derivation of a sentence proceeds by *phase*: particular sub-domains of a sentence are constructed and then treated as complete units after that (complements of phase heads undergo "spellout" or Transfer to the PF and LF interfaces). As an example, consider the derivation of a basic sentence in (103). C° is generally considered a phase head, so upon merger of C°, the complement of C° (here, TP) is spelled out (transferred to LF and PF).

(103) $[_{\text{TP}}$ sentence $]$ + C° $\rightarrow$ $[_{\text{CP}}$ C° $[\sout{_{\text{TP}}\ \text{sentence}\ ]}\ ]$

Empirically, this can account for a range of domain-based phenomena, including (but certainly not limited to) the movement of *wh*-phrases through the edges of phases when undergoing long-distance movement. This ensures that a *wh*-phrase avoids being spelled out too early in the derivation (and therefore being inaccessible to higher operations). As we discuss in §1.4, this is commonly presented as a way of keeping computation of the grammatical structure more efficient.

The result of this cyclic spellout is that phases ought to be impenetrable to higher operations.

(104) **Phase Impenetrability Condition (PIC)**
In phase α with head H, the domain of H is not accessible to operations outside α, only H and its edge are accessible to such operations. (Chomsky, 2000a, 108)

The phase impenetrability condition defines the domain which is impenetrable: the complement of the phase head. Likewise, the edge of a phase (Spec,CP in (103)) is the "escape hatch" of the phase: phrases within a phase can move to the edge of the phase to avoid being spelled out and thus remain accessible to higher operations. Chomsky also articulated another (weaker) version of the PIC (commonly referred to as PIC2).

(105) **Phase Impenetrability Condition (PIC2)**
The domain of H is not accessible to operations at [the higher phase] ZP; only H and its edge are accessible to such operations. (Chomsky, 2001, 13ff)

According to (105), spellout does not occur when the phase head H is merged; rather, spellout of the complement of H only occurs when the next phase head Z is merged. For example, under PIC2, VP is not spelled out when the phase head *v* is merged. Instead, it is spelled out only once C is merged. This allows for more interactions between phase content and external material, as spellout is delayed.

As Bošković (2014, 28) put it, "the question of why phasehood is picky (i.e., why only some phrases function as phases) has never been answered in a satisfactory manner." In this section, we discuss multiple open questions relating to phase theory that we believe the DMS approach can make contributions to.

1.2 Phases as Stages of Acquisition

Hinzen (2006, 2012) and Hinzen and Sheehan (2013) challenge the traditional stance that semantic principles and structure are largely independent of syntax (*contra* Chomsky 2000b, among others). Hinzen's syntactic framework is essentially that of the Minimalist Program (Chomsky, 2000a, 2001, 2008): the syntactic derivation proceeds by phase, and each phase must be legible at the interfaces (LF and PF). However, Hinzen claims that grammar is in fact the principle factor that allows for organization of meaning in language.

On this approach, the phase is the referential component of grammar, and different phases refer to different entities: DPs refer to individuals, *v*Ps refer to events, and CPs refer to propositions/truth (Hinzen and Sheehan, 2013; Sheehan and Hinzen, 2011; Arsenijević and Hinzen, 2012). A phase's semantic contribution is to take the conceptual/predicational content of the phase and to enable linguistic *reference* to relevant entities. Hinzen and Sheehan (2013) argue that phases are fundamentally composed of a phase interior and a phase edge, as shown in (106).

(106) [EDGE [INTERIOR]]

(107) [$_{DP}$ the [$_{NP}$ man]]

A DP phase, for example, will refer to an object/individual. On the approach developed in this collection of work by Hinzen and colleagues, the interior of a phase is the descriptive content of the phase and the edge of the phase (head+extended material) enables reference of varying degrees of specificity. In this sense, lexical content cannot refer on its own—reference is only possible in grammatical contexts.

As has long been established (and as we addressed in §2.2 in Chapter 3), phases roughly correspond to meaningful domains of clause structure. Grohmann (2003) is an early formulation of this observation, although we rely on the formulation from Ritter and Wiltschko (2014) here. In rough terms, the three main domains of the clause are the *v*P phase (predicates and arguments), the inflectional domain (tense, agreement, aspect), and the domain of the extended CP, consisting of discourse-relevant projections like topic, focus, and others. Ritter and Wiltschko (2014) refer to

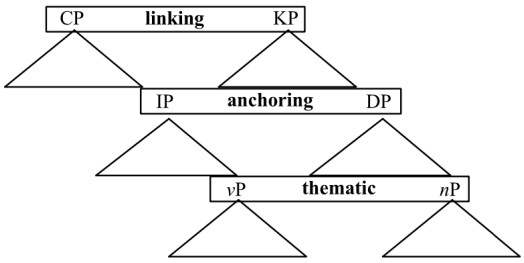


Figure 5.1: The "Universal Spine," defined by functional domains rather than grammatical categories (Ritter and Wiltschko, 2014, (5)). Images are screenshots for draft monograph, will be redrawn in final work.

these as the thematic domain, anchoring domain, and linking domain, respectively. Recall figure 5.1 from Ritter and Wiltschko (2014).

Observations like these are long familiar from work like Grohmann (2003), Wiltschko (2014), Wiltschko (2014), Ramchand and Svenonius (2014), and Ramchand (2018), among many others. The thematic domain deals with event reference: the predicate and arguments (the event and its participants). The anchoring domain is essentially the proposition/situation: an event situated in time and space. The linking domain is related to information structure, related to interlocutor attention and discourse structure.

As we mentioned in Chapter 3, in acquisition, children's main job is to identify what things mean (the so-called "Principle of Reference," ud Deen and Becker 2020). This means, for any particular target of acquisition at any point, children's goal is to establish a referent for some unit of language. At the word level (especially the kinds of nominals acquired early, which tend to be concrete and discrete entities in the world), the word can equal the referent. But once reference for higher-level structures become a target of acquisition (e.g., an event composed of a verb and arguments), children are necessarily investigating abstract elements.

The idea that we are suggesting here is that acquisition proceeds in stages that are in large part defined by what a child is primarily "solving for" at any given point. In the thematic domain, a child is solving for event reference—who does what to whom? In the anchoring domain, they are situating those events in time and space, forming propositions. And in the linking domain, they are solving for discourse, situating those propositions in the nuances of adult-like discourse.

Phases in adult grammar, therefore, are the grammatical realization of an acquisition strategy: the child uses their cognitive toolkit for acquiring language (call it "UG" or "UCL") to identify the referent of a structure. The key here for our concerns is the difference between what unit of reference is being "solved" by a child at any given point of time. If we accept a DMS-style approach to using adult grammar to understand child development, then we do see clear stages emerge: namely, thematic-identification, anchoring, and linking.

Our suggestion is that phases in adult grammar, like many other structures in DMS, are ontogenetic fossils, the structures that remain in adult grammar as a result of passing through acquisition stages. Simply by considering acquisition pathways, something like PIC2 seems much more likely/plausible than PIC1; PIC1 predicts a very clear, very local delination between phases

and edges and between lower phases and higher phases. Consider a *v*P phase, for example: PIC1 suggests that as soon as v° is merged, VP is spelled out and is therefore inaccessible. But this kind of discrete delineation between stages is not characteristic of acquisition, which instead shows much more gradual development of multiple properties of language simultaneously. These properties of acquisition are much more compatible with PIC2, on the other hand: there may well be initial acquisition of properties of the anchoring domain while properties of the thematic domain are being resolved, but by the time children are acquiring structurally high elements like complementizers and the information structural properties of the extended CP, core argument structure is at that point rigid and grammatically productive in adult-like ways.

1.3 Analytical Implications of a DMS Approach to Phases

The DMS approach to phases has promise to shed light on various properties of phases in adult grammar. For example, perhaps the foundational property that phases are meant to capture are aspects of successive-cyclicity, where there is evidence for operations proceeding through the edges of phases. For example, *wh*-elements are posited to move through the edges of phases on the path to their final landing position. If phases are viewed as acquisition stages, it is not surprising to find these kinds of locality effects situated at the edges of phases. When a child is acquiring *wh*-movement, for example, they have a lot of positive evidence for the position of *wh*-phrases and a lot of *wh*-questions in their input, from very early periods of acquisition. So from a very early stage for children acquiring English (i.e., when children are robustly in the "thematic" domain), it is evident to them from their input that *wh*-movement-like constructions include placing specific elements (the *wh*-words) at the left edge of the sentence. But if all they have grammaticalized from their input are low grammatical structures, and all they are "solving for" (to put it informally) is the properties of events and their participants, then we might expect a locality effect wherein at the edge of the thematic domain there is a representation of a *wh*-phrase.

(108) WH-phrase [$_{vP}$ AGENT [$_{VP}$ PREDICATE THEME]]

Of course, this looks very much like the kind of edge-related effects in successive cyclicity that are attributed to phases in Minimalist theory. On the approach sketched in this volume, if something like the representation in (108) holds at the root default stage of child language, we would expect relatively creative and flexible use of *wh*-phrases, even in the absence of other CP-material and TP-material.

Additionally, an emerging realization in the field is that there are problems with the canonical theory that posits individual heads as the delimiting factors in phases (e.g., D heads demarcate the DP phase, C heads demarcate the CP phase, etc). Instead, it appears that a more dynamic approach is required, which allows different projections to be phases depending on the syntactic context (Bobaljik and Wurmbrand, 2005; Wurmbrand, 2013; Bošković, 2013, 2014; Harwood, 2015; den Dikken, 2007; Gallego, 2010; Bošković, 2005; Gallego and Uriagereka, 2007a,b; Despić, 2013; Takahashi, 2010, 2011).

An illustration of the contextual approach to phases comes from Harwood (2015), who argues that the lowest phase in a clause may variably be *v*P or ProgP (the functional projection introducing progressive aspect). To address this, Harwood uses a range of evidence from ellipsis,

but for our purposes we focus on the more transparent fronting evidence. It has been observed by various researchers (e.g., Johnson 2001) that there is a correlation between what can be elided in verb phrase ellipsis and what may be fronted in VP fronting (VPF). Here, the progressive-marked *being* auxiliary is obligatorily fronted in VPF (if present):

(109) Darth Vader says that Han Solo was being frozen in carbonite, then. . .
  a. [**being** frozen in carbonite] he was.
  b. *[frozen in carbonite] he was **being**.
  (Harwood, 2015, (63))

In contrast, the non-finite perfective auxiliary *have* cannot be fronted in the same way:

(110) If Luke says he would have fought hard, then. . .
  a. *[**have** fought hard] he would.
  b. [fought hard] he would **have**.
  (Harwood, 2015, (65))

Harwood (2015) notes that Sailor (2012) observes that pseudo-clefting appears to target the same material as VPF. Hence, in the presence of a progressive, pseudoclefting a verbal projection must include the nonfinite progressive auxiliary *being*, whereas it cannot include *have*.

(111) Elmer Fudd should be being criticised.
  a. No, [**being** praised] is what Elmer Fudd should be.
  b. *No, [praised] is what Elmer Fudd should be **being**.
  (Harwood, 2015, (66))

(112) Elmer Fudd should have been criticised.
  a. *No, [**have** been praised] is what Elmer Fudd should.
  b. No, [praised] is what Elmer Fudd should **have** been.
  (Harwood, 2015, (67))

Notably, however, on the assumption that what you see is what you get (WYSIWYG), a progressive functional projection is not present in clauses that don't bear progressive semantics or morphology. Operating on the assumption that the only phrases that can undergo movement are phases (Holmberg, 2001; Chomsky, 2008; Roberts, 2010; Fowlie, 2010), Harwood (2015) is led to the conclusion that progressive aspect is a phase (along with ellipsis evidence and intermediate positions of low subjects, among other things). Notice, however, that a progressive auxiliary is not necessary in order for pseudoclefting or VPF to occur, as (110b) and (112b) show. What is being fronted in those instances? The straightforward answer is that it is the *v*P phase. This of course necessitates that sometimes the lower phase in a clause is *v*P, and sometimes it is ProgP.

