Emergent syntactic categories and increasing granularity

Evidence from a multilingual corpus study

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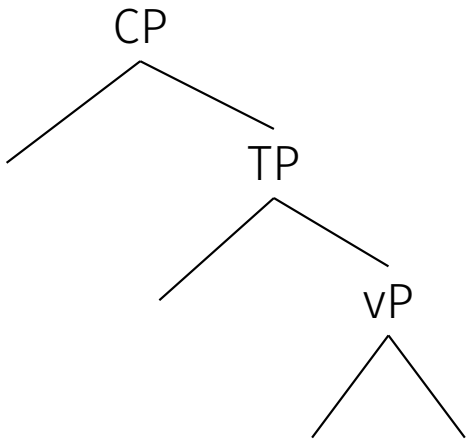
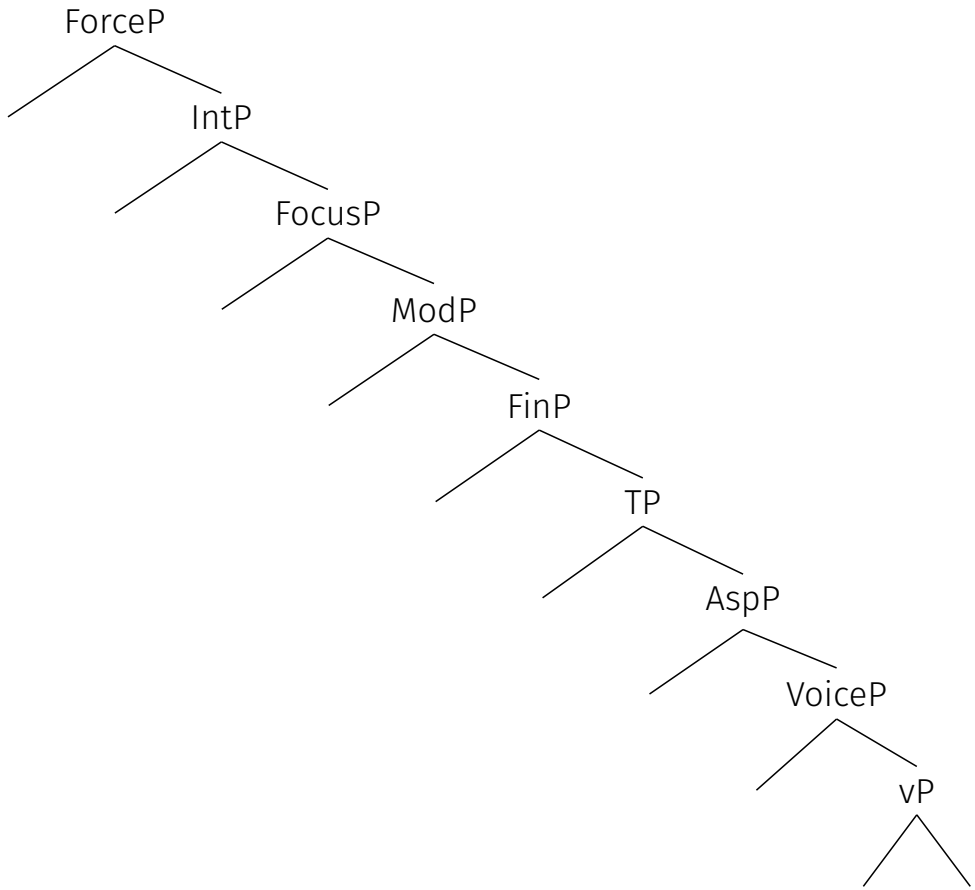
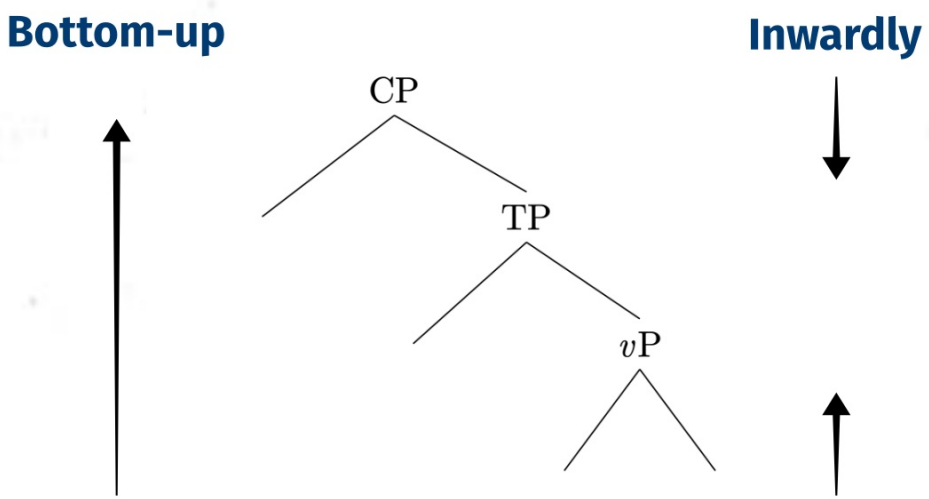
1. Introduction

- Syntactic trees grow → differences in **granularity** across (and within) frameworks:



