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Rethinking structural growth: Insights from the acquisition of interactional language

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In this paper, we introduce a novel proposal for the acquisition of syntactic structure. Most studies of syntactic first language acquisition focus on the increasingly complex expression of propositional thought. Layer by layer, from the bottom up, child language matures into adult-like representations. We challenge this account of an upward growing syntax based on evidence from early interactional language, which has largely been ignored in the study of syntactic acquisition. Given that interactional units of language are associated with the topmost layers of syntactic structure, and given that they are acquired early, it follows that syntactic acquisition cannot be characterized by upward growth. Rather, we propose that syntactic acquisition proceeds in an inward fashion. We present a case study of the early uses of utterance-final *huh* (an interactional unit of language) in North American child English that supports this hypothesis. We thus introduce the Inward Growing Spine Hypothesis as a research agenda.

1 Introduction

Most work on first language acquisition (henceforth L1A) concerns itself with the acquisition of words and phrases that contribute to (the expression of) propositional thought (henceforth p-language). Over the past two decades, however, there has been an emerging consensus that grammatical knowledge is not restricted to p-language (Heim et al. 2016, Miyagawa 2022). Rather, all languages have units of language (henceforth UoLs) that serve to regulate the construction of common ground as well as turn-taking. These do not contribute to p-language but instead manage the communicative interaction (henceforth i-language). Crucially, i-language has been shown to be part of our grammatical knowledge (Wiltschko 2021; 2022). Based on its distribution and interpretation, it is typically assumed that i-language is associated with an articulated structure above the propositional structure, as schematized in (1) (Speas & Tenny 2003; Haegeman & Hill 2013; Woods 2016; Wiltschko 2021; 2022; Corr 2022; Krifka 2023; among others).

(1) [i-language [p-language]]

If i-language is part of grammatical knowledge, it is necessary to include it as an empirical domain in the study of L1A. Indeed, even a cursory look at child-language corpora suggests that i-language is present at the very beginning of L1A.[1] As shown in (2) and (3), children use vocatives and sentence-final tags from an early age, both of which are clear instances of i-language. With the vocative in (2) Naima calls for the mother's attention, and the tag in (3) is used to request a response to the question regarding the truth of the propositional content.

(2) Naima: Mommy? (1 years; 01 months – Providence Corpus)
Mother: Yes.

(3) Chuck: Out ball, huh? (1;08 – Bates Corpus)
Mother: Ball out!

In this paper, we have several interrelated goals. We demonstrate that our proposal to include i-language as part of the empirical domain of L1A is empirically and theoretically motivated (section 2). From adult speakers, we know that there is strong support for i-language to be hosted at the top of the syntactic spine (section 3). The early acquisition of i-language therefore leads to a theoretical conundrum. Many generative approaches towards L1A assume that the acquisition of grammatical knowledge can broadly be characterized by an "upward" trajectory such that structural representations become incrementally available to the child starting at the bottom of a syntactic tree (section 4). On this "maturational" view, the acquisition of i-language is mysterious:

[1] To confirm this, we used the Wang browser (https://childes-sear.ch) which provides a fast search across most English-speaking corpora on the CHILDES database (McWhinney 2002).

since i-language is associated with the topmost structural positions, we would expect i-language to be acquired last, contrary to fact. This conundrum is straightforwardly resolved if we assume that in the course of L1A, the syntactic spine (or tree) "grows inward" rather than upward. We articulate this hypothesis in section 5. In section 6, we present a small corpus-based case study of the acquisition of one interactional UoL, namely *huh*. Finally, in section 7, we introduce the Inward Growing Spine Hypothesis as a research agenda and show that, in addition to providing an account for the acquisitional trajectory of *huh,* it also addresses several classic problems in studies of L1A. Section 8 concludes.

2 Introducing i-language into the study of first language acquisition

We argue that including i-language in the study of L1A is difficult to reconcile with the upward trajectory, which lies at the heart of traditional maturational accounts (Borer & Wexler 1987; Radford 1990), and which have found renewed attention in Friedmann et al.'s (2021) Growing Trees hypothesis. According to the latter, syntax grows from the bottom up by adding phrasal projections at the top of the tree within three major stages of development.[2]

Moreover, including i-language in studies on syntactic acquisition reveals glaring gaps within usage-based accounts of L1A. While these accounts prioritize frequency in input to explain the patterns of structural growth, they do not address the acquisition of i-language despite its ubiquitous use.

Finally, including i-language in the empirical domain of L1A also highlights the importance of non-propositional language as a means for children to participate in the speech community. The interaction between i-language and p-language can shed new light on how non-linguistic capacities combine with language-specific ones.

In this section, we motivate the study of the acquisition of i-language both empirically and theoretically by reviewing early productions of i-language.

2.1 Empirical motivation

Instances of i-language – like vocatives, tags, and response particles – occur early on and often precede the acquisition of complex p-language. A brief look at cross-linguistic data clearly demonstrates that the acquisition of i-language displays interesting acquisitional patterns that

[2] An anonymous reviewer points out that there are very few strictly upward growing accounts remaining. Rizzi's response to challenges like Roeper & Rohrbacher (2000) and Bromberg & Wexler (1995) has been to allow for root attachment of leftmost material, such as in early combinations of wh-pronouns with root infinitives or referring expressions (see also example (21) below). That said, Friedmann et al. (2021) makes the strong prediction that any material surfacing in a position associated with a later stage requires acquisition of the lower stage. The upward growing tree hypothesis is therefore a return to a stronger stance on incremental, linear growth.

require explanation, and which suggest an underlying system that regulates these patterns. It is thus essential to include i-language in the study of L1A.

For example, Japanese sentence-peripheral particles that belong to i-language are acquired before particles that belong to p-language. Shirai et al. (2000) report that sentence-final particles which encode the speaker's attitude toward the proposition are acquired earlier than particles encoding propositional content, like past tense or clause-typing. Shirai et al. (2000) provide a fictional dialogue that exemplifies the use conditions of the particles under investigation.

(4) Situation: There are some biscuits on the table.

Naomi:	Oishii NO?	'Are they good?'
Ken:	Oishii TTE.	'I've heard they are good.'
Ken:	(Ken tries some.) Oishii YO.	'They *are* good. Try some.'
Naomi:	(Namoi tries some.) Oishii NE.	'It is good, isn't it?'

(Shirai et al. 2000:1 (3))

In a comparison of four toddlers, who are aged 1;03 to 1;09 at the beginning of their corpus data, Sihrai et al. then show that these clause-peripheral particles all appear early (around MLU 1.1), and crucially they appear before the onset of tense markers. Other particles, which do not reflect speaker attitudes, have a later onset.

Similarly, in Northern Mandarin, sentence-peripheral particles that encode the speaker's attitude precede the acquisition of modal particles and particles that encode the illocutionary force of the sentence (Zhang et al. 2019). Moreover, Paul & Yan (2022) show that three Mandarin sentence-peripheral particles which are associated with IP and CP are acquired nearly simultaneously. Attitude markers begin to appear at the same time as force markers as well as particles that anchor an event to the utterance time.

(5) Chī táng ba (ZTX 01;08;18)
eat candy FORCE
'(Let me) have some candy.'

(Paul & Yan 2002: 19 (57))

(6) Chī táng ma (ZTX 01;08;24)
eat candy ATT
'(Naturally) I eat candies!'

(Paul & Yan 2002: 19 (61))

Sentence-final particles have been the subject of investigation in Mandarin and Japanese for quite some time, precisely because they are so widespread and paradigmatic in these languages English sentence-final particles along with other instances of i-language (e.g., vocatives) appear to show similar acquisitional patterns as their Mandarin and Japanese counterparts, in that they

are used in early childhood utterances. Examples (7) and (8) show that i-language co-occurs with p-language even at early stages of syntactic development.

(7) What you doing, Daddy? (Carl at 1;11 – Manchester Corpus)

(8) What happen, huh? (Adam at 2;07 – Brown Corpus)

Crucially, combining i-language with p-language is not trivial because its distribution is constrained and therefore reasonably assumed to be syntactically mediated. The examples in (7) and (8) establish that some sentence-peripheral UoLs are acquired before inflection or auxiliaries. This is a pattern that needs to be accounted for in theories of L1A.

2.2 Theoretical motivation

There are several theoretical arguments for why i-language should be considered in the study of L1A. One argument is that language in interaction is constrained by grammar (Ginzburg & Poesio 2016; Kempson et al. 2016; Wiltschko 2021). Here, we review some key pieces of evidence discussed in Wiltschko (2022) that imply that i-language displays all the hallmarks of grammar.

First, the form-meaning relation of vocatives is mediated by their syntactic distribution. Specifically, Zwicky (1974) establishes that there are two types of vocatives (calls and addresses), which differ both in terms of their interactional function and in terms of their distribution. Call vocatives serve to activate the addressee's attention and can be accompanied by phrases like *hey* or *excuse me*. In contrast, address vocatives are employed to maintain the interlocutor's attention and can be accompanied by phrases like *listen* or *I'm afraid*. Crucially, calls only occur turn-initially, while addresses can occur at either end of a sentence, as well as in some sentence-medial positions. Since these different interactional roles correlate with different distributional patterns, we can conclude that they are associated with different syntactic positions just as different grammatical roles are. In other words, just as subject and object roles are grammatically conditioned, so are the interactional roles of call vs. address (Wiltschko 2022).

Second, the interpretation of invariant tags is structure-dependent: sentence-final *eh* is a root phenomenon such that it will always be interpreted with scope over the whole clause, as in (9).

(9) Anneke knows that Milo has a dog, eh?
= Confirm that Anneke knows that Milo has a dog.
≠ Confirm that Anneke has a dog.

(Wiltschko 2022: 7 (8))

There is one exception to this generalization, however, which shows that scope is not merely a matter of linear order. If the clause is embedded within a bleached, interactional clause (*you*

know, I guess), the scope of *eh* will not include this interactional clause but instead scope over the embedded propositional clause only, as shown in (10).[3]

(10) Now, I guess you're here for news about your brother and the other boys, eh?
(Wiltschko 2022: 7 (9))

Thus, i-language has to be sensitive to syntactic structure rather than to linear order.

Finally, i-language displays patterns of contrast and paradigmaticity: for example, invariant tags in Mandarin form paradigms defined by speaker- vs. addressee-orientation, on the one hand, and old vs. new information, on the other (see Section 3.1 for details). Arguably, paradigmatic contrasts derive from properties intrinsic to grammatical structure.

Another argument for the grammatical integration of i-language has to do with considerations of the architecture of grammar. Units of i-language are frequently part of utterances, in children and adults alike. Crucially, many of these units are prosodically integrated into the utterance as a whole. For example, in the presence of an invariant tag, the rising intonation typically associated with inquisitiveness is realized on the tag, not on the host clause (Heim & Wiltschko 2020). Thus, whatever system is responsible for assigning intonational contours must be sensitive to both p-language and i-language. If i-language were to be regulated by a system distinct from p-language (for example if it were purely pragmatic), one would have to assume that intonation is assigned after the utterance is assigned its pragmatic properties. But this requires the postulation of a system that unites syntactic and pragmatic aspects of an utterance – at least some of them. Thus, the more parsimonious assumption is that grammatical architecture includes i-language. And if it does, then i-language will have to be part of the empirical domain of L1A studies.

3 The syntax of i-language in adult speakers

So, if i-language is part of grammar, what is its syntax? While a syntactic representation of i-language is well-established for East Asian languages due to their morpho-syntactic relation to

[3] An anonymous reviewer remarks that the example in (10) does not constitute compelling evidence for a syntactic analysis of *eh* and suggests that it would equally follow from the assumption that *I guess* is a bleached clause and that *eh* only scopes over the propositional content. We submit that the syntactic analysis of Wiltschko (2021; 2022) is still superior as it makes explicit what is responsible for the bleached interpretation: it is precisely because *I guess* is interpreted in the interactional structure rather than the propositional structure. Moreover, Wiltschko (2021) demonstrates that a syntactic analysis of *eh* is preferable over one relying on different lexical entries because the latter could not account for why near-synonymous particles like *huh* show different use-conventions for speaker-and addressee-beliefs (see Section 3.2). These are easily derived by attributing their differences to variation in association with the spine. Crucially, lexical entries alone would not allow us to predict any restrictions in their context of use. Additionally, Wiltschko (2021) shows that the same patterns of multi-functionality observed in confirmationals like *eh* are also found in response markers. This suggests that there is an underlying system, which is responsible for generating these patterns of multi-functionality, and according to Wiltschko (2021) this system is the interactional spine. Under a lexical approach this parallelism in confirmationals and response markers would be a coincidence.

clause-typing particles and honorifics (e.g., Pak et al. 2004; Portner et al. 2019 for Korean; Saito & Haraguchi 2012 for Japanese; Lam 2014 for Cantonese; Yang & Wiltschko 2016 for Mandarin; Woods et al. *in print* for Javanese), i-language in English and other Indo-European languages is much less studied. Until recently, units of i-language have been viewed as sentence-peripheral, spoken phenomena and have therefore been taken to fall outside of the scope of grammar (see Wiltschko & Heim 2016 for a summary of this discussion). To preface the discussion of its acquisition, we briefly summarise here what has led to broad agreement that i-language is regulated by the topmost syntactic structure (section 3.1) before we turn to an analysis of *huh* in adult English (section 3.2).

3.1 Evidence that i-language is regulated by the topmost syntactic structure

As mentioned above, there is an emerging consensus that classic sentence structure (i.e., p-language) is embedded into structure dedicated to regulating speech acts and interaction. In a nutshell, this consensus rests on new evidence for Ross' (1970) 'performative hypothesis' according to which a proposition is introduced by a performative phrase (e.g., *I tell you that…)* which is deleted before spell-out. While the mechanics have changed, the spirit of the proposal remains the same: speech acts are syntactically represented. Support centres around the distribution of units of i-language, agreement in or with units of i-language, and sensitivity of units of i-language to clause-typing. These are all classic arguments for syntactic integration, as is evident in the literature on gapping and ellipsis (Lobeck 1995; Johnson 2001; and many others). We discuss each of these properties in turn.