Both Bošković (2014) and Harwood (2015) argue that phases are not linked with a particular syntactic structure, but are essentially a maximal domain. So for the English example above, we would say that the low phase in English is maximally ProgP, but in the absence of a ProgP projection, *v*P is the phase. We believe this property of phases is a direct result of a DMS approach where phases are the ontogenetic fossils of stages of acquisition, where those stages are defined

by the core referential task that a child is working on at any given moment in development.[1] This is compatible with Ramchand's (2018) analysis of progressive aspect as part of the structurally lowest phase.

In this way, a DMS perspective essentially offers a rationale for why phase-like effects exist that captures a range of properties of phases: the existence of successive-cyclic movement through phase edges, anti-locality effects, and variable sizes of phases. All of these can be thought of as ontogenetic fossils of stages of acquisition, which have broadly been attributed to the idea of a "phase." It may be, then, that the idea of phases can be reduced to what syntactic-semantic properties are being acquired by a child at any given point in time: reference to an event (the thematic properties of predicates and arguments), reference to a proposition (an event anchored in time and space), reference to the discourse context and common ground (the linking domain).

1.4 Computational Efficiency of Phases

From the beginning of the Minimalist program, questions of derivational economy and computational efficiency have been invoked in the quest for the simplest syntactic theory available. Chomsky (2001, 11) repeatedly refers to the Minimalist enterprise reducing "computational burden," and the question of reducing computational load is a constant point of evaluation in Minimalist theorizing. For example, Chomsky (2008, 155) states that "[p]hases should, presumably, be as small as possible, to minimize computation after Transfer and to capture as fully as possible the cyclic/compositional character of mappings to the interface."

It has been a consistent stance of generative syntactic theory (and Minimalist syntactic theory more specifically) that our syntactic models are models of competence and not performance.[2] The repeated references to computational burden and computational efficiency are therefore somewhat at odds with this stance, given that we are not modeling processing in any way. The standard rationalization (in my, Diercks's, experience) is that this is one extended metaphor: there are no literal computations at play, and this is simply a way of pressing for the simplest theory possible. That said, Chomsky himself seems to conflate the computation metaphor with actual neuro-biological computation, considering three factors in language development in an individual: 1) "Genetic endowment, apparently nearly uniform for the species" (UG), 2) "Experience, which leads to variation," and 3) "Principles not specific to the faculty of language" (Chomsky, 2005b, 6). The most minimal theory of UG, then, is one which depends the most on extralinguistic (i.e., "3rd") factors, rather than enriching UG itself with additional content. Along those lines:

> One natural property of efficient computation, with a claim to extralinguistic generality, is that operations forming complex expressions should consist of no more than

[1] We consider it plausible, along with many others, that imperfective aspect is a component of the thematic domain (as the viewpoint from internal to the event), whereas perfective aspect is not, instead being a component of the anchoring domain (as the viewpoint external to the event). This naturally explains why we find progressive aspect occurring in the lowest phase, but perfective aspect in the anchoring phase (Ramchand, 2018; Harwood, 2015).

[2] This distinction is discussed or assumed in most of Chomsky's work on syntax; Chomsky (1965, 3) stated, "Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogeneous speech-community, who knows their language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance."

> a rearrangement of the objects to which they apply, not modifying them internally by deletion or insertion of new elements. If tenable, that sharply reduces computational load: what has once been constructed can be "forgotten'' in later computations, in that it will no longer be changed. (Chomsky, 2005b, 11)

O'Grady (2008, 2012) offers a useful critique that is highly relevant to our concerns here:

> Despite the allusions to memory and forgetting, Chomsky is not proposing a model of how sentences are produced and comprehended: computational efficiency is not the same thing as processing cost. (O'Grady, 2012, 496)

> Take for instance the proposal that the derivation proceeds in "phases," with *v*Ps and CPs receiving a phonological and semantic interpretation immediately upon being formed, after which they are 'forgotten' and become inaccessible to later operations. Chomsky ... suggests that this 'minimize[s] computational load', but it is far from clear how this claim can be interpreted or evaluated psycholinguistically, given that the minimalist computational system that he employs builds structure from right to left—the reverse of what actual processors do. (O'Grady, 2008, 460-461)

We are inclined to agree with O'Grady—while there may be important theoretical benefits to having a computationally efficient system, it is not clear what the "computation" is actually referring to, as it does not appear to align in any direct way with more familiar mental phenomena like psychologically synchronous processing costs. As it has turned out, a model designed to reduce computational burden has been quite successful at what it attempts to do (model adult grammatical competence). This is surely a major reason why these theoretical mechanisms have been retained for over two decades. But despite some efforts to connect the model directly to processing in some way (Chesi 2015, for example), for the most part there has been no clear link to actual processing.

DMS, though, suggests an alternative. It seems relatively clear that the "reduced computational burden" that Minimalist theorizing attempts to capture is not related to language production or perception. We suggest that there are in fact real neuro-biological computational processes being modeled by Minimalist syntactic theories. It is simply that they are not synchronous processes in adults, but instead they are essentially the ontogenetic-historical documentation of the language processing that was involved in the course of language acquisition. If DMS as proposed in Chapters 2 and 3 holds, the resulting adult grammatical structures not only represent a system of grammatical knowledge, but they also encode aspects of the process of acquisition in the first place. We would then *of course* expect to find principles of minimal computation at play, reflecting the same principles of economy and optimal mapping between sound and meaning that Chomsky idealized in his foundational reasoning about the Minimalist Program.

Therefore, DMS provides a path to reconciling this persistent tension in Minimalist theorizing. We are modeling competence, yet using a computational system designed to minimize computational burden. Whose burden is it that is being minimized? In our opinion, it is the child's. But the same mechanisms model adult competence well because new structures are added to existing structures in acquisition, retaining previous knowledge and in essence fossilizing the grammaticalization pathway that children take to the target, adult-like grammar (preserving a record of those pathways in the adult grammatical structures themselves). Therefore adult gram-

mars retain ontogenetic fossils of these acquisition pathways, including phases.

2 Prosodically-driven Movement

While a full exploration of the concerns of this section goes far beyond the scope of this manuscript, the syntax-phonology intersections implicated by DMS are far-reaching and non-standard. As stated succintly by Richards,

> The current consensus about this relationship in Minimalist circles, as [we] understand it, is that a phonological derivation begins once the syntactic derivation of a spellout domain is completed. The details of the phonological derivation are not often a focus of interest for syntacticians … it is generally assumed that the derivation begins with a syntactic tree and performs a series of operations to convert that tree into a representation that can be used by the phonological interface. (2017, 23)

DMS, however, suggests that something entirely different is possible in the syntax-phonology interface. That is to say, we need not assume that all phonology necessarily comes *late* in the logical sequence of operations. Instead, DMS assumes that the Minimalist Analytical Constructs (MACs) specifically as the toolkit by which children grammaticalize their input. It is obvious that phonological forms of morphemes/words/sentences are accessible (to some degree) to children by necessity: phonological forms of one sort or another make up the input that children are receiving and processing. This predicts, however, that relatively robust interactions of (early-accessible) phonological material with aspects of syntactic structure should in principle be possible.

There are, of course, many ways in which phonology *is* necessarily (derivationally) late. Consider tone assignment in Bantu languages, to give just one of a multitude of examples: underlying forms may have tone marked on a few moras/syllables only, but the surface form realizes tone across the entire morphophonology of the sentence. No sequence of the surface linear structure is somehow immune to receiving a tonal designation and pronunciation. So in the Tiriki example in (113), all syllables are underlyingly toneless except for the verb root in the embedded clause (113a). In pronunciation, however, a phonological process of high tone anticipation spreads the H tone in the embedded clause leftward to the first syllable of the matrix infinitive.

(113) Tiriki High Tone Anticipation (Michael Marlo, pc)

a. Underlying Representation
xu[ɻeev-a] muundu xu[xól-a] ʃiindu
INF[ask-FV] someone INF[do-FV] something

b. Surface Form
xú[ɻéév-á] múúndú xú[xól-a] ʃiindu
INF[ask-FV] someone INF[do-FV] something
'to ask someone to do something'

Clearly, phonological processes like these are unconstrained by details of syntactic structure, as even an embedded H tone can spread onto matrix clause material. This is of course just one example of numerous such purely-surface phonological processes: they illustrate what is largely con-

sidered to be the norm, that phonology operates on already-completed syntactic structures.

Despite this reality, Richards (2016, 2017) argues that there are syntax-phonology interactions in the course of a syntactic derivation, contrary to standard assumptions. The details of the puzzles and solutions proposed by Richards go far beyond our current concerns, but we will attempt to overview them very briefly here, in order to demonstrate some of the substance behind Richards's reasoning and proposals about these syntax-phonology interactions. Richards develops a theory explaining the cross-linguistic distribution of overt movement (among other things). For example, (114) illustrates that some SVO languages require movement of subjects to preverbal position (English) whereas others do not (Italian).

(114) a. A man has arrived [English]
b. È arrivato un uomo [Italian]
is arrived a man
(Richards, 2016, 1)

Likewise, some languages move *wh*-words to the left edge of a sentence (English), whereas others do not (Japanese):

(115) a. What did John buy? [English]
b. John-wa nani-o kaimasita ka? [Japanese]
John-TOP what-ACC bought Q
(Richards, 2016, 1)

Richards notes the long-standing observation that some languages exhibit the classical EPP (where Spec,TP *must* be filled, even if by an expletive) (116), whereas other languages apparently allow Spec,TP to be empty (117).[3] The sentences in (116) and (117) are all synonymous with the English example.

(116) a. **There** arrived a man. [English]
b. **Il** est arrive un homme. [French]

(117) a. Apareció un hombre. [Italian]
b. É arrivato un uomo. [Spanish]
c. Va venir un home. [Catalan]
(Richards, 2016, 11)

Richards argues that the effects in (114), (116) and (117) can in fact be derived from the metrical requirements of each language, respectively. Setting aside (a great many) details, the languages in (116) are those whose tense affixes in T° place a prosodic requirement to their left, that they must necessarily follow a prosodic boundary, which must be satisfied in those languages by merging something in an adjacent position (i.e., Spec,TP). Languages like those in (117) are largely similar, but their need for a prosodic boundary is satisfied by their verbs: Richards reviews

[3] It is often assumed that the EPP holds for all languages and that languages like (117) must have a null expletive in Spec,TP; Richards's analysis does not require this.

a range of literature showing that Italian, Spanish, and Catalan all contain verb-internal metrical boundaries that precede their tense morphemes, whereas French and English lack the same. Therefore, the prosodic requirements of T° are satisfied by the verb in (117), but they must be satisfied by a separate phrase in (116), the overt subject (the expletive in these instances). Richards abstracts these requirements into quite general statements (Contiguity Theory) accounting for many kinds of movement (e.g., *wh*-movement and head movement), but the details go far afield from our current concerns. "In a sense, the proposal of Contiguity Theory is a very modest one; this kind of phonological operation, which applies to a syntactic tree, can apply, not after the syntactic derivation is completed, but while it is still under way. In fact, if there are any operations that the phonological derivation can perform before the syntactic derivation is complete, perhaps it makes sense for them to be performed as early as possible, if the goal is for the derivation to produce linguistic objects as quickly and efficiently as it can" (Richards, 2017, 24).