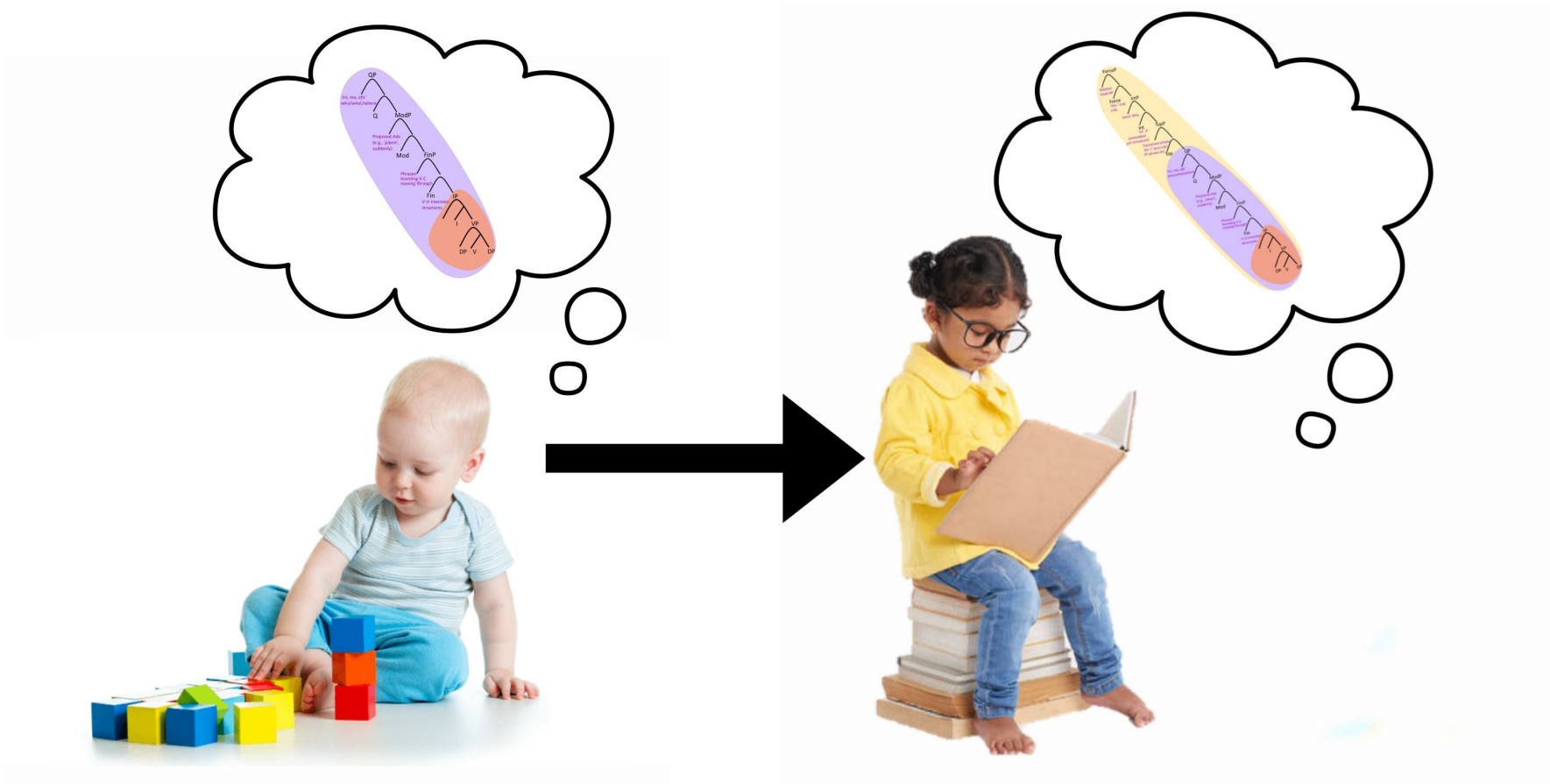


- How do children acquire these trees?
- **Prior maturational work:** focus on *directionality* of acquisition
  - Trees are acquired **bottom-up**: *v*P → TP → CP (i.a., Radford, 1990; Rizzi, 1993; Friedmann et al., 2021; Diercks et al., 2023).
  - Trees are acquired **inwardly**: *v*P & CP → TP (i.a., Galasso, 2003; Tsimpli, 2005; Heim and Wiltschko, 2021).



- **What about granularity, though?** How 'fine-grained' are children's trees at the start?
  - *Implicit* assumption in work thus far: granularity is *fixed* by UG. In cartographic approaches, as soon as a child acquires a specific domain, it is cartographic in nature.
- Existing cartographic approaches:
  - Westergaard (2009)'s micro-cues model: children have access to cartographic left-peripheral knowledge from the start.
  - Friedmann et al. (2021)'s Growing Trees: the cartographic left periphery emerges in two steps, and develops very late in its entirety.

Testable prediction: If (parts of) cartographic CP are available early, we should see (some) evidence for its distinct projections reasonably early (as noted by Westergaard, 2009; Moscati and Rizzi, 2021; Moscati, 2023)



Bigger tree, same granularity?

(Tree diagrams from Friedmann et al., 2021)

- Granularity never changes throughout development?
- **Today:** revisiting the development of the left periphery:
  - Are categories acquired in a specific directionality?
  - But most importantly, when do children show evidence for access to an articulated CP domain?

→ ***Changes in granularity*** **might be an important (unexplored) aspect of syntactic development.**

2. Theoretical background

- **Maturation** of functional categories
  - (Arguably) **dominant** approach so far: **bottom-up** approach.
  - The top of the tree (≈ **CP**) acquired **last** (Radford, 1990; Rizzi, 1993; Friedmann et al., 2021; Diercks et al., 2023).
  - Growing Trees Hypothesis (most recent, left periphery-centred proposal): two-stage development of LP.

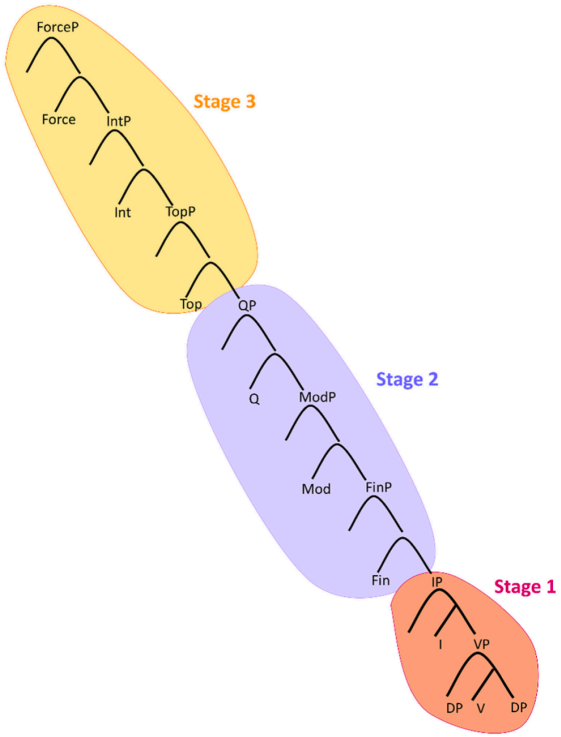


Figure 1: Stages in the Growing Trees Hypothesis (Friedmann et al., 2021, p. 12)