Distributional support for a syntactic integration of (Indo-European) units of i-language comes from strict ordering restrictions of sentence-peripheral discourse particles, as for example reported in Haegeman (2014: 131) for West Flemish *né* and *wè*. The vocative *Valère* exposes the underlying order at the clausal periphery: independently of linearization, the particle *wè* must be directly adjacent to the sentence radical (in CP) while *né* can be separated from it by a vocative.

(11) a. (Né) Valère, men artikel is gereed (wè)
b. *Valère né, men artikel is gereed (wè)
c. (Né) men artikel is gereed wè Valère
d. (*Né) men artikel is gereed Valère wè
né (Valeria) my article is ready wè (Valeria)
'Valeria, my paper is ready

(adapted from Haegeman 2014: 131)

Similar arguments have been brought forth for non-European languages (Heim et al. 2016), which suggests that the sequence of addressee-oriented units of i-language has to be associated with the syntactic spine in a position higher than speaker-oriented units of i-language, contra

the original order in Ross (1970). The data in (12) from Cantonese shows that these ordering restrictions are reminiscent of the data from West Flemish. The clausal periphery can host two discourse particles, which are strictly ordered, with the addressee-oriented one (*ho2*) mandatorily following the speaker-oriented one (*me1*).

(12) a. daai6 seng1 zau6 dak1 laa3 me1 ho2?
b. *daai6 seng1 zau6 dak1 laa3 ho2 me1?
big voice then okay change.of.state me1 ho2
'What, can one get by just by being loud? I assume you'd agree it's a valid question, right?'

(Lam 2014: 64 (6))

The marking of agreement within i-language is evidenced in Southern dialects of German, for example. The sentence-peripheral particle *ge(ll), geu* (and its variants) serve to confirm the interlocutors' beliefs, similarly to what we have seen in the Cantonese data above. Both variants can inflect for the second person plural or in formality (Heim 2019a; Wiltschko 2021). Crucially, agreement on this particle links to the addressee, rather than the subject of the clause. This is shown based on the Swiss German example in (13).[4]

(13) Gell-ed Chind-er, ihr lueged nacher scho, dass d Türe zue isch?
Gell-2.PL children-2.PL you watch later surely that DET door closed is
'Children, you make sure that the door is later closed, right?'

Another case of agreement triggered by i-language is discussed in Miyagawa (2022), based in part on data and observations by Yamada (2019). Japanese, a language where typical phi-feature agreement is absent, presents evidence for honorific agreement. Specifically, *-mas* is used for the honorification of the addressee by the speaker. In the absence of *-mas* the utterance is classified as colloquial, as in (14a), while the presence of *-mas* renders the utterance formal, in (14b).

(14) a. Hanako-wa piza-o tabe-ru
Hanako-TOP pizza-ACC eat-PRS
'Hanako will eat$_{\text{COLLOQUIAL}}$ pizza.'

b. Hanako-wa piza-o tabe-mas-u.
Hanako-NOM pizza-ACC eat-MAS-PRS
'Hanako will eat$_{\text{FORMAL}}$ pizza.'

(Miyagawa 2022: 39 (2))

The sensitivity of *-mas* to the context of interaction suggests that its use is somehow dependent on the topmost structure, i.e., the syntax of i-language. However, on the surface, this does not seem to be the case as *-mas* occurs too low in the structure (i.e., below TENSE) to be associated

[4] This example is taken from a debate between translators on dict.leo.org, which lists further variants: https://dict.leo.org/forum/viewGeneraldiscussion.php?idForum=4&idThread=623719&lp=ende&lang=en.

with the treetop, as Miyagawa (2022) observes. Thus *-mas* appears to be linearized in a position different from where it is interpreted. This type of dissociation between linear position and interpretation has long been established in syntactic theory and can be analyzed as a form of (abstract) agreement or (covert) movement. Significantly, Miyagawa (2022) suggests that there is an overt reflex of this dependency between *-mas* and the topmost structure, namely in the form of sequential allomorphy. That is, when *-mas* is used, all higher heads must reflect the formality of *-mas,* including negation, tense, and certain higher interjections (*daroo* vs. *desyoo*). This is shown in (15).

(15) a. Nimotu-wa todok-a-**na**-kat-**ta** **daroo** ka?
package-TOP arrive-NEG-COP.PST INTERJECTION Q

b. Nimotu-wa todoki-**mas**-**en**-**desita** **desyoo** ka?
package-TOP arrive-MAS- NEG-COP.PST INTERJECTION Q
'Didn't the package arrive?'

(Miyagawa 2024 (16))

According to Miyagawa (2022), this sequential allomorphy can be analysed as a form of agreement (Yamada 2019) and hence provides support for the syntactic integration of i-language.

A final argument comes from the sensitivity of i-language to clause-typing. In Wiltschko & Heim (2020), we show that Canadian English *eh* has a strong preference for being combined with declarative clauses, which in turn can be analyzed as a form of selectional restriction. The only exception to this generalization concerns instances where the particle seeks confirmation of the speech act, rather than the interlocutor's belief. Here, the particles readily combine with interrogatives and exclamatives and mark a request for confirmation of the appropriateness of the speech act, just as in the Cantonese data above.[5]

[5] An anonymous reviewer remarks that i-language seems to be qualitatively different from p-language in that it is not part of a set of syntactic operations like wh-movement, for example. In other words, i-language lacks evidence from some syntactic processes, which in turn undermines the claim that it is regulated by syntactic knowledge. As pointed out in Wiltschko (2021), however, we do not expect i-language to display A- or A'-movement because these types of movement are defined precisely as movement into A- or A'-positions, respectively. Significantly, they are associated with distinct properties, thus movement into the interactional structure is predicted to be associated with yet another set of properties. As discussed in Section 2, it is the whole proposition (CP) that moves into the projections hosting i-language. The mechanics of these transformations are the same as those assumed for p-language (see Wiltschko 2017; 2021; Heim & Wiltschko 2020 for details). We further note that there is evidence that elements that are linearized within the propositional structure can be interpreted in the interactional structure, which in turn is a form of displacement, albeit of the covert type. For example, the speaker- and addressee- orientation of certain sentence-internal discourse particles receive a straightforward analysis assuming that they are interpreted in the relevant interactional layers (Thoma 2016; Wiltschko 2024). Moreover, the sentence-final position of certain interactional particles can be analysed as movement of the propositional structure into SpecGroundP (see Fn. 6). Finally, there is evidence that interactional language allows for pronominalization: for example, Krifka (2013) argues that *that* can be used as a ProSAP and Wiltschko (2024) argues that some discourse markers in Austrian German are best analysed as ProGroundPs.

For further evidence supporting the postulation of a dedicated interactional structure, we refer to Wiltschko (2021), where the interactional spine is introduced in detail. For the present purpose, the data above sufficiently support the assumption that CP (which we refer to as the domain of Linking, following Wiltschko 2014) is embedded in the interactional structure, i.e., projections that can host speaker- and addressee-oriented discourse particles. These projections have been labelled *Grounding* projections in Wiltschko & Heim (2016), to reflect their relevance to updating the Common Ground (Stalnaker 1978; 2002). Each of these grounding projections hosts an abstract argument which can be viewed as the grammatical manifestation of the epistemic state of its holder (i.e., the speaker or the addressee).

Because particles hosted in these projections also combine with a call-on-Addressee (in the sense of Beyssade & Marandin 2006), often in the shape of rising intonation, we further follow Wiltschko & Heim (2016) in assuming a third projection at the very top of the spine, namely *Responding*. The full structure we assume is schematized in **Figure 1**.

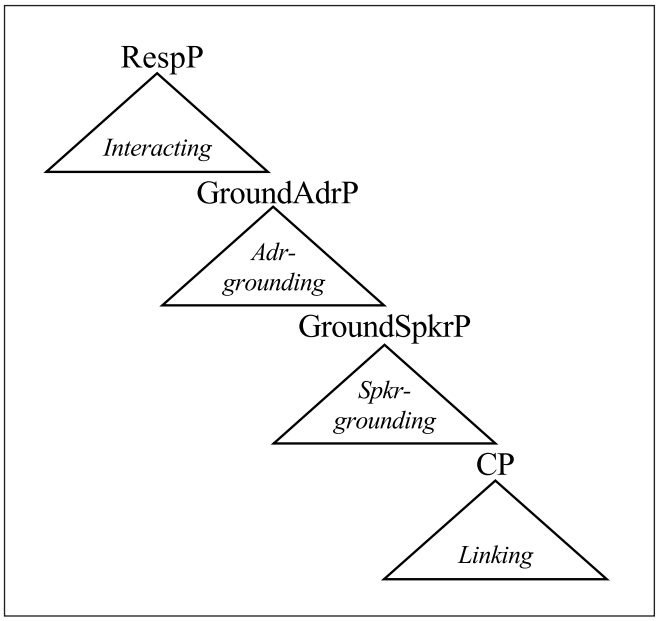

Figure 1: The interactional spine (Wiltschko 2021).

3.2 An analysis of adult *huh*

To show the value of the interactional spine for analyzing i-language, we now turn to the analysis of *huh* in adult language. In North American (adult) English, *huh* has two functions: it serves as an other-initiated repair strategy, as well as a sentence-final (confirmational) particle. We discuss each of these functions in turn.

When used in isolation, *huh* functions as an other-initiated repair strategy (Dingemanse et al. 2013). In this use, *huh* serves to request a response from the addressee. Requesting a response without specifying what the target of the response is leads to the interpretation that it is the previous move of the interlocutor that requires a response, as this is the most salient target. As such, it marks a problem in the current interaction that needs to be addressed (Wiltschko 2021). Arguably, the contribution of the particle *huh* in this context is to provide a host for the rising intonation, which otherwise, too, serves to request a response (Heim 2019b), and which is associated with RespP. Thus, *huh* as an other-initiated repair strategy serves as a bare RespP, as illustrated in (16).

(16) $[_{\text{RespP}}$ huh↑]

The interpretation of *huh* when used as a sentence-final particle is more complex, and this complexity is reflected in the syntactic analysis developed in Wiltschko (2021). To see this, consider the examples in (17). The bare declarative in (17a) asserts that the addressee has a new dog. This would be appropriate if the addressee does not know that they have a new dog (e.g., if the speaker gives the addressee a dog as a present). In contrast, when the particle *huh* is added, as in (17b), the speaker wishes to confirm their suspicion that the addressee has a new dog (e.g., if the speaker sees the addressee walking a dog they have not seen before). Crucially, the addition of *huh* indicates that the speaker does not know if the proposition (*p*) encoded in the host clause is true. In other words, the speaker is not committed to the truth of *p*.

(17) a. You have a new dog.
b. You have a new dog, **huh**?

According to Wiltschko (2021), this interpretation derives from the syntactic configuration schematized in (18). *huh* occupies $Ground_{Adr}$ and combines with the rise (↑) in RespP. Crucially, $Ground_{Spkr}$ remains empty reflecting the speaker's lack of commitment to the truth of *p*.[6]

(18) $[_{\text{RespP}}$ ↑ $[_{\text{GroundAdrP}}$ huh $[_{\text{GroundSpkrP}}$ [*p*]]]]

[6] To account for the sentence-final position of *huh*, we assume (following Haegeman & Hill 2013) that the propositional structure moves into a specifier position preceding the particle (i.e., SpecGroundP). An anonymous reviewer suggests that this analysis could be strengthened if we could show that it is subject to intervention effects of the type discussed in Haegeman (2012). Specifically, Haegeman shows that movement into the left-periphery is prohibited in some but not all embedded clauses and that this provides evidence for the presence vs. absence of an articulated structure at the top. Unfortunately, more research is required to determine whether intervention effects of this type can be found. Specifically, two factors prevent us from simply applying the same tests as those used by Haegeman (2012). First, *eh* or *huh*, are strict root clause phenomena (see Wiltschko 2021). Second, the types of movement into the left periphery that are implicated in these intervention effects pertain to information structure (which underscores our previous point that properties of movement are in part dependent on the target of movement, see Fn. 5). At this point, it is not clear what the relation is between positions that encode information structural notions and those that encode interactional notions (like grounding and responding).

Assuming that *huh* associates with $Ground_{Adr}$ (but not with $Ground_{Spkr}$) captures the contrast between sentence-final *huh* and sentence-final *eh*. Unlike *huh, eh* is compatible with an interpretation where the speaker is committed to the truth of *p*, as shown in (19) and (20).

(19) I have a new dog, eh?
= i) 'You know that I have a new dog, right?'
= ii) 'Is it true that I have a new dog?'

(20) I have a new dog, huh?
≠ i) 'You know that I have a new dog, right?'
= ii) 'Is it true that I have a new dog?'

eh is compatible with an interpretation where the speaker confirms that the addressee knows *p*, as well as with an interpretation where the speaker wishes to confirm that *p* is true. Crucially, *huh* is only compatible with the former interpretation. This contrast between *eh* and *huh* follows on the assumption that only *eh* can be associated with $Ground_{Adr}$ or $Ground_{Spkr}$, as in (21a). If it associates with $Ground_{Spkr}$ it marks the speaker's commitment to the truth of *p*. The restriction on the interpretation of *huh* follows if *huh* can only associate with $Ground_{Adr}$ but not with $Ground_{Spkr}$, as schematized in (21b).

(21) a. $[_{RespP} \uparrow [_{GroundAdrP}$ eh $[_{GroundSpkrP}$ eh $[p]]]]$
b. $[_{RespP} \uparrow [_{GroundAdrP}$ huh $[_{GroundSpkrP}$ *huh $[p]]]]$

Note for completeness that if *huh* (and *eh*) were associated with RespP only, the difference between them would be mysterious. Moreover, if *huh* in its use as a sentence-final tag would only be inserted to host the sentence-final rise associated with RespP, as is the case for free-standing *huh*, we would expect there to be no difference between interrogatives realized with and without *huh*, contrary to fact. As shown in (22a), a polar question (with rising intonation) is used when the speaker requests an answer (i.e., the addressee is expected to provide either a positive or negative answer). In contrast, a polar question with sentence-final *huh*, as in (22b), can be used to express one's suspicion that the addressee has the same question. In this case, the speaker does not necessarily expect an answer but rather wants the addressee to agree that the question is the right one to ask (Heim & Wiltschko 2022).