As noted by Ott (2017) in his review of Richards (2016), "perhaps the most interesting challenge posed by [Richards's] proposals concerns the place of morphophonology in the overall organization of the grammar. In his model, at least some syntactic operations apply in the service of constructing prosodic structure in tandem with the syntactic derivation. Phonological information such as the presence of metrical boundaries is directly accessed by the syntactic computation; the phonology does not merely impose output conditions on completed derivations" (Ott, 2017, 722). Yet, at the same time, "if [Richards] is right, the phonology is more than an ancillary mapping relating the internal computational system to articulation and perception: it is an 'active player' in syntactic computation" (*contra* long-standing claims by Chomsky Ott 2017, 723).

This might be somewhat irrelevant if it were not for the explanatory potential that Contiguity Theory offers: "What weighs far more than any of the questions raised by his proposals is the fact that his book represents the first serious effort to rationalize a fundamental property of natural language in a way that goes beyond a mere restatement of surface observations in technical terms" (Ott, 2017, 722). For the most part, the Minimalist program offers little in terms of underlying explanations for the kinds of movements that are possible (or not) across languages, but Richards provides systematic arguments linking these with aspects of the prosodic systems in different languages. Yet Contiguity Theory requires such a decidedly non-standard theory of the phonology-syntax interface that it is a significant challenge to incorporate these observations into our current models.

Of course, this kind of outcome is precisely what is predicted by DMS: we expect phonological properties of language that are acquired in adult-like ways by children sufficiently early to be not only be eligible to participate in syntactic operations, but perhaps also *likely* to participate/shape syntactic acquisition, since the syntactic observations children are making would be in the context of the phonology they have acquired (at each respective stage of acquisition).

But the question looms: is there any empirical substance to this? That is, for the prosodic properties that Richards argues play a role cyclically within the syntactic derivation, are these properties in fact acquired early, in the way that DMS would predict? We can't possibly address this in any depth, but the short answer is: yes, it appears that metrical/prosodic properties of a child's first language are in fact central to quite-early stages of acquisition. For an excellent overview of the relevant facts, we refer the reader to de Carvalho et al. (2018); as de Carvalho

et al. report, infants are sensitive to prosodic properties of language from birth. Four-day-old infants have been shown to distinguish their native language from a foreign language (Mehler et al., 1988), and Mehler et al. (1988) likewise show that infants use prosodic information (as opposed to segmental phonetic information) to draw such distinctions. By 7-10 months, babies are sensitive to the coherence of intonational phrases (Hirsh-Pasek et al., 1987), and multiple studies have shown that children as young as 6 months exploit prosodic boundaries to find word boundaries (Shukla et al. 2011, among others: see de Carvalho et al. 2018, 23). Far beyond simply parsing words, de Carvalho et al. (2018, 24ff) discuss a range of evidence showing that children as young as 18 months use prosodic boundaries to disambiguate syntactic structures, meaning that (at that point) they have already acquired knowledge of some degree of systematic correlation between syntactic structures and prosodic structure (de Carvalho et al., 2017; He and Lidz, 2017; de Carvalho et al., 2015; Christophe et al., 2008).

Of course, none of this is direct evidence substantiating a link between the prosodic properties that Richards proposes to be relevant in specific languages and the acquisition of those particular properties in those languages (in the timelines predicted by DMS for the syntactic structures of those languages). This is a substantial research program and nothing we can even attempt to answer. Our point is that such a link is quite plausible based on what we *do* know about timelines of acquisition of prosody and syntax, and that taken in context of the rest of what we have proposed for DMS here, we find the potential confirmatory evidence from vastly different empirical domains to be tantalizing, albeit still beyond our reach.

As a final comment on Richards's proposals, Ott (2017, 722) offers the following critique:

> Does the book accomplish its declared goal of 'develop[ing] an explanatory theory of when movement takes place and when it does not' (5)? In view of the empirical and conceptual complexity of the material, answering this question is anything but straightforward. The theoretical machinery established by [Richards] in the course of the discussion is not always obviously more principled than the features it is designed to replace (but see Richards 2017), not least because the system requires a number of rather awkward assumptions at various points. Irregularity is a case in point: verbs with irregular stress patterns in languages such as Spanish behave exactly like regular verbs with regard to EPP effects; this, [Richards] argues, indicates that the syntax simply does not 'see' the irregularity and treats all verbs as exhibiting regular stress (while being generally sensitive to metrical information). He is forced to adopt the same reasoning for lexical accent on *wh*-phrases in Basque, a perfectly systematic property of the language that is nevertheless inaccessible to syntax as a lexical idiosyncrasy. Similar assumptions are required for null subjects in pro-drop languages with EPP effects and null tense affixes: to explain how *pro* can provide, and null affixes require, metrical support, [Richards] is forced to assume that the syntax is oblivious to the fact that these elements ultimately remain unpronounced (although the same cannot hold for PRO, as the discussion in connection with T-subject contiguity in French reveals). (Ott, 2017, 722)

An example of syntax being oblivious to final phonological outputs (despite being centrally driven, per Richards, by "initial" phonological outputs) is colloquial Finnish (Holmberg and Nikanne, 2002), which Richards analyzes along the same lines as English and French, requiring a

preverbal phrase to support the prosodic requirements of T°.

(118) **Sitä** leikkii lapsia kadulla. [Finnish]
EXPL play children in.street
'Children play in the street'
(Holmberg and Nikanne, 2002, 71)

Nonetheless, Finnish displays a limited pro-drop property, with null subjects available in some instances, which might otherwise be unexpected given the analysis of the expletive in (118) emerging because of a prosodic requirement.

(119) Puhu-n englantia
speak-1SG English
'I speak English'
(Holmberg, 2005, 539)

"We can think of the behavior of pro-drop as another instance of syntax being blind to lexical idiosyncracy; Finnish does have pronounced pronouns as well as the unpronounced ones that are involved in pro-drop, and syntax ignores this distinction, treating all DPs as pronounced" (Richards, 2016, 22). Richards (2016, 11) is transparent about these requirements, stating in his introduction:

> [W]e will discover a number of differences between the structure that we want the syntax to make reference to and the actual phonological structure of the output. I will attribute these differences to postsyntactic phonological operations, which will in some cases obscure the reasons for the behavior of the syntactic computation. On the approach developed here, these mismatches shed light on the amount of access syntax has to phonological information, and thus ultimately on the architecture of the derivation; crucially, the syntax is not simply 'looking ahead' to the final phonological representation, but is working from a 'rough draft' of the phonology which will later be revised."

This in effect creates a number of opaque interactions, where later (phonological) processes can obscure the prosodic context that required a movement in the first place.

Without additional context, Ott's criticism from above is a fair one: what theory is there of "rough draft" phonology (addressing prosody/metrical structure) apart from final phonology, especially one in which the rough draft phonology is available to syntax while the final phonology is not? We are surely wearing our bias on our sleeves at this point: DMS provides just such a theory, on principled grounds that have been developed almost entirely separately from the empirical domains that Richards is concerned with. As we noted above, not only do children have access to metrical properties of language at an early acquisition stage, but it is largely thought that these properties of languages are critical bootstrapping devices that allow children to unlock the morphosyntactic properties of their language; as such, we ought not to be surprised if the metrical properties of language play into the correct formulation of syntactic generalizations.

On a DMS approach, we would not only expect children to have access to certain prosodic structures of language early, but we might well expect them to draw syntactic generalizations

based on prosody (nothing in DMS as we've articulated it to this point requires this, but these kinds of analyses are readily available and, in our opinion, quite reasonable). Richards's (2016; 2017) work on prosody-syntax interactions takes us far outside our own expertise, and we are unqualified to comment on its viability on its own. But (as Ott suggests) if some of the largest issues standing in its way are 1) the interaction of prosody with core syntax and 2) the split between syntax-visible phonology (e.g., metrical structure) and syntax-invisible final spellouts of morphophonological forms (e.g., tone assignment in Tiriki, null pronouns in Finnish, and a host of other phenomena), then a DMS perspective has a lot to offer.

3 Information Structure is Derivationally Late

It's possible that one of the reasons that countercyclic analyses persist in the literature despite countercyclic theoretical proposals being only marginally acceptable (at best) in the minds of most theoreticians is that the original constructions they have been invoked to explain are largely narrow and/or uncommon. Chomsky laid this out as an explicit reason to reject non-standard structure-building operations like countercyclic Merge, among others:

> Counter-cyclicity is about the same as Late Merge, so this critique holds for everything that is done with what's called Late Merge: it's completely unacceptable, because it involves operations that are complex, unmotivated, they have nothing to do with the goal we think we ought to obtain, something like the Strong Minimalist Thesis (SMT). These considerations become far more significant in the case of what are sometimes called exotic constructions, those which have virtually no evidence, maybe none, available for the child; things like Antecedent-Contained deletion or Across-the-Board movement, Parasitic gaps … It's simply impossible to propose a new principle for those, it can't be. The child has no evidence for them if he has to understand them. It must be the application of principles that are available for simple, easy, normal cases. So, in fact every kind of construction is in fact pretty exotic of the kind that Charles (Yang) was talking about but some are extremely so thus leading to the invocation of operations like counter-cyclicity, Late-Merge … completely unacceptable. (Chomsky, 2019, 267)

Chomsky's point is a good one: if the only reason we need a dramatically non-standard theoretical mechanism is for a cross-linguistically rare sort of construction that is also (likely) statistically rare in the primary linguistic data available to a child acquiring a language, then it is methodologically questionable to make those non-standard mechanisms available in the theory.

We take a quite different stance on countercyclicity. But this is also an empirical question: are all purported instances of countercyclic operations such "exotic" constructions that a child would have little-to-no access to? This is highly relevant, because it is another way of asking, "how seriously do we have to take this apparent countercyclicity?" So here we entertain the question: are all such constructions "exotic," to use Chomsky's descriptor? Or to use a different one, are they at the periphery of our grammatical concerns? The answer to this is a definitive "no." Another clear instance of countercyclic empirical phenomena come from conjoint/disjoint and object marking constructions across a large range of Bantu languages. We focus on Zulu here as a particularly well-researched example, though the same argument can be replicated in

a number of languages: there are relevant parallels in Lubukusu (Sikuku and Diercks, 2022) and Sambaa (Riedel, 2009), to name just two. We assume the Zulu situation is not extremely familiar to the likely readership of this monograph, and as such we lay out the empirical background in some depth to make the argument clear.

An interesting hypothesis emerges from the discussion in this section. Specifically, the countercyclic properties of object marking and verbal inflection in many Bantu languages appear to be closely linked with information structure. At the end of this section, we posit the hypothesis that discourse-linked properties like information structure are derivationally late, even if in some instances they are structurally low. We offer some brief comments from the DMS perspective, though (like everything in this chapter) these are simply issues for future research from a DMS perspective.

3.1 Zulu Conjoint/Disjoint

Across a broad range of Bantu languages, there are languages that possess forms of verbal marking that correlate with the presence/absence of postverbal material: the forms are known in the Bantu language literature as conjoint forms and disjoint forms.[4] Conjoint forms on a verb show a closer connection between a verb and what follows, and disjoint forms are used when there is a looser connection with what follows or when nothing follows the verb (van der Wal and Hyman, 2017). In Zulu, the predominant analysis of conjoint/disjoint is that the distinction tracks the presence of morphosyntactic content inside *v*P: conjoint is used when a constituent is inside *v*P, and disjoint is used when *v*P is empty.