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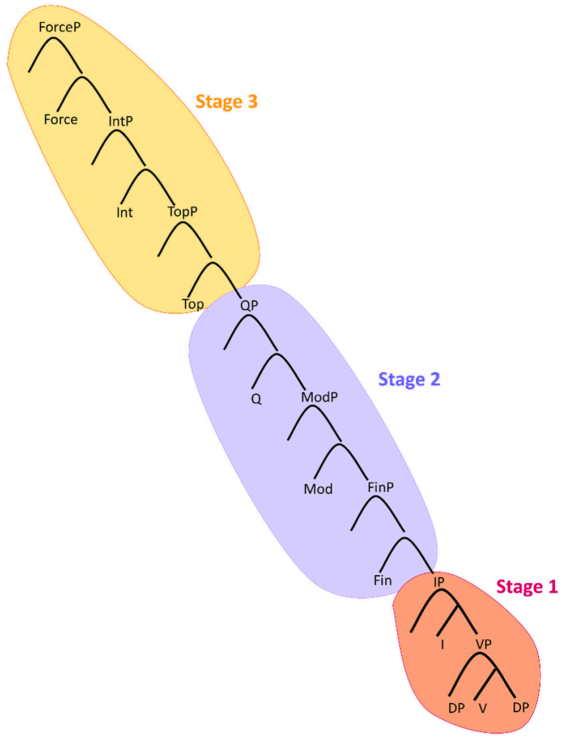

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Bottom-up directionality, fixed granularity

- **Maturation** of functional categories
  - More recently revived idea: **inward** approach. **CP** emerges **early**! (i.a., Galasso, 2003; Tsimpli, 2005; Heim and Wiltschko, 2021).
  - Galasso (2003)'s 'Empty Middle' approach: CP>∅>VP to CP>IP>VP.
  - Heim and Wiltschko (2021)'s Inward Growing Spine: spine matures inwardly.

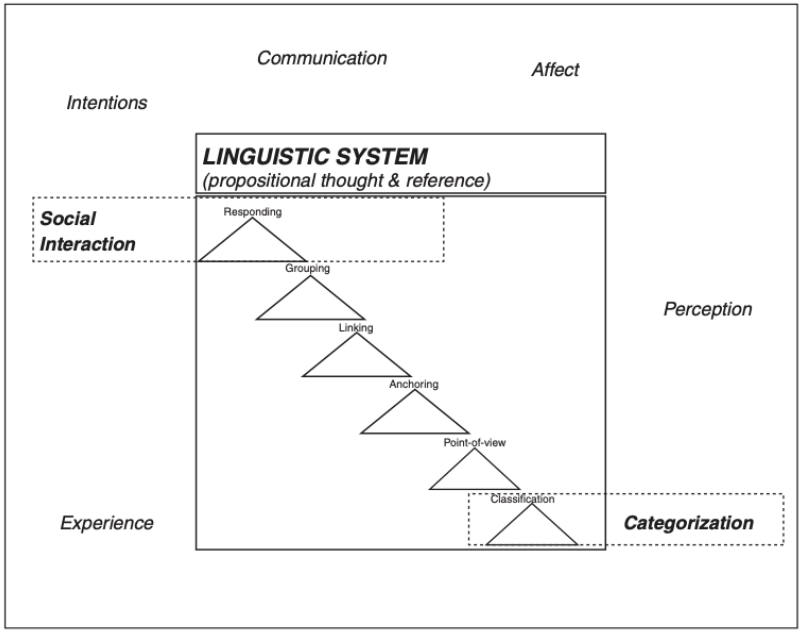

Figure 2: Bridge Model (Hinzen and Wiltschko, 2023)

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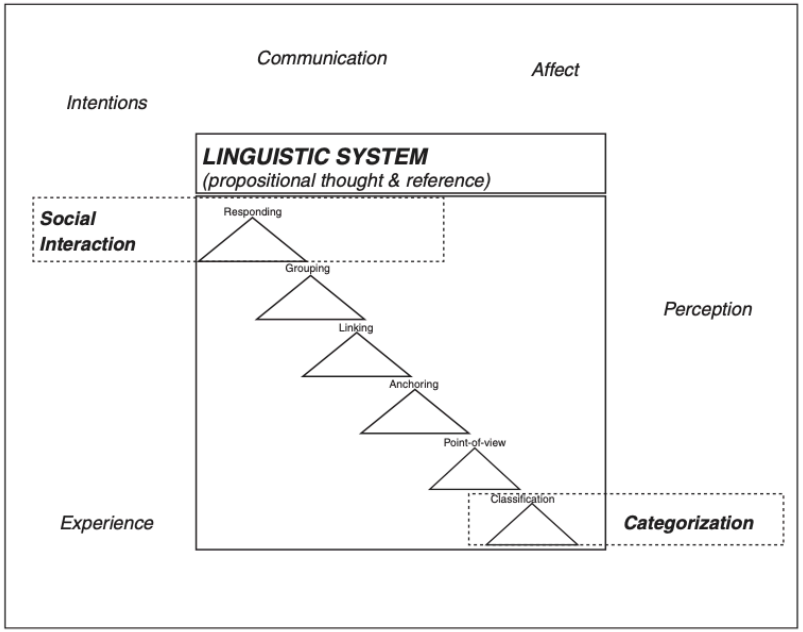

Figure 2: Bridge Model (Hinzen and Wiltschko, 2023)

Inward directionality, (generally) fixed granularity

- **Continuity**: children's initial state ≈ adult's functional inventory.
  - Of various strengths: Strong Continuity, Weak Continuity (Underspecification of features, Lexical Learning, etc.) (i.a., Poeppel and Wexler, 1993; Hyams, 1992, 1996; Clahsen et al., 1994)
  - Westergaard (2009)'s micro-cues approach: sensitivity to cartographic structures early on.