(22) a. Does he have a new dog?
= i) request for positive or negative answer
≠ ii) request to agree with appropriateness of the question

b. Does he have a new dog, huh?
= i) request for positive or negative answer
= ii) request to agree with appropriateness of the question

In what follows, we adopt this analysis of adult *huh* when interpreting the patterns of use of *huh* during its acquisition. We further assume that the acquisition of the interactional spine is an essential task during L1A, which has so far received no attention.

4 Acquisition of syntax: How does structure grow?

Chomsky's (1981) *principles and parameters* framework has been particularly influential in shaping discussions about how children acquire syntax. Language variation was assumed to be due to the setting of innate, linguistic parameters. This leaves open the question of the chronological order of setting individual parameters (but see Yang et al. 2017 for a recent proposal), and relatedly, the development of the syntactic architecture. Within this generative-nativist approach, syntax is assumed to be acquired either via a maturing structure (e.g., Borer & Wexler 1987; Radford 1990), via full continuity between child and adult structure with initial parameter settings that do not match the surrounding language (e.g., Gibson & Wexler 1994), or via computational constraints that result in non-adult output (Lust 1998).

Friedmann et al.'s (2021) "growing tree hypothesis" delivers a recent and particularly strongly formulated hypothesis of syntactic acquisition, which builds on many of the assumptions from the classic maturational account. It proposes an incremental bottom-up growth of the syntactic spine but also shares some assumptions with the continuity approach. According to the growing tree hypothesis, the acquisition of anything that requires association with the upper end of the syntactic spine (Rizzi's 1997 left periphery), such as questions or topicalization, implies completed acquisition further down. After a loosely defined initial stage with little phrasal architecture, syntactic acquisition is assumed to grow upwards in three stages, as schematized in **Figure 2**. Support for this proposal comes from sentence repetition tasks and spontaneous dialogue from Hebrew speakers aged 1;7-4;5 (Friedmann & Reznick 2021). Unaccusative subjects preceding the verb are presented as evidence for constituent movement into IP (what we label *Anchoring* in **Figure 2**); wh-questions and adjunct questions mark subsequent movement into the lower left periphery (*Linking* in **Figure 2**); and topicalization and relative clauses mark the final stage of the acquisition, including the upper left periphery (*Information Packaging* in **Figure 2**).

Each of the trees in **Figure 2** represents a distinct acquisitional stage and groups together functionally related projections and underlying transformations. The presence of a higher structure without an adult-like configuration of a lower structure would falsify the account or require significant revision. In this way, the growing tree hypothesis deviates from Rizzi's (1993) earlier account in assuming that early syntactic representations are generally absent rather than inaccessible due to truncation.[7] Regardless of whether higher layers in the spine are inaccessible

[7] Though Friedmann et al. (2021) still maintain that truncation is possible under the growing tree hypothesis, and in fact will increase in distribution in line with the upward growth of the syntactic spine.

– as in continuity accounts – or absent – as in maturation accounts – every step toward adult-like syntax is building on already available, adult-like layers lower in the spine. Just like cross-linguistic variation, differences in child language and adult language are regarded as superficial (Chomsky 1981; Yang et al. 2017).

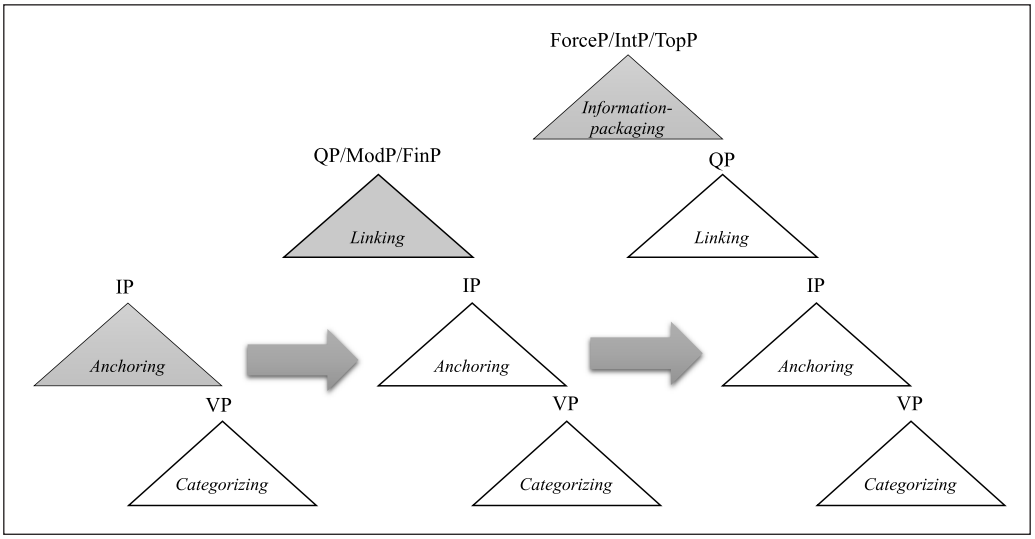

Figure 2: The (upward) growing tree hypothesis (in the spirit of Friedmann et al. 2021).

Challenges to maturational (and possibly continuity) accounts thus arise from non-linear development.[8] The growing tree hypothesis does not predict the existence of child-language utterances where syntactic complexity at the left periphery combines with non-adult performance sentence-medially. However, several empirical generalizations discussed in the literature are difficult to reconcile with Friedmann et al. (2021). We have already seen some of these generalizations in section 2.1. For example, Paul & Yan's (2022) generalization that the sentence-peripheral particles associated with IP and CP are acquired nearly simultaneously is not compatible with the upward growing tree hypothesis. Other facts that are incompatible with the upward trajectory include the following: Wh-questions precede the acquisition of polar questions (Moradlou et al. 2021); English subjects become obligatory only after the acquisition of wh-questions (Valian & Aubry 2005; Yang et al. 2017); tense comprehension and production precede agreement (Valian 2006; Bertinetto et al. 2015), and show clause-dependent error rates (Theakston & Rowland 2009). These findings suggest that a strong version of upward growth is untenable and that even weaker versions have to find ways to account for structures on the left that precede structures in the middle of the tree.

[8] Phenomena associated with inaccessibility to the continuous architecture tend be situated toward the top of the spine, suggesting some similarity in theoretical underpinning even between continuity and maturation.

An alternative to assuming syntactic growth is of course to drastically reduce the role of syntax in language production and computation, and by extension to assume that syntax only emerges very late. Usage-based accounts of L1A (Tomasello 2005; Ambridge 2020) rely on rote learning, schemas, formulas, and exemplars in early constructions. Constructivist accounts (Christiansen & Chater 2016) emphasize the procedural character of learning and a late, purpose-built arrival of abstractions. The absence of early linguistic representations in these accounts makes it difficult to relate syntactic complexity to acquisitional trajectories. Predictions are easier made on grounds of input frequency (Diessel 2004). For instance, it is no surprise that topic movement (e.g. *Pizza, I like.*) occurs later than questions based on input frequency alone (contra Friedmann et al. 2021). Embedded relative clauses should also occur quite late for that reason (see also Yang et al. 2017). However, Friedmann et al.'s (2021) prediction that questions occur at a later stage than obligatory subjects is difficult to reconcile with usage-based accounts, which take root infinitives to be truncated versions of auxiliary constructions, including questions. In general, the emphasis on input and routines would make i-language – and their input frequency – an ideal testing ground for usage-based accounts.

5 The inward-growing spine hypothesis

The observation that i-language, although associated with the top of the syntactic spine, is acquired early calls for a novel approach toward modelling the trajectory of L1A. This is precisely what we set out to do in this paper. Essentially, we propose that the spine grows inward rather than upward. More precisely, we adopt the bridge model of Hinzen & Wiltschko (2023), according to which language serves as a bridge between two pre-linguistic, domain-general cognitive abilities: categorization and (social) interaction. These two general cognitive capacities take on a human-specific form once linked through the syntactic spine. We propose that this defines an acquisitional path that is fundamentally *inward* rather than *upward*. Specifically, based on empirical and theoretical considerations, which we introduce below, we propose that children start by linking categorization and social interaction together via a generalized linking layer thus starting to grow the syntactic spine simultaneously grammaticizing interacting and categorizing. This is schematized in **Figure 3**.

The *Linking* layer roughly corresponds to CP in adult language. This conceptualization of *Linking* is in accord with Rizzi's (1997) observation that the articulated CP-domain consists of categories that are downward-oriented (finiteness) and categories that are upward oriented (force). The *Categorizing* layer roughly corresponds to the structural representation of categorizers (including *nP* and *vP*), whereas the *Interacting* layer corresponds to the layer of structure labeled Resp(onse)P in (Wiltschko 2021). It is responsible for the regulation of interaction itself, such as the typing of turns as initiation or response moves.

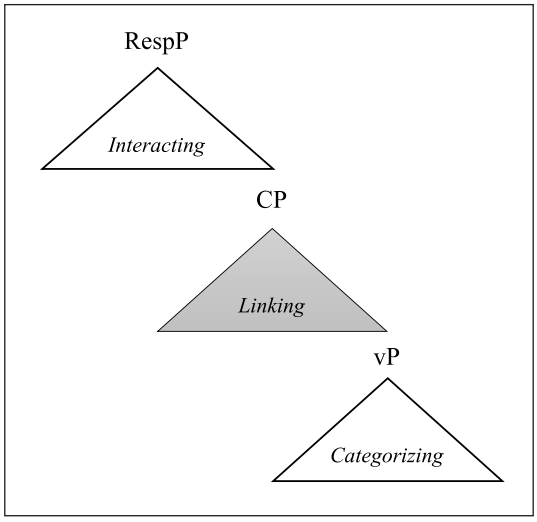

Figure 3: *Linking* bridges between categorization and interaction.

We further hypothesize that, in a next step, the child expands the complexity of the spine by unfolding the linking layer at both ends. Specifically, a generalized *Anchoring* layer bridges between *Linking* and *Categorizing,* and a generalized *Grounding* layer bridges between *Linking* and *Interacting*. This is schematized in **Figure 4**.

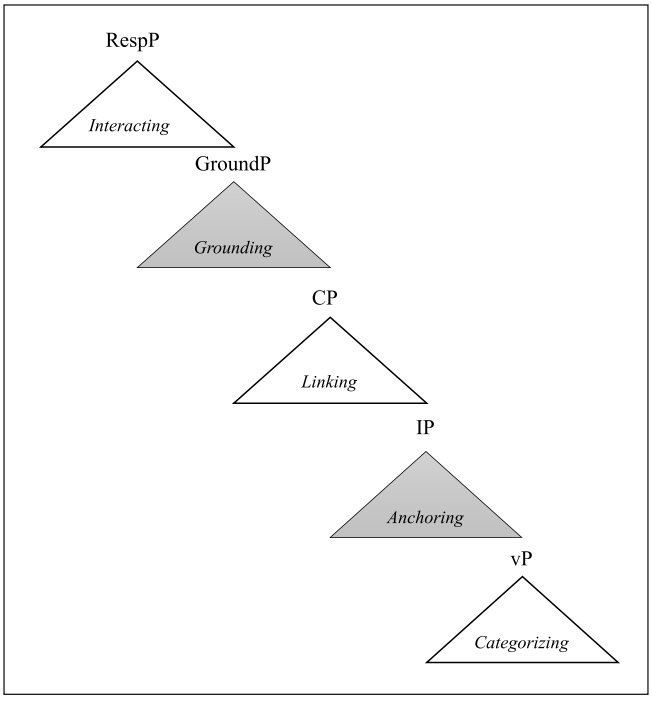

Figure 4: Unfolding the spine: *Grounding* and *Anchoring*.

Roughly, the *Anchoring* layer corresponds to IP (or TP) in adult language and the grounding layer corresponds to the layer of structure labeled *Grounding* (Wiltschko & Heim 2016). Note that in this stage, the spine still differs from the fully developed adult spine. In adult grammar, the *Anchoring* layer is divided into a deictic anchor (e.g., Tense) and a perspectival anchor (e.g., Aspect), whereas the *Grounding* layer is divided into a speaker-oriented and an addressee-oriented layer. Hence, there is no strict equivalent between the generalized grounding and anchoring layers of this stage in the acquisition process and the mature adult structure. These layers of structure are qualitatively different in child and adult language. The unfolding of the generalized *Anchoring* and *Grounding* layers is precisely what we hypothesize characterizes the next step in L1A. Specifically, we propose that the child gradually expands the complexity of the spine to include all the adult layers of structure. This is illustrated in **Figure 5**.