(120) Conjoint-disjoint generalization in Zulu:
Conjoint (Ø): appears when *v*P contains material (after movement)
Disjoint (ya): appears when *v*P does not contain material (after movement)
(Halpert, 2016, 122)

So (121a) occurs with a conjoint form with an overt object, but when there is no overt object the conjoint form is unacceptable in (121b); this circumstance instead requires the disjoint form (121c).[5]

(121) Zulu Conjoint/Disjoint (Zeller, 2015, 19)

a. U-mama u-phek-a i-n-yama (conjoint)
AUG-1a.mother 1SM-cook-FV AUG-9-meat
'Mother is cooking the meat.'

b. *U-mama u-phek-a (conjoint)
AUG-1a.mother 1.SM-cook-FV
Intended: 'Mother is cooking.'

c. U-mama u-ya-phek-a (disjoint)
AUG-1a.mother 1.SM-DJ-cook-FV
'Mother is cooking.'

[4] The literature also refers to these as short and long forms of verbs, along with other language-specific terms.

[5] Zulu verbs raise out of *v*P, to a position usually assumed to be to an aspect projection in the middlefield of the clause.

In Zulu, the *v*P is a focus domain (see below), and as a result there is a link between conjoint/disjoint and information structure, though the predominant analysis for Zulu is that this link is indirect. Others have claimed that the conjoint/disjoint alternation in other languages directly references information structure (see Nshemezimana and Bostoen 2017 and van der Wal and Hyman 2017 for discussion), but the consensus for Zulu is that it is a syntactic pattern and is only indirectly pragmatic.

A central aspect of the conjoint/disjoint distinction is that it is surface-oriented, and it appears to be category-neutral. That is to say, it doesn't matter *what* is in *v*P, as long as something is: in these instances, the conjoint form is used. So we can see that it is not just the presence/absence of an object that conditions the use of conjoint or disjoint. If a subject occurs *in situ* postverbally, the (unmarked) conjoint form must be used:

(122) ku-(*ya)-pheka uSipho $_{vP}$]
17SM-(*DJ)-cook AUG.1.Sipho
'Sipho's cooking.'

Crucially, however, the parallel example above in (121c) shows that preverbal subjects do not require conjoint forms, instead occuring with disjoint verb forms (when nothing else follows the verb). So we can see that the surface position of the *v*P-internal constituent is what is relevant. This is further demonstrated by object marking constructions, which are spelled out in the next section.

Beyond the fact that it is the surface position that matters, it is also striking that the exact content of the *v*P-internal constituent is largely irrelevant. So, for example, *v*P-internal arguments readily require conjoint forms (and disallow the disjoint form), and low adverbials do the same.

(123) Ngi-(*ya-)cul-a kahle.
1SG.SM-(*DJ-)sing-FV well
"I sing well."
(Buell, 2006, (21))

A similar pattern is evident in the relative clauses in (124), both of which require a resumptive pronoun for the extracted phrase (circled in the examples below). Both of these verb forms require the conjoint form of the verb, based on the presence of the resumptive pronoun postverbally.

(124) a. i-ndawo lapho ngi-cul-e khona (conjoint)
DET-9.place there 1SG.SM-sing-FV 17.PRO
"the place where I sang"

b. i-sikhathi engi-cul-e nga-so (conjoint)
DET-7.time REL.1SG.SM-sing-FV at-7.PRO
"the time when I sang"
(Buell, 2006, (21))

The precise analysis of the conjoint/disjoint distinction is deeply interesting, but it is aside from the main point here (we refer the reader to van der Wal and Hyman 2017 for a recent

overview and specific studies). Instead, it is a valuable diagnostic of whether postverbal material appears internal to the *v*P or not, which for our purposes is crucial for understanding Zulu object marking patterns.

3.2 Zulu Object Marking

There is a long history of research on Zulu object marking (OMing) (Adams, 2010; Buell, 2005, 2006; Cheng and Downing, 2009; Halpert, 2012; Van der Spuy, 1993; Zeller, 2012, 2014, 2015, among others). Jochen Zeller's (2012; 2014; 2015) research aggregates and synthesizes this work well; our summary here mainly relies on his work. Zulu only allows a single object marker on the verb form: attempts to pronominalize both objects via OMs on the verb are unacceptable, as (125) shows.

(125) Zulu (Zeller, 2012, 220)

a. U-John u-nik-e a-ba-ntwana i-zi-ncwadi
AUG-1a.John 1SM-give-PST AUG-2-child AUG-10-book
'John gave books to the children.'

b. *U-John u-[ba-] [zi-] nik-il-e.
AUG-1a.John 1SM-2OM-10OM-give-DJ-PST

c. *U-John u-[zi-] [ba-] nik-il-e.
AUG-1a.John 1SM-10OM-2OM-give-DJ-PST

Instead, if one wants to pronominalize both objects, only one may be represented via an OM on the verb, and the other must be a free pronoun following the verb. As (126) shows, however, the grammar does not restrict *which* object may be an OM or a free pronoun. Instead, either object may be represented as an OM.

(126) Zulu (Zeller, 2012, 220)

a. U-John u-[ba-] nik-e zona.
AUG-1a.John 1SM-2OM-give-PST 10PRON
'John gave them to them'

b. U-John u-[zi-] nik-e bona.
AUG-1a.John 1SM-10OM-give-PST 2PRON
'John gave them to them.'

This turns out to be a quite general property of Zulu OMing, that it is what has often been termed "symmetrical" in the literature on Bantu languages. Following a long line of research (cf. Bresnan and Moshi 1990 and much that follows), it has become clear that there is a range of variation between languages (and between constructions within languages) about the properties of objects in multiple object constructions. Specifically, some languages only allow a single object (the structurally highest object, e.g., a benefactive in a benefactive applicative) to carry object properties like being OMed on the verb or being promoted to subject in a passive: these are termed asymmetrical languages. Symmetrical languages, on the other hand, allow multiple objects to do so. With respect to object marking, then, Zulu is symmetrical, illustrated again in (127) with lexical DP objects.

(127) a. U-Langa u-phek-el-a u-mama i-nyama.
AUG-1a.Langa 1SM-cook-APPL-FV AUG-1a.mother AUG-9.meat
'Langa is cooking meat for mother.'

b. U-Langa u-m -phek-el-a i-nyama (u-mama).
AUG-1a.Langa 1SM-1OM-cook-APPL-FV AUG-9.meat AUG-1a.mother
'Langa is cooking meat for her (mother).'

c. U-Langa u-yi -phek-el-a u-mama (i-nyama).
AUG-1a.Langa 1SM-9OM-cook-APPL-FV AUG-1a.mother AUG-9.meat
'Langa is cooking it for mother (the meat).'
(Zeller, 2012, 227)

This symmetricality ends up playing a major role in Zeller's (2014; 2015) analysis of Zulu OMing, which we will see below. There are some restrictions on what kinds of objects can co-occur with OMs, a phenomenon known as (clitic-) doubling or OM-doubling. Unaugmented noun phrases (i.e., negative polarity items) cannot be OMed in Zulu, and the same is true for *wh*-phrases, as (128) shows. *v*P is well-established to be a focus domain in Zulu, and (as we will see below) object marking objects is connecting with those objects leaving the *v*P focal domain.

(128) a. A-ngi-(*m)-thand-i mu-ntu.
NEG-1SM-1OM-like-NEG 1-person
'I don't like anyone.'

b. U-zo-(*m)-qabul-a bani?
1SM-FUT-1OM-kiss-FV 1a.who
'Who will he kiss?'
(Adams, 2010, 42–43)

OM-doubling in a transitive requires the disjoint verb form in Zulu. So a simple monotransitive sentence without an object marker appears in the unmarked conjoint form in (129a), but when an OM appears on the verb (even with the lexical DP object still appearing postverbally) the verb must be in a disjoint form (129b).

(129) a. Ngi-theng-a le moto.
1SG.SM-buy-FV 9DEM 9.car
'I'm buying this car.'

b. Ngi-*(ya)-yi -theng-a le moto.
1SG.SM-DJ-9OM-buy-FV 9DEM 9.car
'I'm buying (it) this car.'
(Zeller, 2012, 222)

The predominant analysis has been to propose that overt postverbal objects that are OMed on the verb are in fact dislocated from their base position, appearing outside the *v*P (Van der Spuy 1993 et seq.). This explains the conjoint/disjoint facts, presuming that conjoint marking is taken to indicate that a constituent remains inside *v*P and that disjoint marking is when *v*P contains no argument constituents or adjunct constituents on the surface (Van der Spuy, 1993; Buell, 2005, 2006; Halpert, 2016, 2017). Zulu shows a lot of consistent evidence that affirms this analysis. For

example, OM-doubled arguments occur to the right of manner adverbs. In (130a), we see that the canonical position of a manner adverb is to the right of the direct object. In (130b), we see that OM-doubling is unacceptable with canonical word order; instead, when an OM appears on the verb, the corresponding lexical object must appear to the right of the manner adverb (130c).

(130) a. Si-bon-a i-n-kosi kahle.
1SG.SM-see-FV AUG-9-chief well
'We are seeing the chief well.'

b. *Si-yi- bon-a i-n-kosi kahle.
1SG.SM-9OM-see-FV AUG-9-chief well

c. Si-yi -bon-a kahle i-n-kosi .
1SG.SM-9OM-see-FV well AUG-9-chief
'We are seeing him well, the chief.'
(Zeller, 2015, 20)

Assuming that manner adverbs adjoin at the edge of *v*P, this suggests that OM-doubled arguments move outside *v*P:

(131) . . .siyibona kahle]$_{vP}$ . . . inkosi = (130c)
(Zeller, 2015, 20)

Double object constructions show the same pattern: when the indirect object is OM-doubled, the indirect object DP cannot appear in its canonical position (132b), instead occurring to the right of the direct object (132c). This is consistent with a right-dislocation of OM-doubled objects.

(132) a. U-John u-nik-a a-ba-ntwana i-mali.
AUG-1a.John 1SM-give-FV AUG-2-child AUG-9.money
'John is giving the children money.'

b. *U-John u-ba -nik-a a-ba-ntwana i-mali.
AUG-1a.John 1SM-2OM-give-FV AUG-2-child AUG-9.money

c. U-John u-ba -nik-a i-mali a-ba-ntwana .
AUG-1a.John 1SM-2OM-give-FV AUG-9.money AUG-2-child
'John is giving the children money.'
(Zeller, 2015, 22)

Another diagnostic comes from the properties of focused phrases in Zulu. It is well-established that focused phrases in Zulu must appear *v*P-internally. This is shown for exclusive focus with *kuphela* 'only' in (133) and for *wh*-elements (assumed to be inherently focused) in (134). In both examples, a focused subject cannot appear in the canonical preverbal subject position, instead appearing *in situ* (and triggering conjoint forms of the verb, confirming the *in situ* position within *v*P).[6]

[6]Several of the examples below are in the past tense/aspect *-ile/e*, which shows a conjoint/disjoint distinction in those two allomorphs, rather than in the *-ya-* marking used above.

(133) a. Ku-fik-e u-Sipho kuphela.
17.EXPL-arrive-PST.CJ AUG-1a.Sipho only
'Only Sipho arrived.'

b. *U-Sipho kuphela u-fik-ile.
AUG-1a.Sipho only 1SM-arrive-PST.DJ

(134) a. Ku-sebenz-e bani?
17.EXPL-work-PST 1a.who
'Who worked?'

b. *U-bani u-sebenz-ile?
AUG-1a.who 1.SM-work-PST
(Zeller, 2015, 20)

If OM-doubled phrases must be outside *v*P, then it is predicted that OM-doubling focused phrases would be impossible, which is confirmed below:

(135) a. Ngi-bon-e u-Sipho kuphela]$_{vP}$.
1SM-see-PST AUG-1a.Sipho only
'I saw only Sipho.'