[1] Possible underspecification of features notwithstanding.

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Continuity (no maturation), fixed granularity[1]

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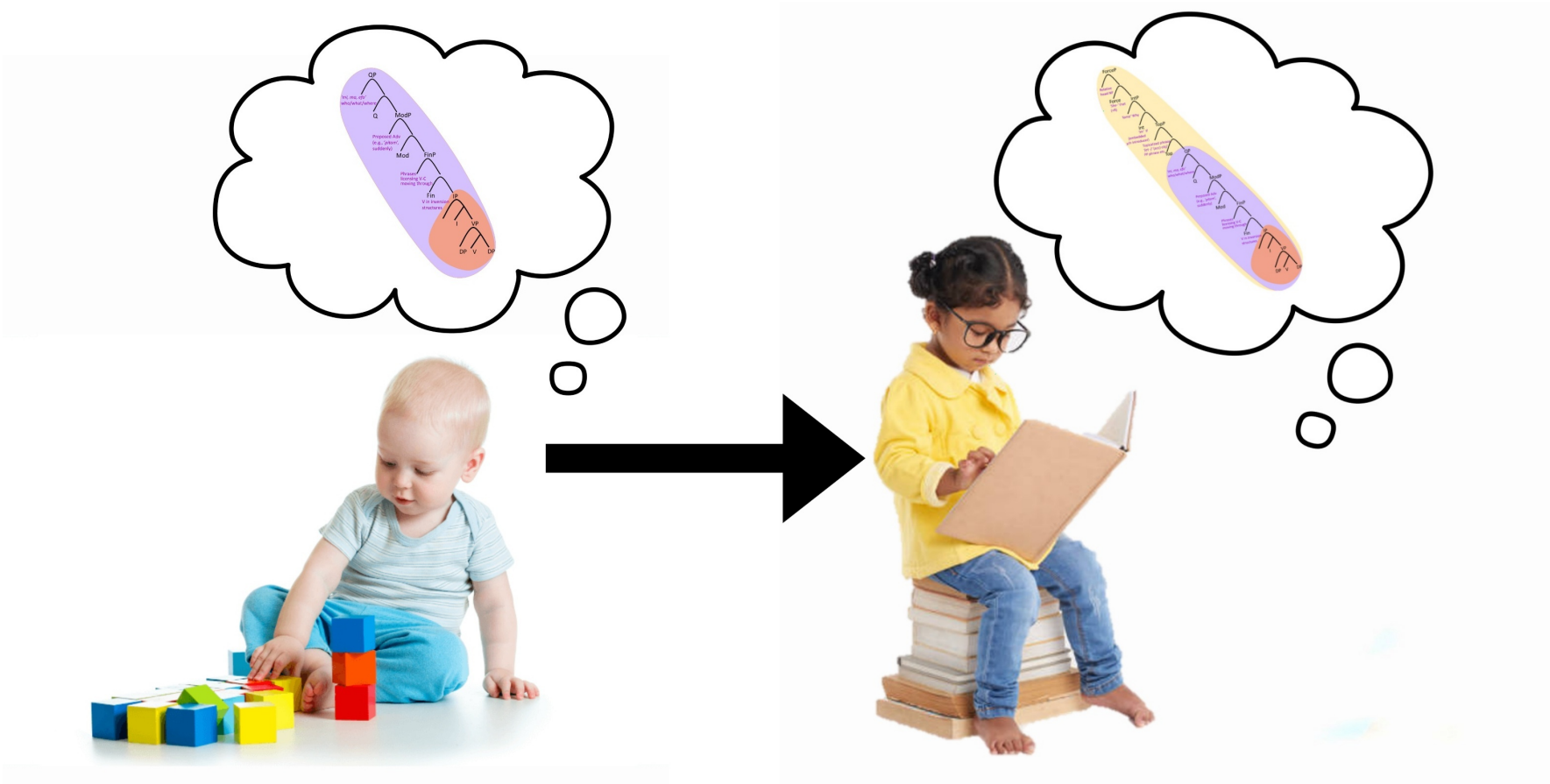
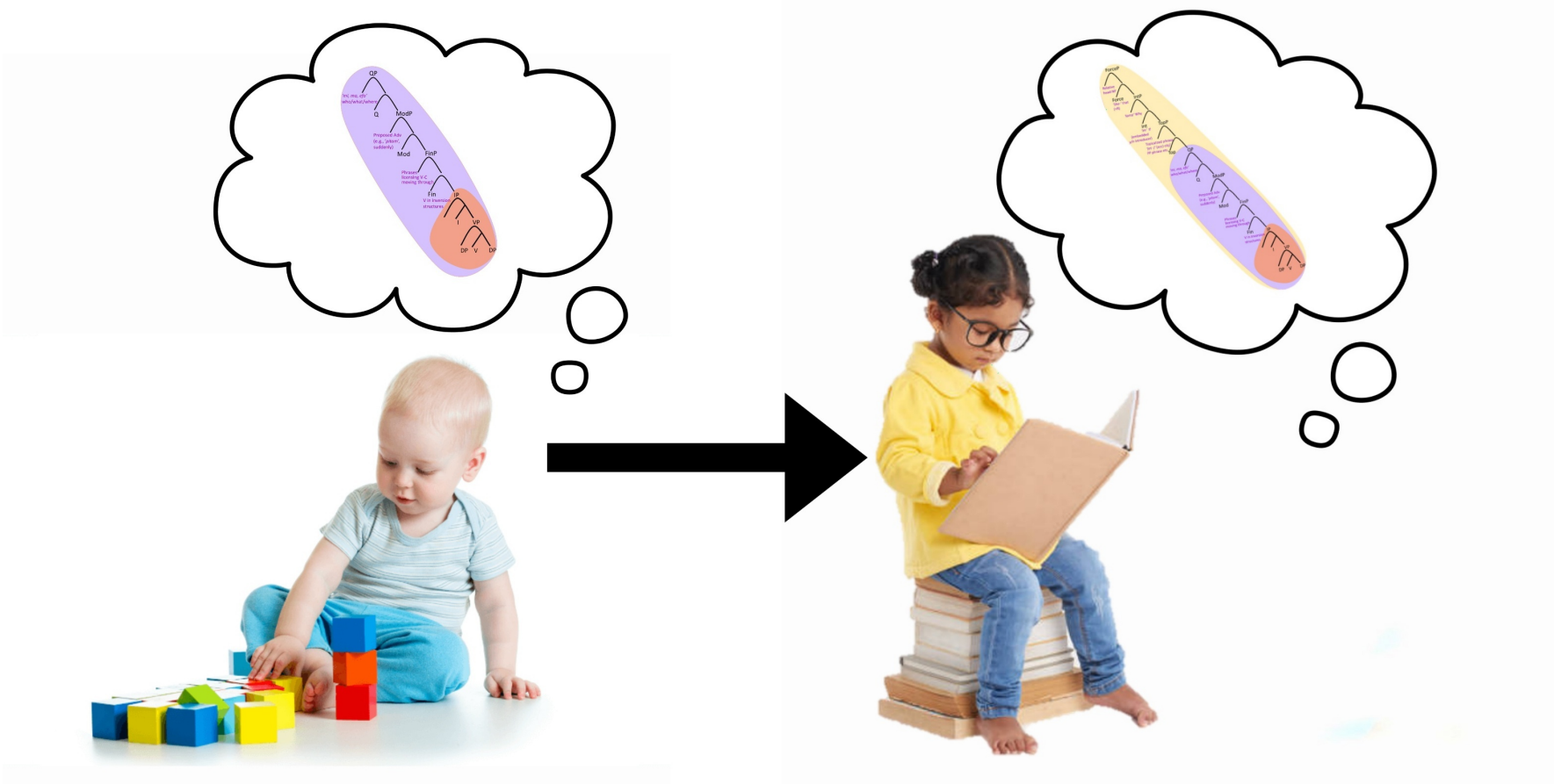