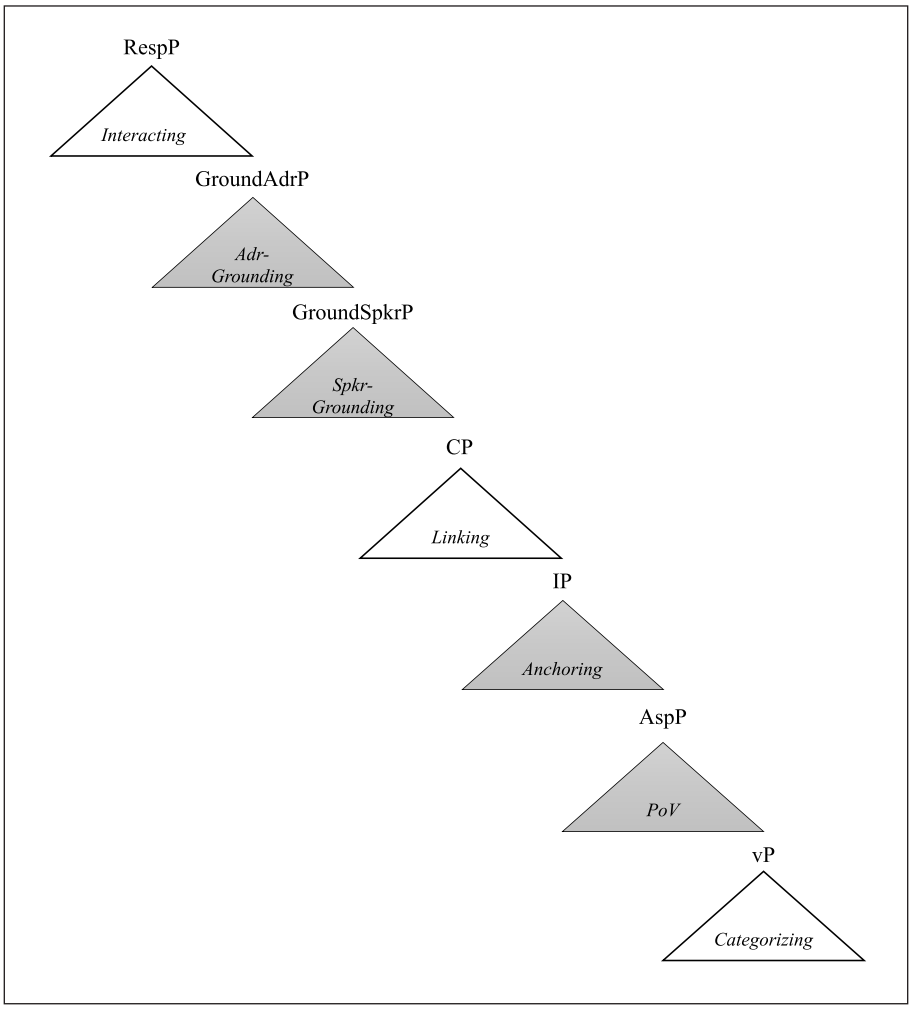

Figure 5: Unfolding generalized *Grounding* and *Anchoring*.

Crucially, until this final adult-like structure is in place, the child must accommodate the linguistic input they are exposed to into a somewhat impoverished structure, which is different from adult-like structures. Thus, it follows that they will need to adjust the way UoLs are integrated into their fully developed structure. For example, if a given UoL is associated with the generalized grounding layer in step 2, the unfolding of this layer into two layers will lead the child to assume (by default) that this UoL is associated with both layers. This might indeed be the case in adult language as some UoLs can be associated with multiple positions. However, this is not the case for all UoLs. That is, if in the adult language, an UoL is associated with speaker-oriented *Ground* only, then the child will have to dissociate it from the addressee-oriented *Ground* to arrive at the adult system. We refer to this stage as the *pruning stage* – analogous to tree pruning, but also to synaptic pruning in development (Low & Cheng 2006; Riccomagno & Kolodin 2015). This is illustrated in **Figure 6**.[9]

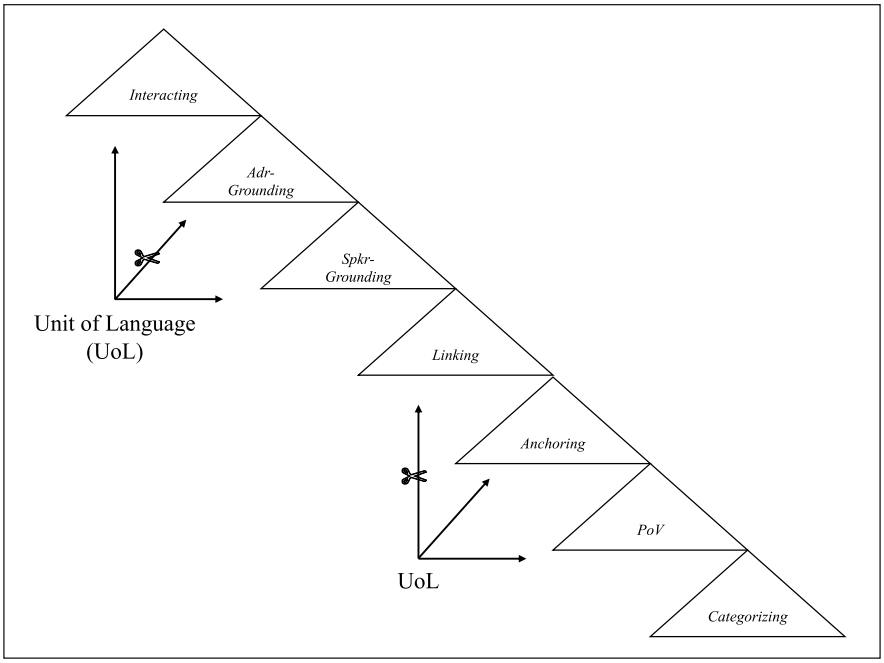

Figure 6: Pruning of non-adult-like associations.

[9] In section 6, we illustrate the necessity for a final stage that reduces logically possible loci of association to those that are attested in the input. Bosch (2023) reports that complementizers in child Romance are used much more freely than in adult language. In more general terms, we submit that pruning is equivalent to the final stage of the u-shaped development attested for inflectional morphology (Pinker & Prince 1988) and other developmental processes (Pauls et al. 2013). The term captures a phenomenon where a child shows a temporary decline of performance after initial signs of mastery, which is ultimately resolved into adult-like performance.

In sum, we propose an alternative to the upward growing tree hypothesis which accommodates the fact that i-language is acquired as early as the one-word stage of acquisition (see Section 7 for further details). Crucially, this so-called one-word stage is not simply defined by utterances used to name objects. Instead, these one-word utterances can also be used to regulate the interaction. Thus, according to our proposal, the spine grows inward such that the layers of the spine that define the outer edges of the adult spine are first connected and then expanded. Given that each stage during the acquisition process is characterized by a spine that is qualitatively different from the mature spine, it follows that the child will have a different grammar for the UoLs they have acquired. As a consequence, in a final stage, readjustments have to be made via pruning existing associations that overgeneralize.

In what follows we present a case study of the acquisition of one interactional UoL, namely *huh*. We show that the acquisitional trajectory we observe for *huh* falls into place if we assume the Inward Growing Spine Hypothesis as outlined above.

6 A case study of *huh*

The Inward Growing Spine Hypothesis leads us to expect that even seemingly simple interactional UoLs, such as *huh*, might undergo four different stages of development. We demonstrate that the acquisitional trajectory of *huh* supports the predictions of the Inward Growing Spine Hypothesis. Specifically, we show how its use in child language develops from a request for response only (associating with RespP) to a tag that requests confirmation about either the speaker's belief or the addressee's belief (thus associating with both RespP and GroundP).

To track the acquisition of *huh*, we consulted the Brown corpus (Brown 1973), the usual starting point for corpus investigations of North American English in the CHILDES database (MacWhinney 2000). All three children of the Brown corpus use interactional language from the beginning of their records. Adam has his first isolated use of *huh* recorded at the age of 2;04, Eve at 1;06, and Sarah at 2;03. Since we are specifically interested in the trajectory of confirmational *huh,* we ignore isolated instances for the purpose of this study. Combinations of *huh* with a host-utterance are recorded at 2;05 for Adam and at 2;08 for Sarah. Eve's recordings do not contain any instances of *huh* combined with a host, likely because she left the study at 2;3 before the first occurrence of such a combination. **Table 1** traces the occurrences of *huh* in multi-word utterances from both Adam and Sarah through the first three years recorded on CHILDES. Host utterances are separated into clause types. The data is separated into periods of six months. Adam's and Sarah's uses of *huh* differ in both onset of use and distribution across clause types.

Huh	**2 0-5**	**2 6-11**	**3 0-5**	**3 6-11**	**Total**
wh-Q	–	21_{Adam}	$50_{\text{Adam;}}\ 1_{\text{Sarah}}$	29_{Adam}	$\mathbf{100_{Adam;}\ 1_{Sarah}}$
PQ	–	1_{Adam}	1_{Adam}	$1_{\text{Adam;}}\ 2_{\text{Sarah}}$	$\mathbf{3_{Adam;}\ 2_{Sarah}}$
Other	–	8_{Sarah}	$2_{\text{Adam;}}\ 2_{\text{Sarah}}$	2_{Adam}	$\mathbf{4_{Adam;}\ 10_{Sarah}}$
Dec	6_{Adam}	$3_{\text{Adam;}}\ 13_{\text{Sarah}}$	$2_{\text{Adam;}}\ 4_{\text{Sarah}}$	$3_{\text{Adam;}}\ 8_{\text{Sarah}}$	$\mathbf{14_{Adam;}\ 25_{Sarah}}$
Total	$\mathbf{6_{Adam}}$	$\mathbf{25_{Adam;}\ 21_{Sarah}}$	$\mathbf{55_{Adam;}\ 7_{Sarah}}$	$\mathbf{35_{Adam;}\ 10_{Sarah}}$	$\mathbf{121_{Adam;}\ 38_{Sarah}}$

Table 1: Clause-type combinations of *huh* in the first four years of life of Adam and Sarah.

What stands out is the high frequency of Adam's use of *huh* in combination with wh-questions with a peak during the first half of his fourth year of life. Polar questions hardly ever co-occur with *huh*. Sarah has only three combinations of *huh* in questions altogether (compared to Adam's 103). Examples such as (23) and (24) suggest that the clause type restrictions present in adult speakers are not yet acquired. The response in (23) and the follow-up in (24) strongly suggest that the preceding questions seek information, not confirmation.

(23) Adam: Where go, huh? (2;07)
Mother: I don't know.

(24) Adam: Where zip it, huh? (2;07)
Adam: There. Zip it right there.

The information requests in these contexts differ from the adult usage of *huh* and their corresponding syntactic representations (see Section 3.2). Clause typing restrictions require a complex representation of *Linking*. The request for confirmation of a belief requires a complex representation of *Grounding*. To account for Adam's early use of *huh,* we propose the syntactic representation illustrated in (25). Specifically, we propose that in these utterances, *huh* associates with RespP, as it does in adult uses of *huh,* when used as other-initiated repair markers. Crucially, this representation differs from the adult representation of sentence-final *huh* introduced in (21) b above in that RespP is directly adjacent to CP.

(25) Stage I: $[_{\text{RespP}}$ huh + ↑ $[_{\text{CP}}$ where $[_{\text{VP}}$ zip it]]]

The lack of a clause-type restriction in Adam's uses of *huh* persists well into the fourth year of life. Significantly, at this stage, Adam's combinations of *huh* and wh-questions lack the auxiliary, which is obligatory in adult questions. This, too, has important implications for modelling syntactic growth: the data in (23) and (24) show that i-language can combine with wh-questions before the acquisition of subject-auxiliary inversion, which requires the presence of the syntactic host for inflection (*Anchoring/IP*).

The upward growing tree hypothesis, as per Friedmann et al. (2021), predicts that wh-questions can only occur when *Anchoring* is in place, contrary to fact. According to the Inward Growing Spine Hypothesis, however, the absence of auxiliaries is expected: the wh-pronoun associates with *Linking* (CP) without any requirement for movement of functional elements into the Anchoring layer as this structure is not yet acquired.

Combinations of *huh* and questions disappear almost entirely after the fourth year of life, and the few that remain are adult-like in that the particle seeks confirmation of the appropriateness of the question, as in (26).

(26) Adam: What's this about, huh? (4;5)

This stage II is characterized by a notable increase of non-interrogative host-clauses (see Table 1). Specifically, *huh* begins to occur with declaratives and fragments at the same time as the co-occurrence with questions decreases. We argue that this distribution corresponds to the expansion of the spine on either side of *Linking*: *Grounding* emerges between *Responding* and *Linking*, and *Anchoring* emerges between *Linking* and *Categorizing* (see **Figure 4**). Thus, with the emergence of *Grounding*, we expect *huh* to show first signs of reflecting beliefs, albeit without a clear separation of speaker and addressee beliefs. The latter is only possible once *Grounding* is unfolded to interlocutor-specific projections, i.e. $Ground_{Spkr}$ and $Ground_{Adr}$ (see **Figure 5**). This expectation is consistent with the data. For example, Sarah's confirmation requests in (27) and (28) target the shared beliefs (or attitudes) of the interlocutors. This is particularly clear in the case of (28) since it contains a subjective judgment which excludes a scenario where the speaker (Sara) is not committed to the proposition. This is precisely the context where adults do not allow *huh*.

(27) Sarah: You come back, huh? (2;09)
Mother: Yeah, I'll come back.

(28) Sarah: That look nice, huh? (3;05)
Ken: Very nice.

These first instances of generalized grounding conflate the perspective of speaker and addressee. At this stage, there are no examples that unambiguously target the addressee's belief only, as is the case in adult language.

Next, we turn to Stage III (roughly corresponding to the fourth year of life). Here we observe clear examples of confirming either the speaker's or the addressee's belief. This is consistent with the postulation of an articulated grounding layer that separates $Ground_{Spkr}$ and $Ground_{Adr}$ (**Figure 5**). For example, in (29) Sarah uses *huh* to confirm her suspicion that the proposition encoded by the host utterance is true. This suspicion is based on what her mother just told her. Crucially, however, Sarah is not committed to the truth of *p* and indeed, the mother further indicates that *p* is false.

(29) Mother: We left him down there.
Sarah: We forgot him, huh? (4; 11)
Mother: No, we didn't forget him, but…

This type of confirmation matches the adult use of *huh.* Yet unlike in adult language, Sarah can also use *huh* when she is committed to the truth of *p*, as in (30). Here, Sarah wants to confirm that her mother also knows *p*. This is evidenced by the fact that she provides an affirmative answer to her mother's response, which indicates that she is committed to the truth of *p*.

(30) Sarah: We got Grampy socks, huh? (4:10)
Mother: You bought Grampy socks?
Sarah: Yeah.

As we have seen in section 5.1, this use of *huh* is well attested for other tags, such as Canadian *eh*, but unacceptable for adult North American *huh.* Thus, at this stage, Sarah has the structure available to separate speaker and addressee ground (as is the case in adult language). But unlike what is the case in adult language, Sarah uses *huh* as if it could associate with both layers of grounding. Thus, we observe a form of overgeneralization, which is – by our hypothesis – due to the unfolding of the grounding layers. We submit that once the structure unfolds, the child will – by default – assume that *huh* can associate with both of these newly separated layers of the interactional structure, $\text{Ground}_{\text{Adr}}$P and $\text{Ground}_{\text{Spk}}$P. Note that the separation of *Grounding* in Stage III, by hypothesis, mirrors the separation of the projections at the lower end of the spine: underspecified *Anchoring* is now expanded into tense-marking *Anchoring* and aspect-marking *PoV*. Consistent with this hypothesis of the spinal expansion of the *Anchoring* layer, we also find inversion errors disappear and tense is marked reliably.