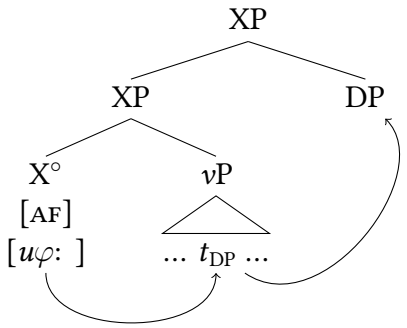
b. *Ngi-(m) -bon-ile]$_{vP}$ (u-Sipho kuphela) .
1SM-1OM-see-PST AUG-1a.Sipho only
(Buell, 2008, (6))

(136) a. U-cul-e i-phi i-n-goma]$_{vP}$?
2SM-sing-PST 9-which AUG-9-song
'Which song did you sing?'

b. *U-(yi) -cul-ile]$_{vP}$ (i-phi i-n-goma) ?
2SM-9OM-sing-PST 9-which AUG-9-song
(Buell, 2008, (5))

Zeller (2015) argues that the appropriate analysis of these patterns is that object markers arise via an agreement relation with a functional head on the edge of *v*P, which triggers movement of the relevant object to a right-facing specifier of the functional projection. (137) sketches this analysis.

(137) Zeller's (2015, (65)) analysis of Zulu object marking



Zeller (2015) argues that the relevant feature triggering this Agree relation is an A'-feature related to the discourse status of objects that undergo this short right-dislocation. Zeller proposes that it is an *anti-focus* feature that accomplishes this in the syntax. This explains, among other things, why Zulu object marking is "symmetrical" (i.e., either object of a ditransitive can be OMed): the anti-focus Probe doesn't necessarily find the closest DP, but it finds the closest anti-focus-marked DP. In (138a), the indirect object *uSipho* is the discourse-familiar object and is dislocated to the right of the direct object. In (138c), the direct object is OMed and dislocated, though less obvious in this case because direct objects appear canonically to the right of indirect objects.

(138) a. Ngi-m -theng-el-a u-bisi u-Sipho . (conjoint)
1SG-1OM-buy-APPL-FV AUG-11.milk AUG-1a.Sipho
'I'm buying him milk, Sipho.'

b. *?Ngi-m -theng-el-a u-Sipho u-bisi. (conjoint)
1SG-1OM-buy-APPL-FV AUG-1a.Sipho AUG-11.milk

c. Ngi-lu -theng-el-a u-Sipho u-bisi . (conjoint)
1SG-11OM-buy-APPL-FV AUG-1a.Sipho AUG-11.milk
'I'm buying it for Sipho, the milk.' (Zeller, 2015, 23)

The pattern in (138a) and (138b) is what is expected based on the preceding discussion: if OMing is connected with a (short) right-dislocation, we expect an OMed indirect object to appear to the right of other objects that remain in *v*P. Notice in all of the examples in (138) that the verb appears in the conjoint form: in each of these instances, only one object is dislocated, and therefore one remains inside *v*P, requiring a conjoint form (on the empirical analysis discussed above, which says that the Zulu conjoint/disjoint distinction tracks whether there is surface content inside *v*P).

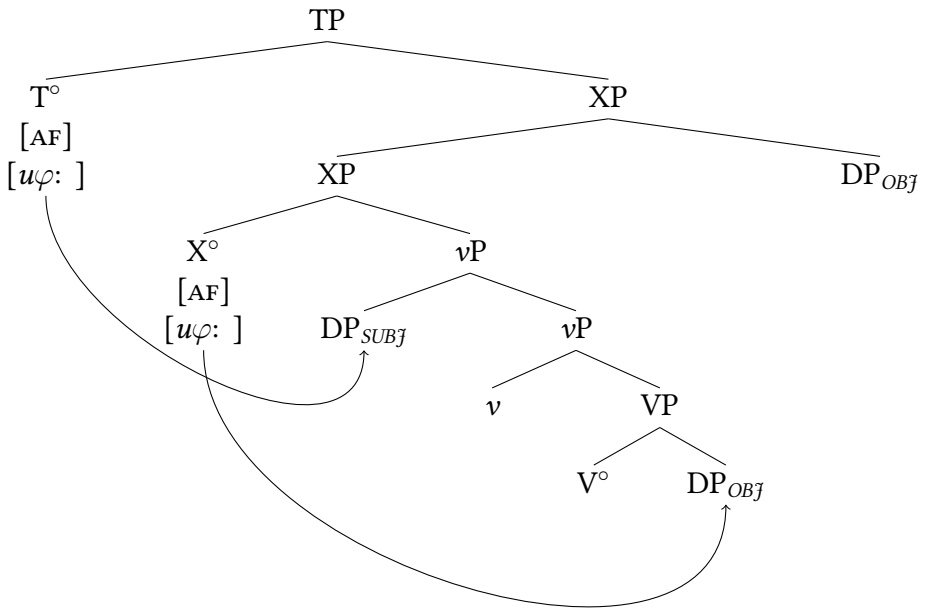
3.3 Countercyclic Object Marking

We are now at the point where the Zulu patterns become relevant to our main concerns here. Zeller tackles a puzzle about the implementation of his account above. Crucially, external arguments (canonical subjects) are generated in Spec,*v*P, before being raised to Spec,TP. A central aspect of Zulu syntax, however, is that the preverbal subject position is incompatible with focused subjects, instead requiring focused subjects to remain postverbal. This suggests that T is also an anti-focus probe, as it can only find an anti-focus subject as a Goal. (Similar accounts have been proposed/assumed by a number of researchers working on southern Bantu languages.) That said, when subjects remain postverbal, they are clearly internal to *v*P, as they require conjoint marking on the verb. Postverbal subjects in Zulu are widely assumed to be in Spec,*v*P (see Halpert 2016 for extensive discussion).

This raises a crucial issue, however. The base position of subjects clearly aligns with standard assumptions, being in Spec,*v*P. This means, however, that in even the most basic object marking sentences, canonical subjects are marked anti-focus and appear in Spec,*v*P before being the target of an [AF] Agree relation from T. But in constructions with object markers, this poses a hard paradox. If the anti-focus probe on X° is merged atop *v*P, it ought to *always* find the subject in Spec,*v*P and never find the object (perhaps also ruling out T° finding the subject as a Goal of

its own Agree relation, if Agree with X° in this hypothetical scenario would also deactivate the subject DP, as we would expect). This is of course the opposite of the normal pattern, where T agrees with subjects and X° with objects. These criss-crossing Agree relations are illustrated in (139):

(139) Zulu countercyclic object marking (failure of subjects to intervene)



Zeller's solution to this is to stipulate that T always probes first and that lower copies of moved elements are not relevant in the calculations of locality (here, irrelevant as a potential Goal for Agree).

(140) The "T Always Probes First" principle (TAPF) (Zeller, 2015, (68))
The first *v*P-external PROBE-GOAL relation in a derivation must involve the uninterpretable features of T.

While we find it reasonable that the copy of the moved subject would not intervene (Riedel 2009 must assume something similar for object marking contexts), (140) is pure stipulation. It should be pointed out that object marking (and conjoint/disjoint constructions) raise this same problem across a large number of Bantu languages, with scholars taking various solutions. For example, Sikuku and Diercks (2022) have the same countercyclic problem of subjects not intervening in the relevant Agree relation between the head generating object marking and the object. Rather than a delayed agreement analysis, they instead propose Late Merger of the head generating object marking (the equivalent of XP here), after T° has already probed the subject in Spec,*v*P. The point is not the details, of course, but that this kind of derivational paradox is not simply an artifact of Zeller's analysis of Zulu; the head that generates the OM is above *v*P and probes for anti-focus features but necessarily does not ever find anti-focus subjects as Goals, despite them

clearly being the most accessible structural argument. Similar countercyclicity puzzles also arise in the analysis of Zulu conjoint/disjoint itself, which (similar to Zeller) Halpert (2016) resolves by stipulating the ordering of probing features that are responsible for moving the subject and tracking *v*P content (see Pietraszko 2020 for a similar argument).

Again, the point of raising this puzzle here is not simply to add to the list of countercyclic constructions; the list of such proposed analyses is much too extensive to try to catalog here. Rather, this addresses the suggestion by Chomsky (2019, 267) that divergences from standard cyclic Merge tend to be necessitated by "exotic" constructions which a child would have little-to-no direct access to in the PLD. Quite to the contrary, of course, conjoint/disjoint distinctions and object marking are the definition of morphological transparency, showing explicit morphology on verbal forms in most basic sentences (in the relevant tenses/aspects, which are not themselves uncommon). There is no reason to think that a child would have limited access to relevant data for constructions like these. Nonetheless, the Zulu constructions pose hard problems for basic cyclic structure building. Importantly, as noted by Diercks (2022b), rather than being exceptional, the Zulu situation seems to be a typical property of Bantu languages, showing a countercyclic property of low focus/givenness in a broad range of languages and constructions. As discussed by Diercks (2022a), a potential unification of these ideas is that constructions related to information structure are derivationally late, whether than means they are structurally high (in the extended left periphery) or Late Merged.

3.4 Towards Explaining Countercyclicity in Zulu OMing

What does the DMS approach predict in the case of Zulu OMing? For the sake of argument, let us assume that the Zulu pattern is derived via Late Merger of XP, rather than by a delayed agreement.[7] This countercyclic analysis of object marking makes very clear predictions according to DMS: Zulu object-marking is predicted to be acquired later than (at least) TP in Zulu. Unfortunately, there is very little acquisition data available for Zulu or for any Bantu language.[8]

However, there is one study that suggests that object marking is acquired later than structurally higher morphology like tense and subject markers. Suzman (2002) provides two case studies of language impairment from Zulu (alongside one control). Language impairment is a useful domain to study acquisition in, as (among other things) the protracted timeline of acquisition for some children offers an extended window to observe acquisition processes and sequences. Suzman (2002) found variable access to morphology in the case studies, finding that while the control subject acquired a relatively broad range of verbal and nominal morphology, only some of these were acquired by the language-impaired children. Crucially for our purposes, object marking was still rare even after subject markers and tense were acquired.

[7] It is perhaps worth noting that in order to derive the rightward movement of objects, if T probes first, a Late Merger is still required under Zeller's analysis, of the DP object to XP; it seems likely that a Late Merger analysis would instead categorize the problem alongside other similar problems, as opposed to the stipulative TAPF in (140).

[8] Perhaps best-studied in this respect is Swahili, but Swahili object marking doesn't (obviously, at least) share the same countercyclic properties that we are concerned with here, different in many ways from Zulu, Lubukusu, Sambaa, etc.

(141)

Grammatical Morphology	Typical Zulu	Impaired Zulu
Selected Noun classes	✓	✓
Subject Markers	✓	✓
Adjectives	✓	✓
Tense	✓	✓
Object Markers	✓	Rare
Relative Clause Markers	✓	Rare

(Partial Replication of Table 9 from Suzman (2002)

This is consistent with the predictions of DMS but is hardly sufficient as an empirical support for our claims. But if more language acquisition work occurs in Zulu, it will open the door to test these predictions more thoroughly. If the early results from Suzman (2002) hold, we would again see that countercyclic properties are possible but arise because of countercyclic acquisition.

We have suggested that countercyclicity emerges when a child is not ready to grammaticalize a pattern that they are encountering on the usual cycle of strict structure-building via Merge. This may well emerge because the child does not yet have the requisite grammatical structures necessary to grammaticalize the input, but Zulu and other countercyclic object marking contexts are not obvious examples of that. Zulu offers a child overt morphology on the verbal form which ought to be readily available to children from the start.