Bigger tree, same granularity?

(Tree diagrams from Friedmann et al., 2021)



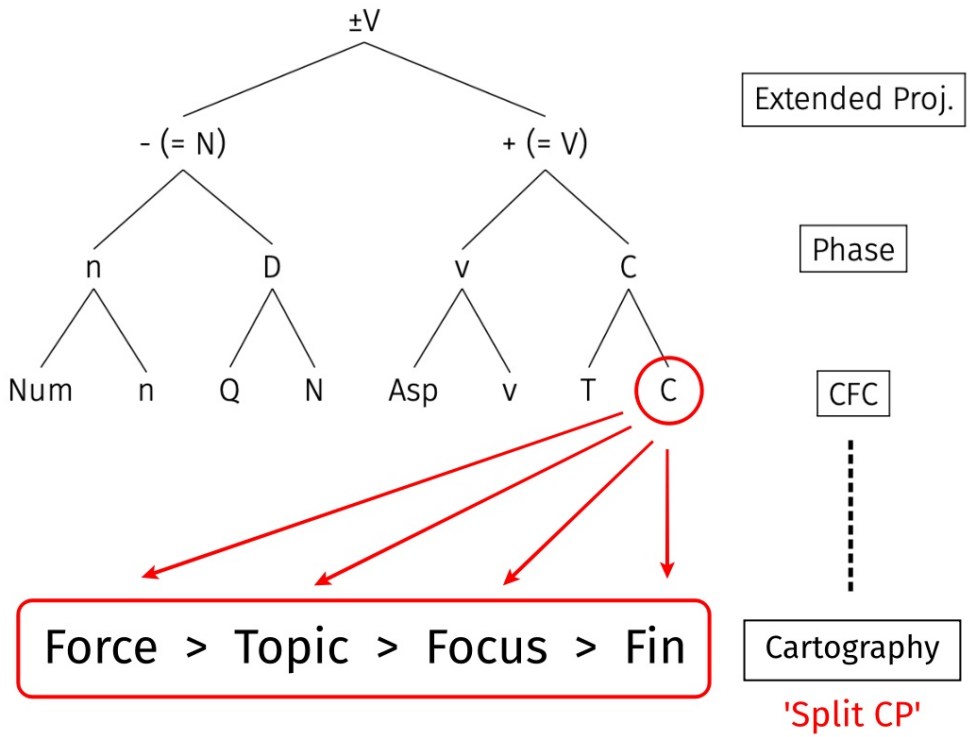
Not in all approaches...

(Tree diagrams from Friedmann et al., 2021)

- **Neo-emergentism** (Biberauer, 2011, *et seq.*; Biberauer and Roberts, 2015)
  - *Emergentist generative approach*: **minimal UG**, no innate categories.
  - → Hypothesis relevant here: Biberauer and Roberts (2015)'s **emergent categorial hierarchy**.
    - Different levels of granularity across frameworks unified → different stages of a learning path (**coarse- to fine-grained**).

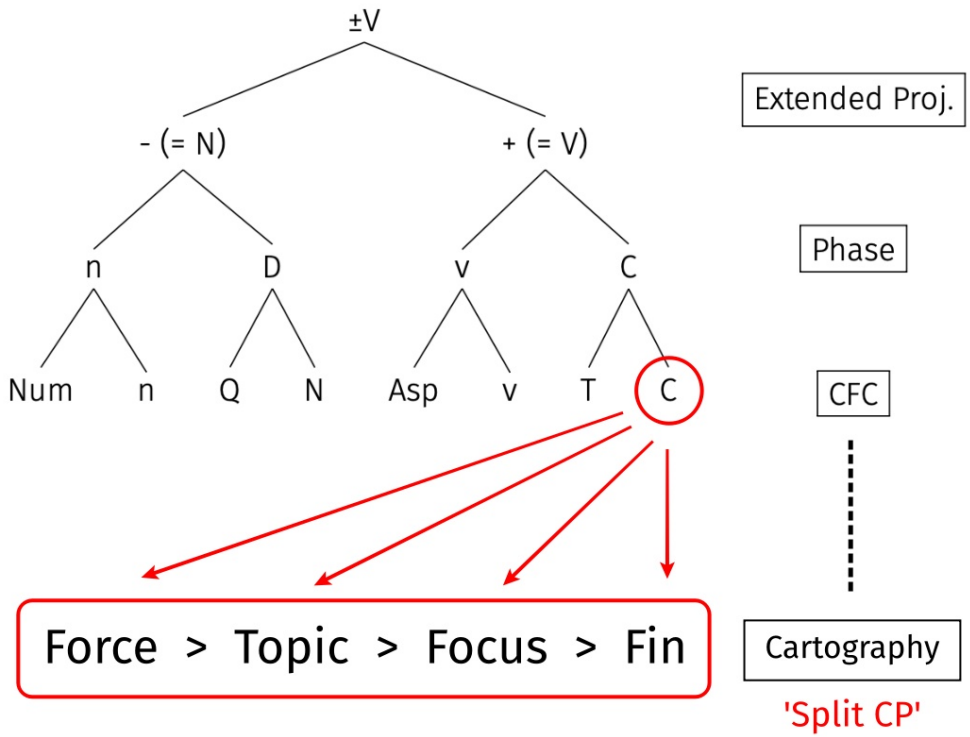
'Basic CP' *before* cartographic-type CP