In sum, the trajectory of the acquisition of *huh* strongly supports the Inward Growing Spine Hypothesis. The different stages of acquisition according to the Inward Growing Spine Hypothesis are schematized in **Figure 7**.[10]

[10] An anonymous reviewer suggests an alternative explanation for the acquisitional trajectory of *huh*. Specifically, they propose that *huh* is initially linked to *wh-*, which is, in turn, linked to the presence of a Q feature that later disappears. While we share the impression that early *huh* resembles the function of a question marker, we do not believe that questions – or their mappings onto interrogatives – are conversational primitives (Heim & Wiltschko 2020; Heim et al. 2025). This implies that Q cannot be a primitive feature of grammar. Rather, canonical questionhood derives from the interplay of interrogativity and calls on the addressee to respond. We have shown elsewhere that even syntactically complex i-language, like variant tag questions, undergo a development parallel to *huh* (Heim & Wiltschko 2021; Heim 2023). We thus find it difficult to assume a Q-based analysis for a wider range of i-language and therefore prefer an account that allows for a more nuanced analysis, which in turn predicts the functional expansion of i-language we have proposed.

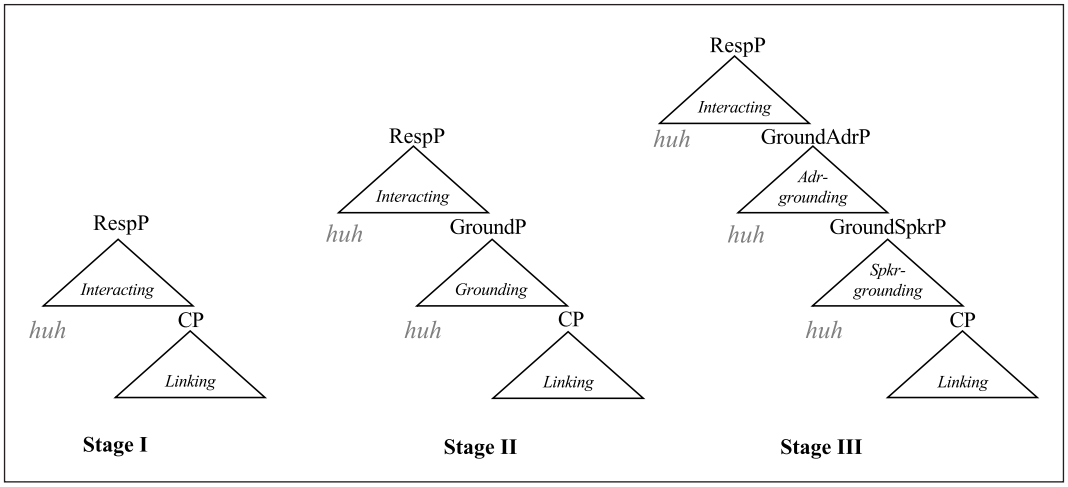

Figure 7: Incremental association of *huh* to the expanding spine.

Crucially, the upward growing tree hypothesis has no means of predicting this pattern. Indeed, we are not aware of any theory of L1A that could. For a start, i-language is rarely incorporated into accounts of syntactic growth; and even those accounts that do incorporate a detailed left periphery would not predict the inward trajectory (but see Biberauer 2018). If interactional language was incorporated, we assume that the upward growing tree hypothesis would struggle to explain how i-language can combine with p-language at a stage where the latter is still developing. For the acquisition of *huh* specifically, that hypothesis would also struggle with accounting for the incremental expansion within the interactional treelet because the stages proposed always include several projections that are related in function.

Finally, the fact that we continue to observe non-adult-like uses of *huh* as in (29), which targets the speaker's beliefs, well into the fifth year of life suggests that a final stage of pruning is necessary. In this stage, we assume that the child dissociates non-adult-like uses of UoLs. In the case of *huh,* this dissociation will have to affect its association with the speaker-oriented *Grounding* layer, while association to the addressee-oriented *Grounding* layer is upheld.

7 The Inward Growing Spine Hypothesis as a research agenda

In this paper, we set out to introduce i-language as part of the empirical domain that studies of L1A must consider. Given that i-language is systematically integrated with p-language (both in adult and child language), it follows that they need to be regulated by a common system. Here we have adopted the assumption that the use of i-language is regulated at the very top of the syntactic spine, the interactional spine being an extension of the spine that regulates p-language. The fact that children acquire i-language before some aspects of p-language suggests that the standard assumption according to which the spine is acquired continuously upward cannot be

upheld. This led us to propose the Inward Growing Spine Hypothesis according to which the outer edges of the spine are acquired first with the rest of the spine growing and unfolding inwardly. Moreover, given that the child starts with a radically different spine, the acquired UoLs will have to be reintegrated as the spine unfolds and existing associations will have to be pruned.[11] By integrating i-language into the empirical domain of L1A we define a novel research agenda which we explicate in this section. We start by making explicit the foundational assumptions that underlie the Inward Growing Spine Hypothesis.

7.1 Foundational assumptions

According to the bridge model (Hinzen & Wiltschko 2023), which underlies the Inward Growing Spine Hypothesis, language bridges two pre-linguistic, domain-general capacities: categorizing and social interaction. These capacities precede linguistic abilities as evidenced by the fact that they are present in animals as well as in neonates. Human linguistic abilities emerge when the spine bridges these two capacities. We hypothesize that it is the linking layer of the spine that first surfaces to generate this bridge, and that it is first realized in the form of the pointing gesture. Subsequently, the other layers of the spine unfold, as outlined in section 4. Adopting the bridge model and integrating i-language as part of the research agenda for L1A implicates some foundational assumptions, which we now discuss.

First, considering i-language to be part of grammatical knowledge requires us to reconsider the classic generative distinction between competence and performance. This is because these interactional aspects of language are part of the capacity for language, and they are acquired early. This conceptualization of language is in the tradition of proposals that postulate a communicative competence (Campbell & Wales 1970; Hymes 1972; Keenan 1974; Mittwoch 1976; Chomsky & Lasnik 1978; Chomsky 1980; Ginzburg 2012; Wiltschko 2021).[12] It is likely the classic generative division of language competence and performance that led to the neglect of i-language in generative studies of L1A. There, the study of both adult and child language has typically focussed on the expression of propositional thought. Once we integrate i-language

[11] We are grateful for the suggestion of one anonymous reviewer to discuss the errors to be expected based on such reintegration, specifically the frequency of co-mission errors (Snyder 2007). Omission errors have been observed to significantly outrank co-mission, the misplacement of words or affixes. This is expected by our account. It is important to note that co-mission errors persist at very low numbers even when the spine is in place. We therefore attribute co-mission to a failed association with the spine, while the omission is rooted in both the absence and under-specification of projections (in that order). For further details on the association with the spine, see Wiltschko (2014).

[12] We refer the reader to Wiltschko (2022) for a detailed discussion about the relation of thought, language, and communication, which proposes a compromise on the classic schism between language emerging for thought vs. communication. We believe that the important role of i-language in early child language makes it difficult to uphold a perspective which takes communication (or thought) to be a secondary purpose of language precisely because language serves to mediate thought and communication.

into our models of grammatical knowledge, language acquisition must also be viewed through the lens of communication. And indeed, from its earliest stages, language links thought and communication, as reflected in our case study above. *Huh* is used interactionally even before it is fully integrated with p-language, and its use-conditions expand in parallel with functional growth in representations of p-language.

This further implies that the acquisition of i-language is to be studied on par with p-language and is therefore part of the syntactic acquisition process. This requires a conceptualization of syntax that differs from the classic one. Specifically, syntax has traditionally been viewed as the linguistic domain that is responsible for the combination of words to create sentences. In turn, this implies that syntactic acquisition starts with multi-word utterances and that only words that belong to p-language are relevant. Accordingly, most aspects of i-language might appear irrelevant as they do not belong to the classic domain of the sentence. In contrast, if we include i-language in this domain, then multi-modal forms of language (e.g., intonation, gestures, and eye gaze) will have to be considered as well, since these belong to i-language. And if so, syntactic acquisition starts much earlier than the classic *multi-word stage* (cf. Radford 1996; Friedmann et al. 2021). On this view, syntactic combination is not defined by the combination of words with each other, but rather by the systematic combination of any linguistically significant form with the spine. Crucially, systematicity here must be defined based on the child's output rather than on specific conventions of the language community the child is born into. From the start, verbal behavior is entrenched in communicative contexts. Just like there is evidence that a child's linguistic competence of p-language cannot be deduced from production data alone, we submit that the competence for i-language, too, is present before it is produced. Consequently, we need to look at preverbal behavior for evidence of the structural development of the interactional spine. Early on, there is evidence for synchronization between infants and caregivers in preverbal communicative behavior. Of particular interest are vocalizations from newborns that are directed toward their caregivers. These are often contingent on the caregiver's turn and occur with little delay (Dominguez et al. 2016). At 5 months, turn-taking assumes a language-specific format with very few gaps and overlaps between turns (Hilbrink et al. 2015). Only when joint attention and pointing begin to surface, does the synchronization of turns begin to include noticeable pauses, which likely reflects the planning of an utterance by the infant. According to the Inward Growing Spine Hypothesis, *Linking* (arguably first instantiated by the pointing gesture) allows the infant to communicate its observation about the world. Categorizing the world is now linked to interacting with other individuals. Thus, the first concrete evidence for the presence of *Linking* consists of combinations of early (pre-)verbal utterances and gestures, which anticipate the earliest word-gesture combinations. Carter (1978) shows that speech acts initially consist of sound-gesture combinations, such as headshakes and nasalized glottal stop sequences for rejections and [d]- or [l]-initial sounds and pointing for drawing attention to an object.

As a case in point for early systematic and complex communicative behavior, consider an example from the Forrester corpus (Forrester 2002). In (31), the father readily engages with Ella's combination of hand gestures, rising intonation, and monosyllables by offering an adult variant of the utterance in his response. This response interprets the child's utterance as a question (with *whaa* strongly resembling adult *what*) and the pointing to an object as demonstrative (*that* in the father's words).

(31) Ella: Whaaa↑ [raises arm] (1;00 – Forrester Corpus)
Ella: Yehh↑ [points to object with extended index finger]
Father: No, what's that? Huh?
Father: I don't know, do you?

We suggest that the child's raised arm and rising intonation serve as a request for a response and thus as being associated with RespP. We further suggest that *yehh*↑ links the response layer with the categorizing layer by communicating Ella's interest in an object (the target of the pointing gesture) to her interactant.

Cases like this indicate that there is no discrete step from which non-syntactic single-word utterances turn into syntactically integrated multi-word utterances, just as there is no discrete step from where variegated (non-repetitive) babbling turns into a one-word stage (Messick 1984). Syntax begins where turn-taking (in *Response*) and first syllables (in *Categorization*) are linked in meaningful, dialogical communication well before the arrival of multiword utterances.

In sum, integrating i-language into the study of L1A requires the study of language well before the use of words, hence the research agenda has to include the study of the child's preverbal competence. The exploration of i-language implicates that we do not just study the content of children's utterances but also the way this content is communicated (e.g., joint attention seeking, pointing, drawing attention, etc.). Crucially, pre-verbal communicative interactions are primarily facilitated by multi-modal cues, such as in example (31). Gestures and gaze serve as substitutes for referring to words yet unknown or not yet pronounceable. Because these interactions are *combining* turn-taking and categorizing, we assume a syntactic representation.

7.2 A Novel Research Agenda

Given that i-language has largely been ignored in previous studies of L1A, there are currently no models available that look at the way early i-language and p-language relate to each other. It is essential to establish the sequencing of acquisition of p-language relative to i-language. The Inward Growing Spine Hypothesis is the only framework that makes clear predictions about this trajectory and initiates the exploration of i-language as a systematic research agenda. Specifically, it invites the following new research questions:

(32) What is the onset and trajectory of acquisition of different UoLs that belong to i-language? Does the complexity in function of these interactional UoLs contribute to their variation in acquisition? (Interactional UoLs include sentence-final particles, response markers, interjections, and vocatives, as well as their combination with multi-modal means of communication, including intonation, gestures, and eye gaze.)

(33) What is the relative timing of the acquisition of i-language and p-language? Is there evidence for simultaneous unfolding within the two domains? For example, do *Grounding* and *Anchoring* emerge simultaneously? Do *Grounding* and *Anchoring* unfold simultaneously into their two articulated layers (i.e., speaker and addressee-oriented ground and tense and aspect, respectively)? Are there corresponding patterns in the nominal domain (see the discussion below)?

(34) Are there correlations of the development of i- and p-language with the development of general cognitive capacities (e.g., the development of a theory of mind and its precursors and the unfolding of speaker vs. addressee-oriented Ground)?

(35) Does input from more than one language prolong periods of under-specification and delay the process of pruning? While such delays are to be expected overall, it seems promising to investigate this for individual layers, such as *Anchoring* and *PoV* given their cross-linguistic variation (see, for instance, Andreou & Tsimpli 2017).

While the study of i-language in the context of L1A is new, the study of the acquisition of p-language has a long tradition. However, the Inward Growing Spine Hypothesis leads to a novel set of predictions that run counter to models that assume an upward trajectory of maturation. Specifically, it predicts the following trajectory of acquisition for p-language (parallel to i-language, see **Figures 3–6**).