What we suspect is at play here is that rather than the requisite grammatical structures having yet to emerge, in an instance like this, children instead don't yet have the cognitive ability to analyze the pattern that is to be grammaticalized in the first place. As noted above, these Zulu patterns are integrally related with information structure and the structure of discourse: these kinds of nuanced semantic and pragmatic notions are quite plausibly unavailable to children at the point when they are acquiring core predicates and argument structures or tense/inflection. While work isn't available from Zulu, more broadly, there is certainly research showing that acquisition of target-level proficiency of grammatical information structure can be *much* later than acquisition of argument structures and/or tense/inflection. As Dimroth and Narasimhan (2012) report, some aspects of adjusting discourse strategies according to the pragmatics of discourse do begin to be used quite young. But

> despite evidence of early sensitivity, children do not always use the linguistic forms in the input in appropriate ways from an early age. For instance, children's use of pronouns is not influenced by the listener's co-presence and ability to perceive the target event although the immediate discourse context does exert a significant influence. German-speaking children's use of word order in phrasal conjuncts demonstrates their sensitivity to the distinction between 'new' and 'old' information, yet their propensity to order 'new' information first is not adult-like. Children's use of the topic marker *ne* in Chinese also suggests that children do not use linguistic forms in the same way as adults do despite their sensitivity to the relevant distinctions. (Dimroth and Narasimhan, 2012, 332)

In fact, von Stutterheim et al. (2012) show that L1 learners of German have often not acquired adult-like structuring of information by age 14 in narratives.

The grammatical underpinnings and syntactic boot strapping into discourse organi-

> sation entail the fusion of syntactic, semantic and pragmatic knowledge in language-specific terms—a system of knowledge which takes years to uncover as well as discover. Grammatical form provides the key for the child in tracking down the knowledge they have to acquire when organising information in text functional terms. No one will deny of course that there are also cognitive prerequisites that have to be met so that the child can begin and continue to acquire more complex systems. (von Stutterheim et al., 2012, 582)

So in a way we do agree with Chomsky that these countercyclic structures are largely unavailable to children, but not because there is evidence lacking in the input. We would instead suggest that it is because the cognitive skillsets necessary to acquire Zulu conjoint/disjoint and object marking patterns are unavailable to children at the time that they are acquiring other verbal morphology at a similar structural level. (The skillsets that are necessary here being whatever enables tracking of discourse participants and interlocutor Common Ground in order to use focus/background structures appropriately.) This is exactly what is predicted on a DMS-style interpretation of Minimalist analyses. But these patterns are not entirely unavailable to children, of course—there is no need to require the countercyclicity of Zulu object marking patterns to emerge directly from the properties of UG as Chomsky suggests for constructions like parasitic gaps, as there is robust direct evidence of object marking and conjoint/disjoint available to children in the input. What we suggest is that, due to the necessary cognitive prerequisites, the pattern is unavailable to children at the developmental point when it would need to be grammaticized if it were to happen via canonical Merge; as such, when it is acquired it is via Late Merger, i.e., a substitution operation that does *not* obey the Extension Condition and instead tampers with the existing structure.

To reiterate, the acquisition evidence that we have for this (from Zulu) is quite limited, though it does support these conclusions. The main contribution here is to show that countercyclic constructions can in fact be both central to the grammar of a language and immediately available in surface-evident morphology, making it hard to marginalize countercyclicity to the periphery of the constructions we allow to structure our theory.

Chapter 6

Conclusions

Michael Diercks
Katherine Johnson

1 Recapping Developmental Minimalist Syntax

The core claim of this work is that there are systematic correlations between Minimalist analyses of adult syntactic structure and the timeline of child language acquisition. The main claim of the manuscript is repeated here:

(142) **Developmental Minimalist Syntax (DMS)**
The Minimalist derivation of adult language structures recapitulates the ontogenetic (i.e., organism-internal) development of those same syntactic structures.

In Chapter 2, we summarized a variety of evidence showing that this is plausible given what we know about acquisition (and we also discussed a variety of previous generative proposals that posit similar ideas). As we suggested in Chapter 3, the correlation in (142) appears most robustly with children's productive, target-like utterances, i.e., their use of grammar that is creative and flexible in a manner similar to adults' (with whatever piece of grammar is under consideration).[1] This predicts that children's use of canonical objects will become creative and flexible before subjects, vP before TP, and TP before CP (to highlight some major structures). We overviewed evidence in Chapter 2 that suggests that this is accurate, although with the expansive nature of the claims, more work is certainly necessary.

As we have attempted to make clear throughout, DMS is by no means an empirical certainty, and its predictions are too expansive to build an exhaustive empirical argument for it. That said, it is consistent with available evidence, it is testable in a variety of ways, and we believe it is both plausible and reasonable to pursue as a perspective on the nature of human knowledge of natural language.

[1] It could perhaps be shown that the relevant correlation is with an internal knowledge state, but we argue that we at least see a correlation in overt productive utterances.

A central component of the DMS proposal that diverges from previous similar proposals is that DMS proposes a correlation not between acquisition of syntax and structural height, but rather between acquisition and the derivation of phrase structures. This is relevant because there are a large number of grammatical patterns that have proven difficult to explain within a strict bottom-up Merge-based syntactic derivation: some grammatical constructions seem to require knowing what the outcome of the derivation will be to get the derivation right, and others seem to require going back and editing a structure after it is built (Late Merge, Remove, Exfoliation, etc.). Essentially, there appear to be mismatches between structural height and the derivational sequences that build structures. We broadly referred to these as countercyclic phenomena.

Our suggestion is that these mismatches are deeply informative. These are instances where sequences of a derivation, and of acquisition, do not proceed strictly bottom-up. But the key point for DMS is that it is quite plausible, based on the available evidence, that these anomalous sequences in adult syntax (at least, anomalous from a perspective of strict Merge-based structure building) correlate rather straightforwardly with sequences of acquisition. Similarly, we discussed a noncanonical analysis regarding how DPs are constructed (layering), where DP construction is distributed over the course of the derivation. This approach to derivational timing is not clearly subsumed under countercyclicity, but it also isn't naturally captured under (current) typical approaches to DP structure, which assume that DPs are merged as a unit into the clause. Layering analyses of DPs suggest that the functional structure of a DP is added as the derivation of a clause proceeds. This is another instance where the timing of a derivation in adult syntax makes precise predictions for children's acquisition, as we expect functional projections atop DP to be acquired after nominals themselves are being used productively in grammar-based (i.e., productive) utterances by children.

The empirical and theoretical consequences of DMS go far beyond what we can describe and evaluate. But in Chapter 5 and below in §3, we discuss plausible ways in which a DMS approach can be productively extended in explanatory ways to other aspects of adult grammatical knowledge.

2 A Neoconstructionist, Emergentist Minimalism

As we have discussed at various points in this manuscript, a DMS approach naturally accommodates emergentist approaches to many properties of language, e.g., categories (Wiltschko, 2014) and parameters (Roberts, 2019; Biberauer and Roberts, 2017), among others. By that we mean that many and even most properties of adult grammar might not emerge from a richly-specified UG, instead emerging from more basic (and perhaps even domain-general) properties of cognition.

There are therefore many ways that the approach we have sketched in this monograph is neo-constructionist and reminiscent of usage-based approaches to language. The emergent DMS approach that we have adopted throughout posits little-to-no innate, language-specific content to a "Universal Grammar," instead allowing that many of the constructs we use to model adult grammar may well arise from domain-general cognition. We suggested that referring to the **Minimalist Analytical Constructs (MACs)** that make up theories of UG might be better served to be discussed under the moniker **Universal Cognition for Language (UCL)**, in order to sus-

pend the question of innate domain-specificity that appears to trouble many cognitive scientists and linguists.[2] Likewise, the DMS model posits a network of master trees that corresponds to the "constructicon" posited by constructionist grammarians, another way in which DMS is neo-constructionist.

However, there are a number of ways that a DMS approach does not fit naturally with prominent usage-based constructionist approaches to grammar. Specifically, DMS does not eschew abstraction in language knowledge: to the contrary, the picture that we have sketched of language knowledge results in highly abstract, deeply hierarchical language knowledge (cf. Goldberg 2013). Likewise, a tendency of usage-based constructionist approaches like those of Michael Tomasello and Adele Goldberg is to de-emphasize theorizing based solely on the properties of adult grammar. DMS, however, does not shy away from adopting generative proposals for innate mechanisms that were arrived at based on adult grammar, despite the yet-unsettled link between the mechanisms proposed based on adult syntactic properties and properties of cognition more broadly. The presumption instead is that the seemingly endless complexity of adult grammars has much to teach us about cognition and, potentially, development.

3 Future Directions

The theory advanced in this monograph requires a vast amount of additional investigation (from a theoretical perspective, and also direct empirical work). What this volume offers is a precise, testable formulation of these ideas that this future work can proceed from. In this section, we sketch a couple ideas of directions for that work.

There are various implications of DMS for our overall model of syntax. For example, Chapter 5 includes discussion of phases as an ontogenetic fossil, resulting from stages of acquisition that correlate to the kinds of clausal partitions that have long been posited (event structure in *v*P, the anchoring domain in TP/CP that constructs a full proposition, and the extended CP domain linking that proposition to discourse context. The proposal that these domains persist in adult syntax *because* they are significant stages in acquisition requires empirical work on acquisition, but it also provides a perspective on the existence of phases in adult grammar: specifically, it accords most naturally with an approach to phases as *domains* within a syntactic derivation, and not as particular heads. It also suggests that an approach to spellout where the complement of a phase head is immediately spelled out (PIC1) is too rigid.

In general, DMS suggests that a theory that relies (only) on a strict, cyclic Merge-based approach to structure-building is overly rigid. DMS embraces the existence of countercyclic phenomena; rather than treating them as anomalous and (potentially) errors in analysis, countercyclicity is considered a real empirical phenomena that is simply revealed by an assumption of a strict cyclic Merge. But a crucial consideration is developing (with much more precision) a theory that appropriately constrains a countercyclic operation like Late Merge: why is Merge-based structure-building the canonical choice, if Late Merge is in principle available? Lebeaux (1988, 2000) adopted a maturational account (where some operations, namely countercyclic ones, only

[2] Again, it's not that DMS requires denying the linguistic innateness approach long claimed by UG theorists, but rather that a DMS approach gives a natural way to think about generative syntactic formalisms (the MACs) that doesn't require adhering to the existence of a traditional UG.

become available at a later stage in acquisition), which is plausible on a DMS approach but would require formalization and additional precision.

Similarly, the traditional inverted Y-model is not strictly necessary on the account sketched here. Instead, we expect a model where early-acquired generalizations are available to build later generalizations on, whether those generalizations are semantic, syntactic, or phonological in nature. We suggested in Chapter 5 that this could provide an underlying rationale for why it appears to be possible for aspects of phonology (i.e., prosodic structure) to influence syntax, as argued by Richards (2016, 2017) and others. This approach is no less constrained than a strict application of the inverted-Y model in principle: rather than a structure where syntax feeds phonology and not the other way around, we expect that early-acquired generalizations may factor into generalizations acquired later, but not the other way around. But in actuality, this proposal surely leads to some degree of lesser precision in theorizing and analysis, mainly because it is not transparent to say what is acquired earlier or later.

It is for precisely these reasons that the inverted-Y model and the assumption of a strict cyclic Merge are not themselves automatically problematic or deserving of being abandoned. To the contrary, they do appear to be the default case (a fact that itself requires investigation, as mentioned above). Furthermore, it is only by starting with these assumptions that we are able to uncover the anomalies that don't accord with the assumptions. So DMS doesn't require abandoning these assumptions as a baseline, but it instead suggests embracing the anomalies as themselves empirically-real, though in need of a more constrained theory than is currently available.