(1) **Extended Projection** (V) > **phase** (C, v) > **Core Functional Category** or **CFC** (C, T, v) > "**cartographic field**" (e.g. Tense, Mood, Aspect, Topic, Focus) > **semantically distinct head** (e.g., Cinque, 1999; Frascarelli and Hinterhölzl, 2007).



Syntactic categories 'granularise' (become *refined*) during development

(2) **Extended Projection** (V) > **phase** (C, v) > **Core Functional Category** or **CFC** (C, T, v) > "**cartographic field**" (e.g. Tense, Mood, Aspect, Topic, Focus) > **semantically distinct head** (e.g., Cinque, 1999; Frascarelli and Hinterhölzl, 2007).



Any apparent directionality epiphenomenal, flexible granularity

Predictions for development of left periphery

- **Bottom up (Growing Trees)**:
  - Late CP (two-stage).
  - Fixed (cartographic) granularity: evidence for it once (or soon after) CP matures.
- **Inward maturation**:
  - Early CP.
  - Fixed granularity: if cartographic, evidence for it once (or soon after) CP matures.
- **Neo-emergentism (Biberauer and Roberts, 2015)**:
  - Early CP.
  - *Flexible* granularity: *late* emergence of cartographic elaboration of CP.

3. Corpus study

- Longitudinal analysis of 10 typically-developing children in CHILDES, across five languages (Catalan, Spanish, Italian, German and Dutch)

Table 1: Children studied in the CHILDES database and summary information

Language	Corpus	Child	Files	Age	MLUw
Catalan	Serra-Solé	Laura	19	1;07-4;00	1.03-3.47
		Gisela	21	1;07-4;02	1.02-3.51
Italian	Calambrone	Martina	13	1;07-2;07	1.26-2.69
		Rosa	21	1;07-3;03	1.27-3.24
Spanish	Llinàs-Ojea	Irene	59	0;11-3;02	1.0-5.13
	Montes	Koki	13	1;07-2;11	1.96-3.61
German	Miller	Kerstin	37	1;03-3;04	1.09-2.89
		Simone	50	1;09-2;09	1.52-4.89
Dutch	Groningen	Josse	28	2;0-3;04	1.2-4.01
	van Kampen	Sarah	50	1;06-5;02	1.07-6.07

- **CP diagnostics**:
  1. Wh-questions
  2. Yes/no questions (Germanic only)
  3. V-to-C movement (Germanic only)
  4. Topics/Foci
  5. Illocutionary (main clause) complementisers (Romance only)
  6. Finite embedding

- **Split CP diagnostics** (Romance):
  1. Top > Wh
  2. Top > Top/Foc
  3. Complementiser > Wh/Top
  4. Quotative *que* 'that' > Wh (Ibero-Romance only)
  5. Topic > interrogative que 'that' (Catalan only)
  6. *Sí que/sì che* 'yes that' and *que sí que* 'that yes that' structures (for the latter, Ibero-Romance only)

(3) a. **La Júlia**, **on** ha anat? (Top > Wh, Catalan)
the Júlia where AUX.HAVE.3SG go.PTCP
'Júlia, where has she gone?'

b. **Questo**, **a te**, ti spaventa (Top > Top/Foc, Italian)
this to you CL.IO= scare.3SG
'This, it scares YOU.'

c. ¿**Que** **cuánto** te han costado estas
that.QUOT how.much CL.IO= AUX.HAVE.3PL cost.PTCP these
bambas? (Comp > Wh, Spanish)
trainers
'How much have you said these trainers have cost you!?'

- **CP diagnostics**:
  1. Wh-questions
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  3. V-to-C movement (Germanic only)
  4. Topics/Foci
  5. Illocutionary (main clause) complementisers (Romance only)
  6. Finite embedding

- **Split CP diagnostics** (Germanic, V3 orders):
  1. Frame-setters
  2. Hanging Topic Left-Dislocation
  3. Contrastive Left-Dislocation
  4. Conditional/temporal clauses with resumptive *dann*/*dan* 'then'

(4) a. **In alle geval**, ik had het niet verwacht (Frame-setter, Dutch)
in any case I AUX.HAVE.PST.1SG it not expect.PTCP
'Anyway, I had not expected it.' (Haegeman and Greco, 2020, p. 65)

b. **Diesen Kuchen hier**, den möchte ich probieren (CLD, German)
the.ACC cake.ACC here PRON.ACC want.1SG I try.INF
'This cake here, I want to try.'

c. **Als** het niet zo warm is, **dan** ga ik naar buiten (Conditional with resumptive, Dutch)
when/if it not so hot be.3SG then go.1SG I to outside
'When/if it isn't so hot, then I'll go out.'