(36) Stage 0: $[_{vP}$ Categorizing]
Stage I: $[_{CP}$ Linking $[_{vP}$ Categorizing]]
Stage II: $[_{CP}$ Linking $[_{IP}$ generalized Anchoring $[_{vP}$ Categorizing]]]
Stage III: $[_{CP}$ Linking $[_{IP}$ temp. Anchoring $[_{AspP}$ asp. PoV $[_{vP}$ Categorizing]]]]

By hypothesis, the Inward Growing Spine Hypothesis applies to both the clausal and the nominal spine. This follows Wiltschko's (2014) Universal Spine Hypothesis, according to which the spine is intrinsically category-neutral (i.e., not specified for being verbal or nominal). In turn, Wiltschko's claim is based on the well-documented parallelism between the clausal and the nominal spine (Chomsky 1970, Abney 1987, a.o.). If indeed the spine is not intrinsically nominal or verbal, it follows that the Inward Growing Spine Hypothesis should equally apply to both instantiations. We submit that this provides a fruitful avenue of analysis for the acquisition of determiners, for example. We consider it likely that the acquisition of articles mirrors the development of i-language, as exemplified by our case study of *huh*. Indeed, early articles lack a clear distinction between definite and indefinite uses. Schaeffer & Matthewson (2005) show that the in/definite

distinction in St'at'imcets (Lillooet Salish) resembles the usage of early articles in English. In contrast to adult English, both St'at'imcets and child English allow a definite article in contexts where the addressee is unfamiliar with the referent. In adult English, these contexts require an indefinite article. Schaeffer & Matthewson (2005) propose for English children that a concept of non-shared assumptions is responsible for this overextension. This pattern is amenable to an analysis according to which the Grounding layers in the nominal spine are not yet articulated. Interestingly, Guasti et al. (2008) make a similar proposal for Dutch children omitting articles. Spoken adult Dutch allows bare singular nouns if speaker and addressee have shared knowledge of the referent. Thus, both Schaeffer & Matthewson (2005) and Guasti et al. (2008) independently draw on an ability to distinguish interlocutor beliefs to explain the acquisition of articles. This is consistent with the hypothesis that the child starts with a generalized Grounding layer where speaker and addressee ground cannot be distinguished.

7.3 The Inward Growing Spine Hypothesis and p-language

Finally, we briefly discuss how the Inward Growing Spine Hypothesis addresses classic problems in research on the acquisition of the syntax of p-language. Specifically, we briefly discuss the acquisition of *Anchoring*, whose trajectory is difficult to analyse on the assumption that trees grow upwards but falls into place assuming the Inward Growing Spine Hypothesis.

In adult English, the *Anchoring* domain corresponds to what is known as IP, the syntactic layer of structure that hosts tense and agreement morphology, as well as grammatical subjects. IP is located above AspP, which hosts aspectual morphology and grammatical objects, and below CP, which hosts complementizers, wh-pronouns, and auxiliaries in questions and negation. According to the upward growing tree hypothesis, AspP and IP should be acquired before CP. However, the empirical facts do not bear out this prediction.

To see this, consider again the data in (23) and (24) repeated from above. At the age of 2;07, Adam uses wh-questions (marked by an utterance initial wh-word) but the rest of the clause differs significantly from its adult counterpart. What is missing is precisely the UoLs that occupy IP: subjects, auxiliaries, and inflection for tense and agreement.

(23) Adam: Where go, huh? (2;07)
Mother: I don't know.

(24) Adam: Where zip it, huh? (2;07)
Adam: There. Zip it right there.

Note that the absence of IP-internal material is independent of the presence of *huh.* That is, Adam also produces wh-questions without subjects, auxiliaries, or inflection when he does not use the sentence-final *huh,* as shown in (37)–(39). The presence of the wh-pronoun is key for our claim

here since the growing spine hypothesis also assumes IP to come after an initial vP/VP stage where subjects stay low. Postverbal subjects of various kinds are in fact well attested in early, tenseless multiword utterances (see e.g., Tsimpli 1992 citing examples from Bowerman 1990: "ride Christy", "fall mommy" or "write Sissy"). Yet any material above IP before the arrival of subject movement is not expected in a strictly upward growing tree.

(37) Adam: Where go ? (2;03)

(38) Adam: Where ball go? (2;03)

(39) Adam: Where dat [: that] come from? (2;04)

This pattern follows straightforwardly from the assumption that CP (i.e., *Linking*) is present before IP (*Anchoring*). Specifically, it appears that VP-internal material (the verb with its arguments) can be realized in combination with an utterance-initial wh-word (by our hypothesis, occupying Spec, CP). However, auxiliaries and inflection (associated with IP in adult language) are conspicuously absent.[13]

To account for this pattern, the upward growing tree hypothesis has to be enriched with auxiliary assumptions. Specifically, it is often assumed that children truncate structure (Rizzi 1993) which is (in principle) available to them (e.g., the CP). Significantly, the presence of some finite wh-questions in English is challenging for this approach (see Guasti 2017 for an overview). The data in (37)–(39) would then require the wh-pronoun to associate with the specifier of whatever root node is available after truncation. This option is, however, not considered by Friedmann et al. (2021) because the use of wh-questions will always require an adult-like structure in the lower IP domain.

The truncation account is typically also invoked for another property that characterizes English child language, namely the frequent absence of subjects (Hyams 1986), as in (37) above. That is, subjects may be absent in the context of wh-questions, which differs from adult English, where subject drop is ungrammatical (apart from fragments, diary style, and imperatives). However, subject drop is consistent with the assumption that the spine grows inwards. Accordingly, the CP will first embed VP thus providing no position for grammatical subjects. Note that the presence of subjects in early child language does not contradict the claim that *Anchoring* is acquired late. That is, assuming the VP-internal subject hypothesis it follows that subjects may remain

[13] An anonymous reviewer points out that child utterances like "peas please" might be instances of early topic constructions that precede other structural complexity. If so, this would follow from our proposal. Specifically, it would be an early instantiation of *Linking* (CP), the host of the topic, which according to our hypothesis appears early. It links the categorizing structure to the interactional structure (see section 5). We leave the empirical verification of any expansion of CP reminiscent of Rizzi's (1997) finer structure of the left periphery with dedicated focus and topic positions to further research.

VP-internally and thus may occur early on. Thus, the optional presence of subjects (as seen in (37) and (38)) can be analyzed as the realization of a VP-internal subject. Arguably, the overt realization of subjects becomes mandatory only when the *Anchoring* layer unfolds completely.[14] This hypothesis is consistent with the fact that expletive subjects are acquired significantly later than lexical subjects (Yang 2002). It follows if early subjects are VP-internal and hence necessarily thematic. Consistent with this idea is the fact that agreement surfaces around the same time as expletive subjects, namely at the age of 3;0 (Lukyanenko & Miller 2023).

Finally, according to the Inward Growing Spine Hypothesis, the *Anchoring* category is predicted to first emerge as a category that subsumes both IP and AspP of adult English (see Vainikka & Young-Sholten 1996 for a similar proposal in second language acquisition). This is consistent with the well-known observation that in the course of L1A, tense and aspect inflections are often applied inconsistently (see Guasti 2017 citing Valian 1991; 1992; Wexler 1998). Moreover, according to Valian (2006), 2.5-year-olds perform better with tense comprehension than with aspect comprehension against the prediction of the Aspect First Hypothesis (Antinucci & Miller 1976), which assumes the opposite order. This is consistent with the Inward Growing Spine Hypothesis but is not expected under the classic upward growing tree trajectory according to which aspect should be acquired before tense.

7.4 Possible alternatives to the Inward Growing Spine Hypothesis

Assuming that i-language is part of grammar, and thus part of the spine (Section 3), the fact that i-language is acquired early casts doubt on the assumption that the spine matures in an upward trajectory. In this paper, we have proposed an alternative, according to which the spine matures in an inward fashion (Section 5).

An anonymous reviewer suggests an alternative, which would save the traditional view that the spine matures in an upward fashion. According to this reviewer, “the early emergence of interactional phenomena could simply be an artefact of such phenomena being a system separate to the syntax (or at least not integrated into the syntactic spine). If interactional phenomena aren’t part of the syntactic spine beyond some interface condition, their early emergence could be quite independent of the growth of the syntactic spine, and there would be no need to propose

[14] In English, early sentences with intransitive root infinitives and subjects are structurally ambiguous. It is unclear whether an utterance like *Ball go* involves movement of the subject to IP. This is because *go* is an unergative verb which is base-generated as the external argument of the verb (Perlmutter 1978). Only an unaccusative subject, which is base-generated as the internal argument, would convincingly show movement when it occurs sentence-initially. Friedmann et al. (2021) predict subject-verb and verb-subject alternation for unaccusative subjects to occur early on (at their stage 1) among the first multiword constructions. And indeed, Adam produces both low and high unaccusative subjects at 2;03 (*I fell down*) and 2;04, (*fell down Mummy rug*), respectively. But we can also report contemporary unaccusatives without a subject that occur with a vocative, such as *fell down, Mommy* (2;06). We will have to explore the sequencing of vocatives and subjects of unaccusatives in future research.

the inward growing spine hypothesis." In other words, the reviewer suggests that the acquisition of i-language fundamentally differs from the acquisition of p-language and hence need not be taken into consideration when modelling the acquisition of (p-)language, where i-language is typically ignored, as illustrated in **Figure 8** where '*' signifies recursive input.

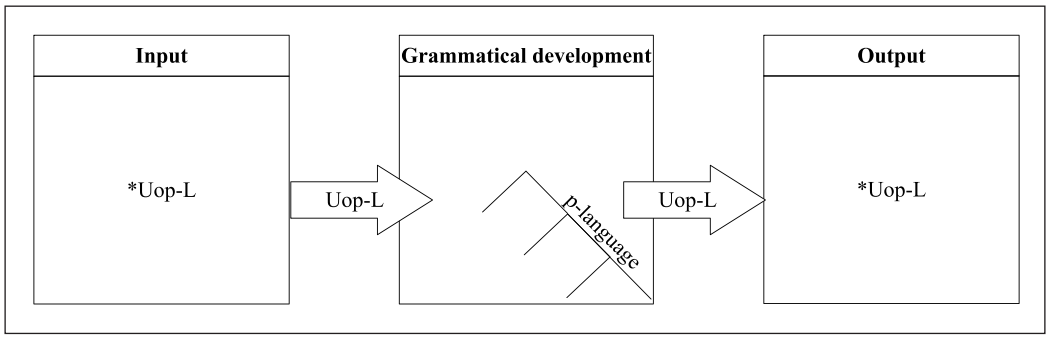

Figure 8: Classic assumptions regarding language acquisition.

On this view, what is modelled is the acquisition of p-language alone: only units of p-language (Uop-L) are considered, and grammatical development is viewed as the development of the propositional spine. This is in fact the implicit assumption that underlies all work on the acquisition of syntax and has led to the status quo where the question as to how i-language is acquired is not addressed. It is, of course, an empirical fact that the input for the child contains units of interactional language (Uoi-L). Hence, a comprehensive theory of language acquisition will have to take into consideration how these are acquired alongside propositional language. What the reviewer suggests is something along the lines schematized in **Figure 9**, where the acquisition of i-language is qualitatively different from the acquisition of p-language.

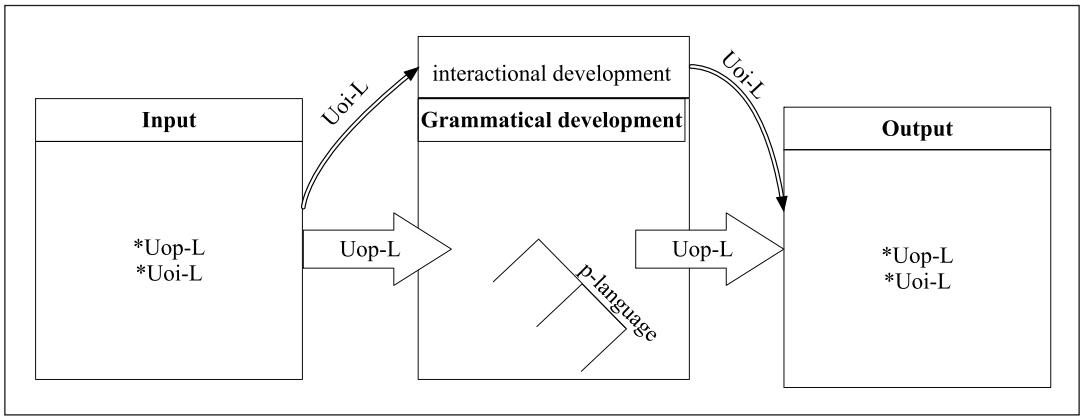

Figure 9: Acquisition of i-language differs qualitatively from acquisition of p-language.

This model, however, faces some challenges which our proposal does not. Specifically, the assumption that i-language is different exacerbates the classic *word discovery problem* (Brown et al. 1969), i.e., the problem as to how children are able to identify words even though there are no reliable signals in speech. Assuming that i-language is acquired in ways that are fundamentally different from the way units of p-language are acquired only amplifies this problem. This is because the child does not only have to identify words, she will also have to determine whether a given unit "counts" as a word belonging to p-language and hence will need to be integrated into the spine or whether it does not count as such and will have to be ignored.[15] What would make this task particularly difficult is the fact that many units of i-language are identical to units of p-language, with their difference in use correlating with a difference in syntactic distribution. For example, in English *right* can be used as a propositional predicate (*We might be right.*) or as an interactional confirmational (*I know, right?*). In fact, it is well-documented that propositional language can develop into interactional language (Haegeman & Hill 2013), akin to processes of grammaticalization (Heine 1997; Shukla et al. 2022).

Moreover, recall that we assume that grammatical knowledge in adults includes i-language (see Sections 3 and 7.1). If so, the proposal sketched in **Figure 9**, will have to be augmented with a mechanism which – at some point during language acquisition – will integrate i-language and p-language to arrive at the adult system, as in **Figure 10**, where grammatical development is first restricted to p-language before i-language is integrated.