More specific to particular areas of syntactic theory, the DMS approach may offer insight into a number of grammatical constructions and theoretical domains. For example, it has long been posited that there are parallels between DP and CP domains (see Wiltschko 2014 for an overview): this accords quite naturally with a DMS approach where both DPs and CPs are constructed in parallel in acquisition. This is the layering approach to the structure of nominals (Thoms, 2019; Thoms and Heycock, forthcoming), which we suggested in Chapter 4 may have its roots in acquisition. This may even suggest a wholesale layering approach where all instances of additional acquisition of properties of nominals are paired with additional structure being added to the nominal: this is precisely the approach suggested by Safir (2019) and Colley (2021), where the variable properties of A-movement and A'-movement are attributed to movement-created additional layers of structure ("insulation") on the moved element. There is an intuitive sense in which a developmental perspective on these analyses may be fruitful in suggesting deeper explanations, but more work is necessary on layering/insulation in adult grammar, as well as on the resulting predictions for developmental pathways.

As mentioned at the end of Chapter 5, the first author (Diercks) is currently exploring a potential of left-peripheral information structure and structurally low focus-givenness in Bantu languages (Diercks, 2022a); this would find a natural explanation on a DMS approach, if information structure concerns like topicalization and focalization can be demonstrated to be a late-acquired property of grammar. Another potential area to explore are anti-locality effects: just as there appear to be locality effects in grammar (where operations cannot be too long-distance), there are anti-locality effects, where operations cannot be too short-distance, either (see Erlewine 2020 for an overview and an illustration). We suggested earlier that movement in syntax is an ontoge-

netic fossil of a child reaching an appropriate grammatical generalization from one perspective (e.g., the position/existence of agentive arguments) that is later revised in some other dimension (the role of agents as subjects of sentences in agreement and case-marking). So a child can have multiple distinct representations of agentive subjects: *in situ* in the verb phrase and then *ex situ* in the inflectional/anchoring domain, i.e., "moved" to a higher position. But this should only be possible if a child has fully grammaticalized one position before later grammaticalizing another one. Otherwise (presumably) a child would simply be adjusting their hypothesized structures within their active hypothesis space at any point in acquisition. So it could be that anti-locality effects emerge themselves as a property of developmental sequences as well.

Finally, there are a large number of empirical directions of investigation as a result of DMS with respect to acquisition itself. If DMS is on the right track, at least one and probably multiple measures of grammatical knowledge in children should correlate with the point in acquisition that "counts" for the derivational sequences in question. In this volume, we suggested that a child's expressive grammatical productivity is the relevant point and referenced work on measuring children's grammatical productivity, but more work is necessary to identify appropriate measures and to show whether or not they truly correlate with the sequences predicted by a DMS interpretation of Minimalist analyses.

This also generates a range of relevant questions about acquisition based on our knowledge of adult syntax. For example, we discussed in Chapter 3 how adverb hierarchies and the standard hierarchy of progressive vs. perfective aspect should show distinctive sequences in acquisition. And there are a host of similar areas of research on adult grammar that will generate specific predictions for acquisition. Chapter 5 discussed object marking and conjoint/disjoint constructions in Bantu languages as an instance where a derivationally-late part of grammar is nonetheless structurally low. The suggestion was that information structure is derivationally late cross-linguistically, and the DMS suggestion is that the links of an utterance to the surrounding linguistic and non-linguistic pragmatic context are relatively late-acquired by children, at least with respect to other core properties of morphosyntax. This makes predictions for these constructions in the Bantu languages that possess them, however: we ought to see adult-like (expressive) use of object marking and conjoint/disjoint emerge in children *after* structurally higher properties of the anchoring domain like tense and subject agreement.

All of these are just initial suggestions that emerge immediately from the work in this volume. DMS as formulated in this work makes predictions about a huge range of grammatical constructions across languages (assuming that some measure of productivity can successfully measure the correlations). This is because if there is a reliable analysis of a particular hierarchical relationship in adult grammar (either universally or within a particular language), that creates specific predictions about sequences of acquisition of those hierarchies: specifically, children should become grammatically productive with the relevant components of grammar in the predicted derivational sequence. Very little in this volume is "settled" or fully established. Rather, we attempt to give a relatively thorough articulation of this theoretical perspective in order to enable further investigation.

4 Outstanding Issues

As we conclude, we want to explicitly point out some of the issues that are outstanding and still in need of resolution on a DMS approach to grammar. The preceding section commented on areas where future research appears to be promising; this section points to puzzles/problems that we are already aware of.

4.1 Outstanding Empirical Questions about Child Language

In terms of child language, some puzzles have emerged in the literature that are not immediately resolved on the perspectives adopted here. One area of extensive research is Germanic V2; as raised by a reviewer at an earlier stage of this work, children acquiring German begin to place (finite) verbs at a V2-like position quite early in acquisition. On the standard analysis of German V2, the finite verb is in a C-level head and the element preceding it (usually, but not always, the subject) is in Spec,CP; VP and *v*P are head-final. Nonetheless, German children at early stages will place verbs in a V2-like position: (143) shows the verb preceding negation.

(143) da paß nicht — German child (M 2;4)
there fits not
'These pieces do not fit together'
(Clahsen, 1990/1991, 376)

If children are acquiring that word order early, does that mean they are acquiring CP early? Clahsen (1990/1991) looks at four syntactic features across five stages of the acquisition of core German phrase structure: verb placement, negation, subject agreement, and (exceptional, for German) null subjects. In the investigation in Clahsen (1990/1991), most of the relevant acquisition occurred between stages II and IV, with the transition between stages II and III only being minimal and gradual for these structures. So the main distinction to be looked at here is between stage II/III (conflated for the purposes of this discussion) and stage IV. The various patterns documented by Clahsen (1990/1991) are summarized in (144).

(144)

	Stage II/III	**Stage IV**
Verb position	V never precedes subject; variable V positions; finite V placed in V2; non-finite verb placed V-final	largely adult-like, including complex contexts like phrasal verbs and auxiliaries/modals
Subject agreement	properties of subject don't determine verb agreement (II); high proportion of errors (III)	largely adult-like
Negation	postverbal NEG with inflected V preverbal neg with uninflected V	NEG placement largely adult-like; preverbal NEG pattern stops
null subjects?	grammatical subjects often absent	grammatical subjects usually present

We can see the variable verb and negation placement at stage II/III in the example in (145). The uninflected verb form appears utterance-finally in (145a), following negation. In contrast,

the verb bearing the *-t* inflection appears initially, preceding negation (Clahsen assumes with a null subject here).

(145) a. nich aua mache — German child (S 1;10)
not ouch make

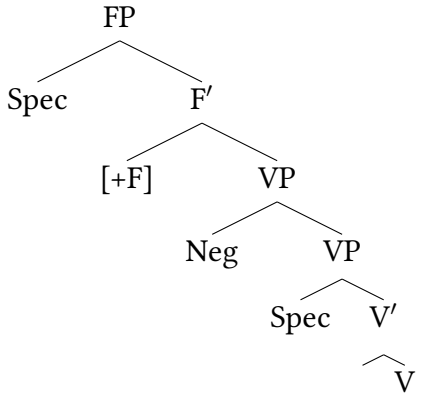
b. macht nich aua — German child (S 1;10)
makes not ouch
(Clahsen, 1990/1991, 378)

The preverbal negation in (145a) is distinctly non-adultlike (as is the uninflected root verb form): this is clearly the root default/optional infinitive stage of acquisition for this child.

On the approach taken in DMS, a major question is raised about the position of the verb in German at Stage II/III. If, at this point, the only structures that exist for the child are VP/*v*P, how is it that the children have two verb positions available? It is not shocking that children (from quite early) distinguish between the position of inflected verbs (initial/V2) vs. uninflected verbs (final), as this directly matches the word order in the target. But what is their internal grammar at that point? Following standard assumptions of German V2, the VP/*v*P is head-final; the uninflected verb remains structurally low, explaining its final position (in both child and adult grammars). So what position are the non-final verbs in?

Clahsen (1990/1991) proposes that there is a functional projection (labeled FP here, +F being +finite) that children posit above the verb phrase at Stage II/III. This is the position where finite verbs are positioned at this stage.

(146) **Clahsen Stage II/III Structure** (Clahsen, 1990/1991, 382):

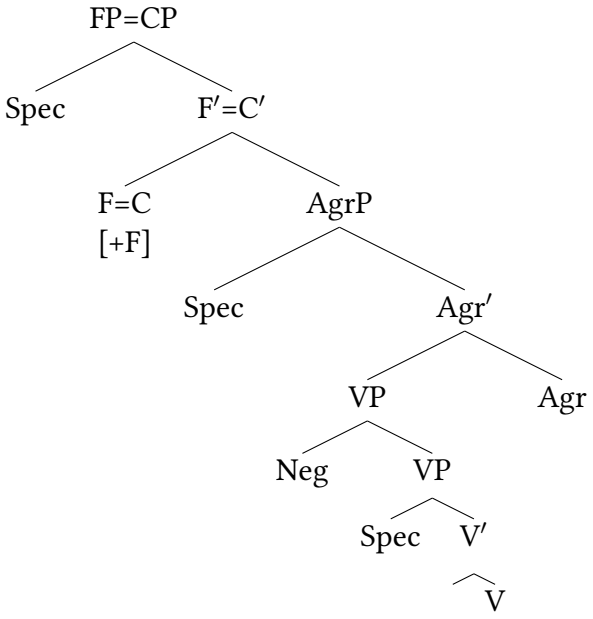


A key for Clahsen is that, even at stage IV, it is implausible that children have acquired the full clause structure: embedded clauses have not arisen at this point. Once embedded clauses do arise, they are essentially target-like immediately, suggesting that children have already acquired the requisite structures by the time they are embedding clauses. This does show, however, that syntactic development is not complete at stage IV, despite V2 operating robustly. But even moreso, it shows that at stage II/III when there is a non-final position of verbs, this is clearly not an adult-like CP at work, so this is not an instance of early CP acquisition (i.e., it doesn't contradict the "bottom-up" claim of DMS or Organic Grammar or Rakhlin and Progovac 2021).

At Stage IV, subject agreement is target-like, subjects are largely overt, and root defaults

disappear, resolving the placement of negation. Here, Clahsen suggests that an agreement projection (we might assume it to be TP) is now present, and FP is still present, but the agreement projection is between FP and VP.

(147) **Clahsen Stage IV Structure** (Clahsen, 1990/1991, 384):



Centrally, as we represent in (147), what was previously FP (and the placement of the finite verb) is what the child will eventually grammaticalize as CP. So here we don't see strict-bottom up structure building that a Merge-based system (with nothing else considered) might imply. Rather, we see a period of time where structures may be posited and adjusted before they are finalized. So while children are clearly using a position for a verb (specifically, a finite verb) that precedes the rest of their verb phrase structures at a very early stage, this position appears to be able to be adjusted as necessary, based on the input they are receiving.

A DMS approach can essentially follow Clahsen's proposals. In §6 of Chapter 3, we discussed how a DMS approach requires children to be using mixed-status utterances at various points, including both adult-like grammatical structures (e.g., *v*P) and non-adult-like, pre-syntactic structures (e.g., holophrases). And we expect children to adhere closely to their input in many ways, so productions that surface-match adult CPs do not necessarily (on the approach adopted here) require positing an adult-like CP: as with Clahsen's approach, the absence of other CP structures argues against positing an adult-like CP. Therefore, the early presence of German V2 for children is parallel to the early use of sentence-initial *wh*-phrases in child English.