3. Corpus study

3.1. Results and generalisations

- Transparent order of appearance of the structures analysed in the ten children. **Very early CP emergence**. **Split CP structures** systematically emerge at a ***later*** stage.
  1. Stage 1 – **CP structures**: 1.38 MLUw (range 1.15-1.54).
  2. Stage 2 – **CP and TP structures**: 1.64 MLUw (range 1.44-1.94).
  3. Stage 3 – **Split CP structures**: 2.57 MLUw (range 2.32-2.8).
- Focus on Stages 1 and 2 (as a group) *vs* Stage 3 here.

Generalisation 1: Early Acquisition of CP

CP-structures emerge early on in the developmental data.

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CP-structures emerge early on in the developmental data.

→ 'Directionality' of emergence likely isn't bottom-up.

Some children:

Age	MLUw	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.20	1.03									
1;09.07	1.09									
1;10.22	1.15							✓		
1;11.12	1.15							✓		
2;02.05	1.35							✓		
2;02.13	1.3					✓				
2;04.11	1.44				✓	✓				
2;05.08	1.64									
2;06.25	1.76				✓	✓				
2;07.20	1.78	✓		✓	✓	✓		✓		
2;08.30	1.88			✓	✓	✓	✓	✓		
2;11.17	1.98	✓	✓		✓	✓	✓	✓		
3;00.02	2.42	✓		✓	✓	✓	✓	✓	✓	
3;03.21	3.47	✓		✓	✓	✓	✓	✓	✓	✓
3;05.13	2.54	✓		✓	✓	✓	✓	✓	✓	✓
3;10.00	2.97	✓		✓	✓	✓	✓	✓	✓	✓
3;10.01	2.91	✓		✓	✓	✓	✓	✓	✓	✓
3;11.12	3.0	✓		✓	✓	✓	✓	✓	✓	✓
4;00.10	3.18	✓	✓		✓	✓	✓	✓	✓	✓

Table 2: Production of structures by Laura (Catalan)

Age	MLUw	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.13	1.27					✓				
1;09.11	1.5					✓				
1;10.08	1.44					✓				
1;11.24	1.39				✓	✓				
2;01.14	1.41					✓				
2;01.29	1.5				✓	✓				
2;02.11	1.54					✓				
2;04.23	1.75					✓	✓			
2;04.29	1.78				✓	✓	✓			
2;05.25	2.14	✓		✓	✓	✓	✓			
2;06.29	2.6				✓	✓			✓	
2;07.00	1.34					✓				
2;07.26	2.78	✓			✓	✓	✓		✓	
2;09.04	2.87	✓		✓	✓	✓	✓	✓	✓	
2;09.24	2.54				✓	✓	✓	✓	✓	
2;10.14	2.5				✓	✓	✓		✓	✓
2;11.12	3.03				✓	✓	✓		✓	
2;11.30	2.6	✓			✓	✓	✓		✓	✓
3;00.24	3.07	✓			✓	✓	✓	✓	✓	✓
3;01.29	2.89	✓			✓	✓	✓		✓	✓
3;03.23	3.24	✓		✓	✓	✓	✓	✓	✓	✓

Table 3: Production of structures by Rosa (Italian)

See Appendix for full tables of all children.

Age	MLUw	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
1;09.11	1.54					✓				
1;10.20	1.62				✓	✓		✓		
1;10.21	1.69				✓	✓		✓		
1;10.22	1.71				✓	✓		✓		
1;10.27	1.52									
1;10.28	1.94		✓		✓	✓		✓		
1;11.13	1.53		✓		✓	✓				
1;11.14	1.88		✓		✓	✓				
1;11.23	2.21		✓	✓	✓	✓		✓		
2;00.01	2.27		✓	✓	✓	✓				
2;00.03	2.28		✓		✓	✓		✓		
2;00.05	2.31		✓		✓	✓		✓		
2;00.23	2.31	✓	✓		✓	✓	✓	✓		
2;00.26	1.98	✓	✓		✓	✓		✓		
2;01.12	1.93	✓	✓	✓	✓	✓	✓	✓		
2;01.16	1.63			✓	✓	✓		✓		
2;01.18	1.72			✓	✓	✓		✓		
2;01.19	1.78		✓	✓	✓	✓		✓		
2;01.20	2.03				✓	✓				
2;01.21	1.79	✓			✓	✓		✓		
2;02.03	1.71			✓	✓	✓		✓		
2;02.04	1.94		✓	✓	✓	✓		✓		
2;02.07	1.66	✓	✓	✓	✓	✓		✓		
2;02.18	2.22			✓	✓	✓				
2;02.19	2.0					✓				
2;02.20	2.09	✓	✓	✓	✓	✓	✓	✓		
2;02.21	1.99	✓	✓	✓	✓	✓		✓		
2;04.17	1.82	✓			✓	✓		✓		
2;04.19	1.89			✓	✓	✓				
2;04.20	1.96			✓	✓	✓		✓	✓	
2;04.21	1.92		✓	✓	✓	✓		✓		
2;05.13	2.52		✓	✓	✓	✓		✓	✓	
2;05.16	2.35				✓	✓		✓		
2;05.19	2.62	✓		✓	✓	✓		✓	✓	
2;05.22	2.67			✓	✓				✓	
2;06.10	3.35			✓	✓	✓		✓	✓	
2;06.16	4.04			✓	✓	✓		✓	✓	
2;06.23	2.78		✓	✓	✓	✓	✓	✓	✓	✓
2;06.24	2.27			✓	✓					
2;06.26	2.88	✓	✓	✓	✓	✓		✓	✓	
2;06.28	3.43				✓			✓		
2;07.04	4.89	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;07.19	4.0	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;07.23	2.67	✓		✓	✓	✓	✓	✓	✓	✓
2;08.08	2.97		✓		✓	✓	✓	✓	✓	
2;08.09	2.9		✓		✓	✓	✓	✓	✓	
2;08.15	2.5	✓	✓	✓	✓	✓		✓	✓	
2;08.16	2.0				✓		✓			
2;09.10	3.47		✓		✓	✓		✓		
2;09.26	2.85	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;09.28	3.46		✓	✓	✓	✓		✓	✓	

Table 4: Production of structures by Simone (German)