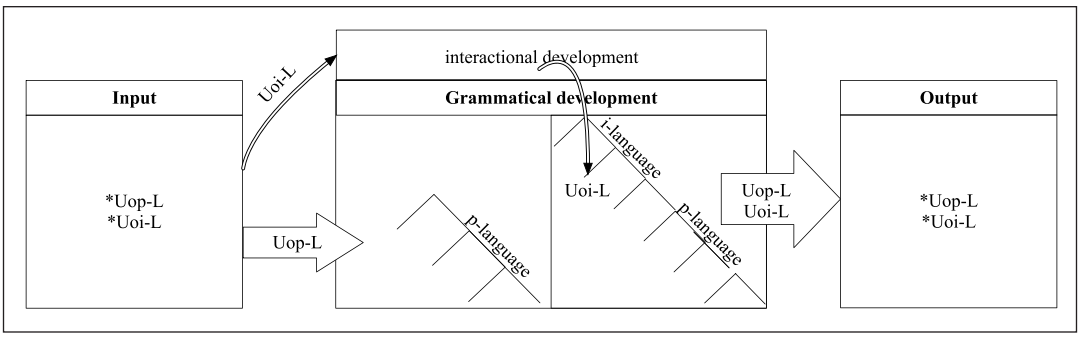

Figure 10: Integrating i-language during the course of acquisition.

Crucially, the hypothesized separation of the acquisition of i- and p-language could only be maintained until we see the development of i-language that unequivocally requires syntactic integration. Variant tag questions like *It's raining, isn't it?* are a case in point. They require

[15] In turn, this logic also implies that there is not only a word discovery problem, but also a *sentence discovery problem.* Specifically, being able to identify what belongs to p-language amounts to being able to recognize what counts as p-language and hence what belongs to sentence grammar even when evidence for sentencehood is likely absent from the speech signal.

agreement and movement processes as well as an awareness of speaker knowledge for licensing their use. Traditionally, these tags have been assumed to be acquired late due to their syntactic complexity (Bellugi 1965). Yet, novel data from British English (Woods & Roeper 2021; Heim 2023) clearly show that children produce adult-like tag questions as early as 2;02 – an age where even conservative estimates assume the presence of syntactic representations (Diessel 1984). If syntactically integrated i-language is available so early, the requirement to separate the acquisition path of i- and p-language would have to end here. Thus, ignoring early i-language in modelling language acquisition comes at a price: it requires us to enrich the model of the language faculty with a component that is responsible for the acquisition of i-language and one that will then allow for its integration. We thus submit that the assumption that i-language is acquired with p-language at the outset, as in **Figure 11**, is more parsimonious than relegating it to a different system.

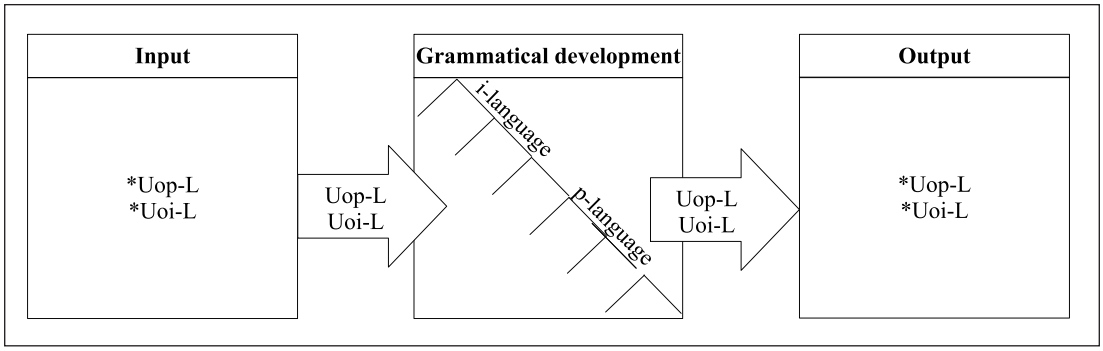

Figure 11: Acquisition of i-language is part of the grammatical development.

But if i-language is part of the syntactic acquisition path then the classic assumption that the syntactic spine matures in an upward fashion cannot be upheld. Hence, the goal of this paper was to introduce a viable alternative.

8 Conclusion

The Inward Growing Spine Hypothesis is the first model that can account for the early acquisition of i-language. In addition, it also allows for promising reanalysis of observations in the acquisition of p-language which have proven problematic for classic maturational accounts that assume an upward trajectory of syntactic development. We thus hope that this article inspires a fresh look at L1A of syntactic structure, particularly through the lens of i-language, along the lines of the research agenda we have sketched.

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Competing interests

The authors have no competing interests to declare.

References

Abney, Steven P. 1987. *The English noun phrase in its sentential aspect*. Unpublished doctoral dissertation. Cambridge: MIT.

Ambridge, Ben. 2020. Against stored abstractions: A radical exemplar model of language acquisition. *First Language* 40(5–6). 509–559. DOI: https://doi.org/10.1177/0142723719869731

Andreou, Maria. & Tsimpli, Ianthi. 2017. Aspectual distinctions in the narratives of bilingual children. *International Review of Applied Linguistics in Language Teaching* 55(3). 305–324. DOI: https://doi.org/10.1515/iral-2017-0111

Antinucci, Francesco & Miller, Ruth. 1976. How children talk about what happened. *Journal of Child Language* 3(2). 167–189. DOI: https://doi.org/10.1017/S0305000900001434

Bellugi, Ursula. 1965. The development of interrogative structures in children's speech. In Riegel, Karl F. (ed.), *The development of language functions*. University of Michigan Language Development Program, Ann Arbor, Report No. 8.

Bertinetto, Pier Marco & Freiberger, Eva Maria & Lenci, Alessandro & Noccetti, Sabrina & Agonigi, Maddalena. 2015. The acquisition of tense and aspect in a morphology-sensitive framework: Data from Italian and Austrian-German children. *Linguistics* 53(5). 1113–1168. DOI: https://doi.org/10.1515/ling-2015-0030

Beyssade, Claire & Marandin, Jean-Marie. 2006. The speech act assignment problem revisited: Disentangling speaker's commitment from speaker's call on addressee. *Empirical Issues in Syntax and Semantics* 6. 37–68.

Biberauer, Theresa. 2018. Peripheral significance: a phasal perspective on the grammaticalization of speaker perspective. Talk presented at *DiGS 20* (York). June. Retrieved from: https://www.york.ac.uk/media/languageandlinguistics/documents/conferences/digs20/Biberauer_handout_DiGS20.pdf.

Borer, Hagit & Wexler, Kenneth. 1987. The maturation of syntax. In Roeper, Tom & Williams, Edwin (eds.), *Parameter setting*, 123–172. Dortrecht: Springer Netherlands. DOI: https://doi.org/10.1007/978-94-009-3727-7_6

Bosch, Núria. 2023. Not all complementisers are late: a first look at the acquisition of illocutionary complementisers in Catalan and Spanish. *Isogloss. Open Journal of Romance Linguistics* 9(1)/12. 1–39. DOI: https://doi.org/10.5565/rev/isogloss.313

Bowerman, Melissa. 1990. Mapping thematic roles onto syntactic functions: Are children helped by innate linking rules? *Linguistics* 28. 1253–1289. DOI: https://doi.org/10.1515/ling.1990.28.6.1253

Bromberg, Hillary & Wexler, Kenneth. 1995. Null subjects in child wh-questions. *MIT Working Papers in Linguistics* 26. 221–247.

Brown, Roger. 1973. *A First Language: The Early Stages*. Harvard University Press. DOI: https://doi.org/10.4159/harvard.9780674732469

Brown, Roger, Cazden, Courtney & Bellugi-Klima, Ursula. 1969. The child's grammar from I to III. In Hill, John P. (ed.), *Minnesota symposia on child psychology*, 28–73. Minneapolis: University of Minnesota Press.

Campbell, Robin & Wales, Roger. 1970. The study of language acquisition. *New Horizons in Linguistics* 1. 242–260.

Carter, Anne L. 1978. The development of systematic vocalizations prior to words: A case study. In Waterson, Natalie & Snow, Catherine E. (eds.), *The Development of Communication* Vol 3, 127–138. Toronto: J. Wiley.

Chomsky, Noam. 1970. Remarks on nominalization. In Jacobs, Roderick A. & Rosenbaum, Peter S. (eds.), *Reading in English Transformational Grammar*, 184–221. Waltham: Ginn.

Chomsky, Noam. 1980. Rules and representations. *Behavioral and Brain Sciences* 3(1). 1–15. DOI: https://doi.org/10.1017/S0140525X00001515

Chomsky, Noam. 1981. Principles and parameters in syntactic theory. *Explanation in Linguistics*, 32–75.

Chomsky, Noam & Lasnik, Howard. 1978. A remark on contraction. *Linguistic Inquiry* 9(2). 268–274.

Christiansen, Morten H. & Chater, Nick. 2016. *Creating language: Integrating evolution, acquisition, and processing*. MIT Press. DOI: https://doi.org/10.7551/mitpress/10406.001.0001

Corr, Alice. 2022. *The grammar of the utterance: How to do things with Ibero-Romance*. Oxford University Press. DOI: https://doi.org/10.1093/oso/9780198856597.001.0001

Diessel, Holger. 2004. *The acquisition of complex sentences* Vol. 105. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9780511486531

Dingemanse, Mark & Torreira, Francisco & Enfield, Nick J. 2013. Is "Huh?" a universal word? Conversational infrastructure and the convergent evolution of linguistic items. *PloS One* 8(11). e78273. DOI: https://doi.org/10.1371/journal.pone.0078273

Dominguez, Sarah & Devouche, Emmanuel & Apter, Giselle & Gratier, Maya. 2016. The Roots of Turn-Taking in the Neonatal Period. *Infant and Child Development* 25(3). 240–255. DOI: https://doi.org/10.1002/icd.1976

Forrester, Michael A. 2002. Appropriating Cultural Conceptions of Childhood: Participation in Conversation. *Childhood* 9(3). 255–276. DOI: https://doi.org/10.1177/0907568202009003043

Friedmann, Naama & Belletti, Adriana & Rizzi, Luigi. 2021. Growing trees: The acquisition of the left periphery. *Glossa: A Journal of General Linguistics* 6(1). DOI: https://doi.org/10.16995/glossa.5877

Friedmann, Naama & Reznick, Julia. 2021. Stages rather than ages in the acquisition of movement structures: Data from sentence repetition and 27696 spontaneous clauses. *Glossa: A Journal of General Linguistics* 39(1). DOI: https://doi.org/10.16995/glossa.5716

Gibson, Edward & Wexler, Kenneth. 1994. Triggers. *Linguistic Inquiry* 25(3). 407–454.

Ginzburg, Jonathan. 2012. *The interactive stance: Meaning for conversation*. Oxford University Press. DOI: https://doi.org/10.1093/acprof:oso/9780199697922.001.0001

Ginzburg, Jonathan & Poesio, Massimo. 2016. Grammar is a system that characterizes talk in interaction. *Frontiers in Psychology* 7. 1938. DOI: https://doi.org/10.3389/fpsyg.2016.01938

Guasti, Maria Teresa. 2017. *Language acquisition: The growth of grammar*. MIT Press. DOI: https://doi.org/10.1093/oxfordhb/9780199573776.013.12

Guasti, Maria Teresa & Gavarró, Anna & De Lange, Joke & Caprin, Claudia. 2008. Article omission across child languages. *Language acquisition* 15(2). 89–119. DOI: https://doi.org/10.1080/10489220801937346

Haegeman, Liliane. 2012. *Adverbial clauses, main clause phenomena, and the composition of the left periphery: The cartography of syntactic structures, Vol. 8*. Oxford, Oxford University Press. DOI: https://doi.org/10.1093/acprof:oso/9780199858774.001.0001

Haegeman, Liliane. 2014. West flemish verb-based discourse markers and the articulation of the speech act layer. *Studia Lingüística* 68(1). 116–139. DOI: https://doi.org/10.1111/stul.12023

Haegeman, Liliane & Hill, Virginia. 2013. The syntacticization of discourse. *Syntax and Its Limits* 48. 370–390. DOI: https://doi.org/10.1093/acprof:oso/9780199683239.003.0018

Heim, Johannes. 2019a. Turn-peripheral management of Common Ground: A study of Swabian gell. *Journal of Pragmatics* 141. 130–146. DOI: https://doi.org/10.1016/j.pragma.2018.12.007

Heim, Johannes. 2019b. *Commitment and engagement: The role of intonation in deriving speech acts*. Vancouver: University of British Columbia PhD thesis.

Heim, Johannes. 2023. Acquisitional trajectories of North American vs British English tags. Paper present at *LAGB 2023*. Retrieved from: https://aura.abdn.ac.uk/bitstream/handle/2164/22533/LAGB_Acquisitional_Trajectoires_of_Tags-1.pdf

Heim, Johannes & Bala, Maryam & Sinclair, Arabella. 2025. Modelling and feedback in the context of early questions. DOI: https://doi.org/10.31234/osf.io/a48v6_v1

Heim, Johannes & Keupdjio, Hermann & Lam, Zoe Wai-Man & Osa-Gómez, Adriana & Thoma, Sonja & Wiltschko, Martina. 2016. Intonation and particles as speech act modifiers: A syntactic analysis. *Studies in Chinese Linguistics* 37(2). 109–129. DOI: https://doi.org/10.1515/scl-2016-0005

Heim, Johannes & Wiltschko, Martina. 2020. Deconstructing questions: Reanalyzing a heterogeneous class of speech acts via commitment and engagement. *Scandinavian Studies in Language* 11. 56–82. DOI: https://doi.org/10.7146/sss.v11i1.121361

Heim, Johannes & Wiltschko, Martina. 2021. Acquiring the form and function of interactional language. Paper presented at *the annual meeting of the Linguistic Association of Great Britain and Northern Ireland (LAGB)*. Retrieved from: https://www.lagb.org.uk/resources/Documents/LAGB2021_Abstracts/Heim_Wiltschko.pdf

Heim, Johannes & Wiltschko, Martina. 2022. Timing of belief as a key to cross-linguistic variation in common ground management. *Linguistics Vanguard* 8(2). 261–275. DOI: https://doi.org/10.1515/lingvan-2020-0116

Heine, Bernd. 1997. *Cognitive foundations of grammar*. Oxford: Oxford University Press. DOI: https://doi.org/10.1093/oso/9780195102512.001.0001

Hilbrink, Elma E. & Gattis, Merideth & Levinson, Stephen C. 2015. Early developmental changes in the timing of turn-taking: A longitudinal study of mother–infant interaction. *Frontiers in Psychology* 6. 1492. DOI: https://doi.org/10.3389/fpsyg.2015.01492

Hinzen, Wolfram & Wiltschko, Martina. 2023. Modelling non-specific linguistic variation in cognitive disorders. *Journal of Linguistics* 59(1). 61–87. DOI: https://doi.org/10.1017/S0022226722000123

Hyams, Nina. 1986. *Language acquisition and the theory of parameters* Vol. 3. Springer Science & Business Media. DOI: https://doi.org/10.1007/978-94-009-4638-5

Hymes, Dell. 1972. On communicative competence. *Sociolinguistics*, 269–293.