All of this said, this cursory discussion is not completely satisfactory insofar as DMS is concerned. With German V2 (as with any similar kind of puzzle in child language), the question will persist as to what the precise nature of children's immature representations are and what they can tell us about children's mechanisms for learning and representing language. DMS is largely silent on this question, apart from readily allowing for the use of surface patterns that match adult productions without using adult-like categories (so some representational capacity akin to linear concatenation is necessary). That idea is not necessarily deeply controversial, but the details in

any given instance (German V2 here) will always require their own investigation.

4.2 Outstanding Issues with Respect to Adult Grammar

With respect to adult grammar, DMS provides a rationale for countercyclicity and other kinds of non-traditional derivational timing. For those researchers who have found it difficult to explain particular grammatical constructions without reference to such mechanisms, this is surely a welcome result. But most of these approaches are not yet systematically incorporated into broadly-accepted theory. So while layering analyses do solve a variety of apparently paradoxical properties of nominal reconstruction, for example, the layering approaches are still relatively immature: a comprehensive theory of layering derivations of nominals is still needed (though the work is very much in progress: Colley 2021, Thoms and Heycock forthcoming, Thoms 2022).

Likewise (and as we've commented throughout), a full embrace of countercyclicity requires a much more constrained theory of countercyclic operations than exists at this point. While some such proposals exist (e.g., Zyman 2021), a systematic and constrained theory of Late Merger is not yet widely accepted. This may be in no small part due to the fact that the predominant paradigm excludes Late Merger operations, so the theoretical impetus is for researchers to resort to Late Merger analyses only when all other options are exhausted. Perhaps with DMS offering a plausible rationale for the existence of countercyclicity in adult grammars, there will be more license for researchers to explore and constrain Late Merger more extensively.

5 Final Thought: Is This Still Generative Grammar?

Martin Haspelmath, in a blog post entitled "Some (ex-)generative grammarians who are abandoning innateness," surveys several comments from generative syntacticians to the effect that explanations for some (or even many/all) grammatical patterns may arise from non-language-specific aspects of cognition.

> Overall, our theory must allow these properties of the (canonical) passive to vary independently, rather than positing necessary dependencies between them. This is indeed achieved on an approach wherein there is little or no innate information specific to voice in the language faculty, but rather the properties of each voice construction must be learned on the basis of evidence. For an impoverished language-specific innate component, see, for example, Fitch et al. (2005), who argue on independent grounds that Universal Grammar consists only of the operation Merge, the operation that builds binary-branching structure[.] (Legate, 2021, §4).

> Why should the same distribution of ergative and nominative arise by different mechanisms in different languages? Why should some languages do by morphological means the exact same thing that other languages do with person-sensitive assignment of abstract case features? A deeper fact must be at stake on the relative markedness of the various person features, outside of the particular vocabulary of any one grammatical module. It therefore seems to me quite reasonable to conclude that hierarchy effects ultimately must arise external to the grammar itself, from the orga-

> nization of human cognition and communication – a conclusion in line with various approaches that locate the origin of these effects extra-grammatically (i.a. Silverstein 1976, Dixon 1979, DeLancey 1981, Newmeyer 2002, Haspelmath 2008) … this approach to the status of hierarchies echoes Chomsky (2005)'s view of language design as arising from the confluence of an extremely simple UG component with a range of Language-independent, "third factor" effects, some of them representing aspects of general human cognition. (Deal, 2016, §6)

> I think you overstate the innateness thing. Nothing I actually do in practice would change if I discovered tomorrow that everything that all languages have in common is highly abstract, cognitive and not specific to language. (Gillian Ramchand, from a 2019 interview with Haspelmath).

Haspelmath concludes that "there seems to be less and less certainty about the idea of innate grammatical structures (called 'universal grammar', or 'innate grammar blueprint')" (Haspelmath, 2021). Haspelmath asks, "Are these linguists who are abandoning most of Chomsky's programme from the 1960s through 1990s still 'generative grammarians,' or are they ex-generative grammarians? How can they continue to work with the assumption of uniform building blocks, if these are not innate?" In a response on his own blog, David Adger (2021) responded: "Yes, they are still generative grammarians; the reason they work with current theories is that they recognize that theoretical posits are placeholders for future understanding. Whether a particular phenomenon is explained by a language specific innate property of the mind, or by a general cognitive capacity, or by a law of nature is something to find out, and working with current generative theories is a good way to do that."

The question that persists is: "Does Universal Grammar Exist?" The answer from an emergent DMS perspective seems to be both "yes" and "no," depending on what is meant by "Universal Grammar."[3] If we interpret "Universal Grammar" in this question along the lines of the traditional account of UG as it is often represented in many polemics, it would mean something like "a set of categories (e.g., noun, verb), constraints/principles (e.g., structure dependence, subjacency, the binding principles), and parameters (e.g., head direction, V2) that are innate (i.e., that are genetically encoded and do not have to be learned or constructed through interaction with the environment)" (Ambridge et al., 2014, e54). On this understanding of UG, the answer from an emergent DMS is "no:" this version of UG probably does not exist. But this has also been the overarching stance of most Minimalist syntacticians for decades at this point.

What becomes confusing is that those same Minimalist syntacticians nonetheless continue to theorize about UG. So what exactly are they modeling, if it is not the traditional UG? We think it is fair to typify the Minimalist UG as a model of what kinds of generalization-making cognitive abilities are employed by humans in their language grammars (and, more specifically, are employed by children in constructing their language grammar(s) in acquisition). The presumption is that these properties of grammar/cognition are inducible by analysts, in principle, by examining adult language grammars themselves. The sticking point is whether or not "UG" is domain-specific to language: the traditional generative answer is "yes;" at least one iteration of the Chomskyan Minimalist answer was "only recursion is language-specific" (Chomsky, 2001;

[3] See Ambridge et al. (2014, e53ff) for a similar discussion.

Hauser et al., 2002), and our best guess is that the average working grammarian within the Minimalist framework would simply shrug in response to the question: our work can proceed nonetheless, no matter what the answer is. While DMS in and of itself is relatively agnostic with respect to the traditional UG, as we discussed in §2, a DMS approach is very naturally amenable to a radically-emergent account of the Minimalist Analytical Constructs (MACs) that make up Minimalist theorizing, which would hold that none of the content of so-called "UG" is necessarily language-specific at all. This is why we suggested that theorizing about innate cognitive constructs under a new moniker is desirable: we suggested Universal Cognition for Language (UCL).

This is why you can find so many Minimalist syntacticians nowadays who are noncommittal (or explicitly uncommitted) to the traditional UG that assumes innate categories, principles, and parameters that are necessarily domain-specific to language. Some people may have changed their minds, but the Minimalist era is in part defined by attempts to explain language patterns with as little reference as possible to domain-specific properties of language. It is not hard to find collective indifference among Minimalist syntacticians regarding this question surrounding traditional UG. It's useful in this regard (following Hornstein's tendency, in his blog and in Hornstein 2013) to distinguish purist Minimalist theoreticians from what he refers to as "philologists" who nonetheless operate in the Minimalist theoretical framework. Much Minimalist syntax work is in fact simply an attempt to work out the properties of particular languages, couched in Minimalist terminology. Some of this work makes explicit attempts—in addition to finding language-specific analytical generalizations—to explicitly offer a resulting impact on what must be necessarily contained (or not) in UG. But it is not surprising that it can be difficult to distinguish the actual goals of a Minimalist investigation at any point, as not only may they range from the cognitive to the philological, but they can also land somewhere in between, attempting both tasks at once.

On the emergentist DMS approach that has been sketched in this manuscript, "Universal Grammar" in an idealized sense is essentially a precise statement about cognitive constraints, biases, or mechanisms that influence how children come to mentally represent the morphosyntactic patterns that they are acquiring.[4] Because the traditional UG is attached to a modularity claim that is not itself necessary for the framework to have value, we have suggeted that "UCL" is a better term, because it is agnostic not on innateness, but on the domain-specificity of the model. In this sense, the UG model as developed in the Minimalist Program is deeply important: it is attempting to capture, in precise terms, the characteristics of how abstract grammatical constructions are mentally represented. And in this sense, the term "Universal Grammar" is not inappropriate on an ahistorical interpretation: these are the characteristics of grammar in human language that are universal due to universal aspects of human cognition. That said, reality is not ahistorical, and the term "Universal Grammar" has a long history at the center of stringent polemic argumentation. While we haven't, for example, associated Minimalist analytical constructs like Merge or Agree with particular domain-general cognitive processes, we hope to have shown how they can fit into a conception of language that also takes acquisition pathways quite seriously, perhaps opening the door to more precise cognitive correlates for Minimalist theoretical constructs (this assuming a radically-emergent DMS, where there is no domain-specific cognitive property dedicated to language alone). As Pearl (in press, 12) puts it, "we're all nativists,"

[4] If Vainikka and Young-Scholten (2011) are correct, this is also how naturalistic second language acquisition proceeds too.

and the question is whether we believe that the innate knowledge is domain specific to language (linguistic nativists) or the innate knowledge is domain-general (nonlinguistic nativists).[5]

A reasonable question is what, then, is the actual content of the so-called "UG," the MACs, the Universal Cognition for Language that determines what language grammar looks like? (148) offers a baseline description of the actual content of UCL, which must include at least these constructs. This list is constructed on the basis of broadly-accepted Minimalist theory.

(148) Minimalist Analytical Constructs: The minimum content of UCL
- Merge (builds structure sequentially, i.e., a "derivation")
- Agree (shares features between distinct syntactic elements)
- Phases (structure is built in relatively discrete chunks)
- Mechanism to form categories (Wiltschko, 2014)
- Mechanism to posit grammatical features (Biberauer, 2019a)

While all of these elements are *innate* in the sense that they emerge from human cognition in some way, none are necessarily language-specific, and they could in fact all arise from domain-general cognitive properties when applied to language and the acquisition of grammar. This result would likely be viewed as highly welcome by a large community of generative syntax researchers.

Though the list in (148) captures quite a broad range of patterns in language, depending on the outcomes of various Minimalist exercises, there may be some constructs to add to the list. One major one is an explanation for the effects explained through classical Binding Theory: long-standing attempts to reduce binding to Agree have not been obviously successful/satisfactory: see Safir (2004), Reuland (2011), Rooryck and Vanden Wyngaerd (2011), among many others. Likewise, it is my (Diercks's) impression that there is not yet consensus about whether issues of construal related to control constructions can be explained by the constructs in (148) without reference to additional constructs (an extensive line of research on this front is summarized in Boeckx et al. 2010). Likewise, issues around Case/Vergnaud Licensing are still active areas of inquiry (Sheehan and van der Wal, 2018, 2016; Baker, 2015; Kalin, 2019, 2018, among many others).

These are just a few major areas; the point of this comment is not to be comprehensive, but instead to point out that there is more work to be done on a number of fronts to continue to refine our conceptions of what constructs belong among the MACs that delimit available syntactic structures. This is of course not a flaw: the data set of all possible constructions in all human languages is almost impossibly large. But that is the project.

So again, from our perspective the question of the domain-specificity (or not) of the MACs that are the components of the Universal Cognition for Language is somewhat of a red herring. It is interesting, of course, but the work of a generative syntactician can proceed regardless of the conclusion. DMS is an example of this kind of work: we can learn important lessons from "UG"-based theories about the structure of human language syntax that nonetheless don't require us to take a strong stance on domain-specificity and that in fact may themselves be suggestive

[5]Minimalists may disagree as to whether any particular MAC arises from linguistic cognition or domain-general cognition applied to language, but it doesn't change the nature of the theoretical enterprise to theorize about the nature of those MACs and how they explain properties of language.

of an emergentist approach. We are by no means the first to suggest this line of reasoning (see Biberauer 2019b, among many others). But perhaps the discussion can clarify why and how researchers like us can simultaneously embrace the Minimalist framework and generative research findings while eschewing and/or ignoring traditional linguistic nativism.

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