Johnson, Kyle. 2001. What VP ellipsis can do, and what it can't, but not why. In Baltin, Mark & Collins, Chris (eds.), *The handbook of contemporary syntactic theory*, 439–479. Oxford: Blackwell Publishers. DOI: https://doi.org/10.1002/9780470756416.ch14

Keenan, Elinor O. 1974. Conversational competence in children. *Journal of Child Language* 1(2). 163–183. DOI: https://doi.org/10.1017/S0305000900000623

Kempson, Ruth & Cann, Ronnie & Gregoromichelaki, Eleni & Chatzikyriakidis, Stergios. 2016. Language as Mechanisms for Interaction. *Theoretical Linguistics* 42(3–4). DOI: https://doi.org/10.1515/tl-2016-0011

Krifka, Manfred. 2013. Response particles as propositional anaphors. In *Proceedings of SALT*. Vol 23. 1–18. DOI: https://doi.org/10.3765/salt.v23i0.2676

Krifka, Manfred. 2023. Layers of assertive clauses: Propositions, judgements, commitments, acts. In Hartmann, Jutta M. & Wollstein, Angelika (eds.), *Propositional arguments in cross-linguistic research: Theoretical and Empirical Issues*, 115–182. Tübingen: Narr.

Lam, Zoe Wai-Man. 2014. A Complex ForceP for Speaker-and Addressee-oriented Discourse Particles in Cantonese. *Studies in Chinese Linguistics* 35(2). 61–80.

Lobeck, Anne. 1995. *Functional heads, Licensing, and Identification*. Oxford University Press. DOI: https://doi.org/10.1093/oso/9780195091816.003.0003

Low, Lawrence K. & Cheng, Hwai-Jong. 2006. Axon pruning: an essential step underlying the developmental plasticity of neuronal connections. *Philosophical Transactions of the Royal Society B: Biological Sciences* 361(1473). 1531–1544. DOI: https://doi.org/10.1098/rstb.2006.1883

Lukyanenko, Cynthia & Miller, Karen. 2023. Agreeing when to disagree: A corpus analysis of variable agreement in caregiver and child English. *Language Variation and Change,* 1–26. DOI: https://doi.org/10.1017/S0954394523000054

Lust, Barbara. 1998. Universal grammar: The strong continuity hypothesis in first language acquisition. In *Handbook of Child Language Acquisition*, 111–155. Brill. DOI: https://doi.org/10.1163/9789004653023_007

MacWhinney, Brian. 2000. *The CHILDES project: The database* Vol. 2. Psychology Press.

Messick, Cheryl Kaye. 1984. *Phonetic and contextual aspects of the transition to early words (lexical acquisition, pre-speech, routines)*. Purdue dissertation.

Mittwoch, Anita. 1976. Grammar and illocutionary force. *Lingua* 40(1). 21–42. DOI: https://doi.org/10.1016/0024-3841(76)90030-9

Miyagawa, Shigeru. 2022. *Syntax in the treetops*. MIT Press. DOI: https://doi.org/10.7551/mitpress/14421.001.0001

Miyagawa, Shigeru. 2024. Treetop structure as a way forward for unifying the study of human language. Talk given at *the Workshop on Speech Act Related Operators*. June 27–29, 2024, ZAS, Berlin, Germany.

Moradlou, Sara & Zheng, Xiaobei & Ye, Tian & Ginzburg, Jonathan. 2021. Wh-Questions are understood before polar-questions: Evidence from English, German, and Chinese. *Journal of Child Language* 48(1). 157–183. DOI: https://doi.org/10.1017/S0305000920000276

Pak, Miok & Portner, Paul & Zanuttini, Raffaella. 2004. Deriving clause types: Focusing on Korean. *Proceedings of Linguistic Society of Korea*, 359–368.

Paul, Waltraud & Yan, Shanshan. 2022. Sentence-final particles in Mandarin Chinese. *Discourse Particles: Syntactic, Semantic, Pragmatic, and Historical Aspects* 276. 179. DOI: https://doi.org/10.1075/la.276.07pau

Pauls, Franz & Macha, Thorsten & Petermann, Franz. 2013. U-shaped development: An old but unsolved problem. *Frontiers in Psychology* 4. 301. DOI: https://doi.org/10.3389/fpsyg.2013.00301

Perlmutter, David M. 1978. Impersonal passives and the unaccusative hypothesis. In *Annual meeting of the Berkeley Linguistics Society*, 157–190. DOI: https://doi.org/10.3765/bls.v4i0.2198

Pinker, Steve & Prince, Alan. 1988. On language and connectionism: Analysis of a parallel distributed processing model of language acquisition. *Cognition* 28(1–2). 73–193. DOI: https://doi.org/10.1016/0010-0277(88)90032-7

Portner, Paul & Pak, Miok & Zanuttini, Raffaella. 2019. The speaker-addressee relation at the syntax-semantics interface. *Language* 95(1). 1–36. DOI: https://doi.org/10.1353/lan.2019.0008

Radford, Andrew. 1990. The Nature of Children's initial grammars of English. *Logical issues in language acquisition*. Foris Publications. DOI: https://doi.org/10.1515/9783110870374-011

Radford, Andrew. 1996. Towards a structure-building model of acquisition. *Language acquisition and language disorders* 14. 43–90. DOI: https://doi.org/10.1075/lald.14.06rad

Riccomagno, Martin M. & Kolodkin, Alex L. 2015. Sculpting neural circuits by axon and dendrite pruning. *Annual review of cell and developmental biology* 31(1). 779–805. DOI: https://doi.org/10.1146/annurev-cellbio-100913-013038

Rizzi, Luigi. 1993. Some notes on linguistic theory and language development: The case of root infinitives. *Language Acquisition* 3(4). 371–393. DOI: https://doi.org/10.1207/s15327817la0304_2

Rizzi, Luigi. 1997. The fine structure of the left periphery. In Haegeman, Liliane (ed.), *Elements of Grammar*, 281–337. Dordrecht: Springer Netherlands. DOI: https://doi.org/10.1007/978-94-011-5420-8_7

Roeper, Thomas & Rohrbacher, Bernhard. 2000. Null subjects in early child English and the theory of economy of projection. In *The acquisition of scrambling and cliticization*, 345–396. Dordrecht: Springer Netherlands. DOI: https://doi.org/10.1007/978-94-017-3232-1_14

Ross, John. 1970. On declarative sentences. Jacobs, R. A. & Rosenbaum, P. S. (eds.), *Readings in English transformational grammar*, 222–272. Ginn.

Saito, Mamoru & Haraguchi, Tomoko. 2012. Deriving the cartography of the Japanese right periphery: The case of sentence-final discourse particles. *IBERIA: An International Journal of Theoretical Linguistics* 4(2). 104–123.

Schaeffer, Jeannette & Matthewson, Lisa. 2005. Grammar and pragmatics in the acquisition of article systems. *Natural Language & Linguistic Theory* 23(1). 53–101. DOI: https://doi.org/10.1007/s11049-004-5540-1

Shirai, Junko & Shirai, Hidetoshi & Furuta, Yoshiteru. 2000. Acquisition of Sentence-Final Particles in Japanese. In Perkins, Michael & Howard, Sara (eds.), *New Directions In Language Development And Disorders*, 243–250. Boston, MA: Springer US. DOI: https://doi.org/10.1007/978-1-4615-4157-8_23

Shukla, Vishakha & Long, Madeleine & Rubio-Fernandez, Paula. 2022. Children's acquisition of new/given markers in English, Hindi, Mandinka and Spanish: Exploring the effect of optionality during grammaticalization. *Glossa Psycholinguistics* 1(1). DOI: https://doi.org/10.5070/G6011120

Speas, Peggy & Tenny, Carol. 2003. Configurational properties of point of view roles. *Asymmetry in Grammar* 1. 315–345. Amsterdam: John Benjamins Publishing. DOI: https://doi.org/10.1075/la.57.15spe

Stalnaker, Robert. 1978. Assertion. In Cole, Peter (ed.), *Syntax and Semantics* 9, 315–332. New York: Academic Press. DOI: https://doi.org/10.1163/9789004368873_013

Stalnaker, Robert. 2002. Common ground. *Linguistics and Philosophy* 25(5). 701–721. DOI: https://doi.org/10.1023/A:1020867916902

Theakston, Anna L. & Rowland, Carol. F. 2009. The acquisition of auxiliary syntax: a longitudinal elicitation study. Part I: auxiliary BE. *Journal of Speech, Language, and Hearing Research* 52. 1449–71. DOI: https://doi.org/10.1044/1092-4388(2009/08-0037)

Thoma, Sonja. 2016. *Discourse particles and the syntax of discourse-evidence from Miesbach Bavarian* [Unpublished doctoral dissertation]. University of British Columbia. https://open.library.ubc.ca/collections/ubctheses/24/items/1

Tomasello, Michael. 2005. *Constructing a language: A usage-based theory of language acquisition*. Harvard University Press. DOI: https://doi.org/10.2307/j.ctv26070v8

Tsimpli, Ianth-Maria. 1992. *Functional categories and maturation: the prefunctional stage of language acquisition*. University of London, University College London.

Vainikka, Anne & Young-Scholten, Martha. 1996. Gradual development of L2 phrase structure. *Second language research* 12(1). 7–39. DOI: https://doi.org/10.1177/026765839601200102

Valian, Virginia. 1991. Syntactic subjects in the early speech of American and Italian children. *Cognition* 40(1–2). 21–81. DOI: https://doi.org/10.1016/0010-0277(91)90046-7

Valian, Virginia. 1992. Categories of First Syntax: Be, Be + ing, and Nothingness. In Meisel, Jürgen M. (ed.), *The Acquisition of Verb Placement*, Vol. 16, 401–422. Dordrecht: Springer Netherlands. DOI: https://doi.org/10.1007/978-94-011-2803-2_13

Valian, Virginia. 2006. Young Children's Understanding of Present and Past Tense. *Language Learning and Development* 2(4). 251–276. DOI: https://doi.org/10.1207/s15473341lld0204_2

Valian, Virginia & Aubry, Stephanie. 2005. When opportunity knocks twice: two-year-olds' repetition of sentence subjects. *Journal of Child Language* 32(3). 617–641. DOI: https://doi.org/10.1017/S0305000905006987

Wexler, Ken. 1998. Very early parameter setting and the unique checking constraint: A new explanation of the optional infinitive stage. *Lingua* 106(1–4). 23–79. DOI: https://doi.org/10.1016/S0024-3841(98)00029-1

Wiltschko, Martina. 2014. *The universal structure of categories*. Cambridge University Press. DOI: https://doi.org/10.1017/CBO9781139833899

Wiltschko, Martina. 2021. *The grammar of interactional language*. Cambridge: Cambridge University Press. DOI: https://doi.org/10.1017/9781108693707

Wiltschko, Martina. 2022. Language is for thought and communication. *Glossa* 7(1). DOI: https://doi.org/10.16995/glossa.5786

Wiltschko, Martina. 2024. The syntax of talking heads. *Journal of Pragmatics* 232. 182–198. DOI: https://doi.org/10.1016/j.pragma.2024.08.011

Wiltschko, Martina & Heim, Johannes. 2016. The syntax of confirmationals: A neo-performative analysis. In Kaltenböck, Gunter & Keizer, Evelien & Lohmann, Arne (eds.), *Outside the clause: Form and function ofextra-clausal constituents*, 305–340. John Benjamins Publishing. DOI: https://doi.org/10.1075/slcs.178.11wil

Wiltschko, Martina & Heim, Johannes. 2020. Grounding beliefs: Structured variation in Canadian discourse particles. In *Exoticism in English tag questions: Strengthening arguments and caressing the social Wheel*, 37–82. Cambridge Scholars Publishing. DOI: https://doi.org/10.1075/slcs.178.11wil

Woods, Rebecca. 2016. *Investigating the syntax of speech acts: Embedding illocutionary force*. University of York dissertation.

Woods, Rebecca & Roeper, Tom. 2021. The acquisition path of 'high'negation in English. In Dionne, Danielle & Vidal Covas, Lee-Ann (eds.), *Proceedings of the 45th Boston University Conference on Language Development* (BUCLD), 761–775.

Woods, Rebecca & Vander Klok, Jozina & Heim, Johannes. In print. *Javanese discourse particles: interlocutor perspective is in the syntax, kok*! Retrieved from https://pure.abdn.ac.uk/ws/files/302530565/WoodsVanderKlokHeim_Javanese_discourse_particles_accepted.pdf.

Yamada, Akitaka. 2019. *The syntax, semantics and pragmatics of Japanese addressee-honorific markers*. PhD dissertation Georgetown University.

Yang, Charles & Crain, Stephen & Berwick, Robert C. & Chomsky, Noam & Bolhuis, Johan J. 2017. The growth of language: Universal Grammar, experience, and principles of computation. *Neuroscience & Biobehavioral Reviews* 81. 103–119. DOI: https://doi.org/10.1016/j.neubiorev.2016.12.023

Yang, Charles D. 2002. *Knowledge and learning in natural language*. Oxford University Press, USA.

Yang, Xiadong & Wiltschko, Martina. 2016. The confirmational marker ha in Northern Mandarin. *Journal of Pragmatics* 104. 67–82. DOI: https://doi.org/10.1016/j.pragma.2016.09.004

Zhang, Di & Xu, Qianli & Elliott, Robert W. 2019. The construction of acquisition pattern of sentence-final particles. *Language and Cognitive Science* 5(1). 1–20. DOI: https://doi.org/10.35534/LCS201905001

Zwicky, Arnold M. 1974. Hey, Whatsyourname! *Chicago Linguistic Society* 10(78). 787–801.