Age	MLUw	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
1;06.16	1.12									
1;07.21	1.17					Wh-less				
1;08.28	1.07									
1;09.10	1.17					Wh-less				
1;10.05	1.09				✓					
1;10.13	1.17				✓					
1;11.01	1.25				✓					
1;11.15	1.37				✓	Wh-less				
2;00.17	1.68	✓			✓		✓	✓		
2;01.10	1.88		✓	✓	✓		✓	✓		
2;02.18	2.11	✓	✓		✓	✓	✓			
2;03.16	2.05		✓	✓	✓	✓	✓			
2;04.02	2.53	✓	✓	✓	✓	✓	✓	✓		
2;04.09	2.34			✓	✓	✓	✓			
2;04.27	2.46	✓	✓	✓	✓	✓	✓	✓		
2;05.09	2.47	✓	✓	✓	✓	✓	✓	✓		
2;05.22	2.59		✓	✓	✓	✓	✓	✓		
2;06.04	2.74		✓	✓	✓	✓	✓	✓		
2;06.11	2.45	✓	✓	✓	✓		✓	✓		
2;06.18	2.8		✓	✓	✓	Wh-less	✓	✓		
2;07.16	2.51	✓	✓	✓	✓	✓	✓	✓		
2;08.06	2.66		✓	✓	✓	✓	✓	✓		
2;08.19	2.97	✓	✓	✓	✓	✓	✓	✓		
2;09.02	2.59	✓	✓	✓	✓	✓	✓	✓		
2;09.07	3.15	✓	✓	✓	✓	✓	✓	✓		
2;10.18	2.88	✓	✓	✓	✓	✓	✓	✓		
2;11.03	2.87	✓	✓	✓	✓	✓	✓	✓		
2;11.27	3.64	✓	✓	✓	✓	✓	✓	✓		
3;00.19	3.52	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;01.17	3.06		✓	✓	✓	✓	✓	✓	✓	✓
3;02.13	3.82	✓	✓	✓		✓	✓	✓	✓	✓
3;03.21	3.05	✓	✓		✓	✓	✓	✓	✓	✓
3;04.13	3.15	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;05.30	2.89	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;07.25	3.24	✓	✓		✓	✓	✓	✓	✓	
3;10.07	3.71	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;11.04	4.07	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;00.11	3.81	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;00.30	4.08	✓	✓	✓	✓	✓	✓	✓	✓	
4;01.11	4.66	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;03.04	5.37	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;04.28	4.28	✓	✓	✓	✓	✓	✓	✓	✓	
4;05.29	4.7	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;06.12	5.06	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;07.25	4.62	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;08.03	5.03	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;09.13	6.07	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;09.29	5.2	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;11.15	4.01	✓	✓	✓	✓	✓	✓	✓	✓	✓
5;02.13	4.92	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 5: Production of structures by Sarah (Dutch)

Table 6: CP-structures produced at Stages 1 + 2 and its length

	V2	Wh-Q	Y/N-Q	Top/Foc	Illoc	Embed	Length
Laura		15		4	42	4	1;10.22-3;03.21 (MLUw 1.15-2.54)
Gisela		1		0	6	0	2;04.25-2;08.00 (MLUw 1.58-2.61)
Martina		21		4	7	8	1;08.02-2;04.13 (MLUw 1.57-2.69)
Rosa		133		12	3	8	1;07.13-2;10.14 (MLUw 1.27-2.5)
Irene		18		3	10	4	1;04.16-1;11.13 (MLUw 1.32-2.95)
Koki		32		7	2	4	1;07.20-2;04.18 (MLUw 1.96-2.69)
Kerstin	✓	16	21	27		1	1;10.03-2;09.11 (MLUw 1.28-2.32)
Simone	✓	166	3	105		24	1;10.03-2;06.23 (MLUw 1.54-2.78)
Josse	✓	62	37	68		1	2;00.07-2;11.09 (MLUw 1.2-3.57)
Sarah	✓	124	104	116		0	1;10.05-3;00.19 (MLUw 1.09-3.52)

Generalisation 2: Structural Height and Acquisition Mismatch

There is a dissociation between structural height and order of emergence. Acquisition does not proceed successively upwards; some syntactically very high elements emerge early.

→ Evidences comes from early **topics** and **illocutionary complementisers**.

- Simultaneous emergence of embedding markers and topicalisation in Friedmann et al. (2021) (their Stage 3) is, in several instances, not replicated.

Table 7: Emergence of topicalisation *vs* embedding markers

	Topicalisation	**Embedding**
Laura	2;08.03	3;00.02
	1.88 MLUw	2.42 MLUw
Gisela	2;08.00	2;08.00 (**same file**)
	2.61 MLUw	2.61 MLUw
Martina	1;08.17	1;11.20
	1.56 MLUw	1.99 MLUw
Rosa	2;04.29	2;06.29
	1.77 MLUw	2.6 MLUw
Irene	1;08.09b	1;09.10
	2.24 MLUw	3.28 MLUw
Koki	1;11.25	1;11.25 (**same file**)
	2.47 MLUw	2.47 MLUw
Kerstin	2;00.05	2;07.23
	1.76 MLUw	2.13 MLUw
Simone	1;10.20	2;04.20
	1.62 MLUw	1.96 MLUw
Josse	2;03.28	2;09.02
	1.94 MLUw	2.42 MLUw
Sarah	2;00.17	3;00.19
	1.68 MLUw	3.52 MLUw
Average	1.93 MLUw	2.54 MLUw

- Illocutionary complementisers also emerge from the earliest files for many children (Bosch, 2023c).

(5) a. Ai, **que** crema! (Laura, MLUw 1.35)
ouch that.EXCL burn.3SG
'Ouch, it's burning!'

b. **Que** cau! (Laura, MLUw 1.3)
that.EXCL fall.3SG
'It's falling!'

→ Development *cannot* be recapitulating a cartographic spine in a bottom-up manner.
  - **Some of the structurally highest elements don't emerge last.**

Generalisation 3: Cartography is Emergent

Evidence for cartographic-type structure within CP systematically and abruptly emerges at a later developmental stage, elaborating on developmentally-prior structure (a 'basic' CP).

Table 8: Emergence of CP- *vs* Split CP-structures

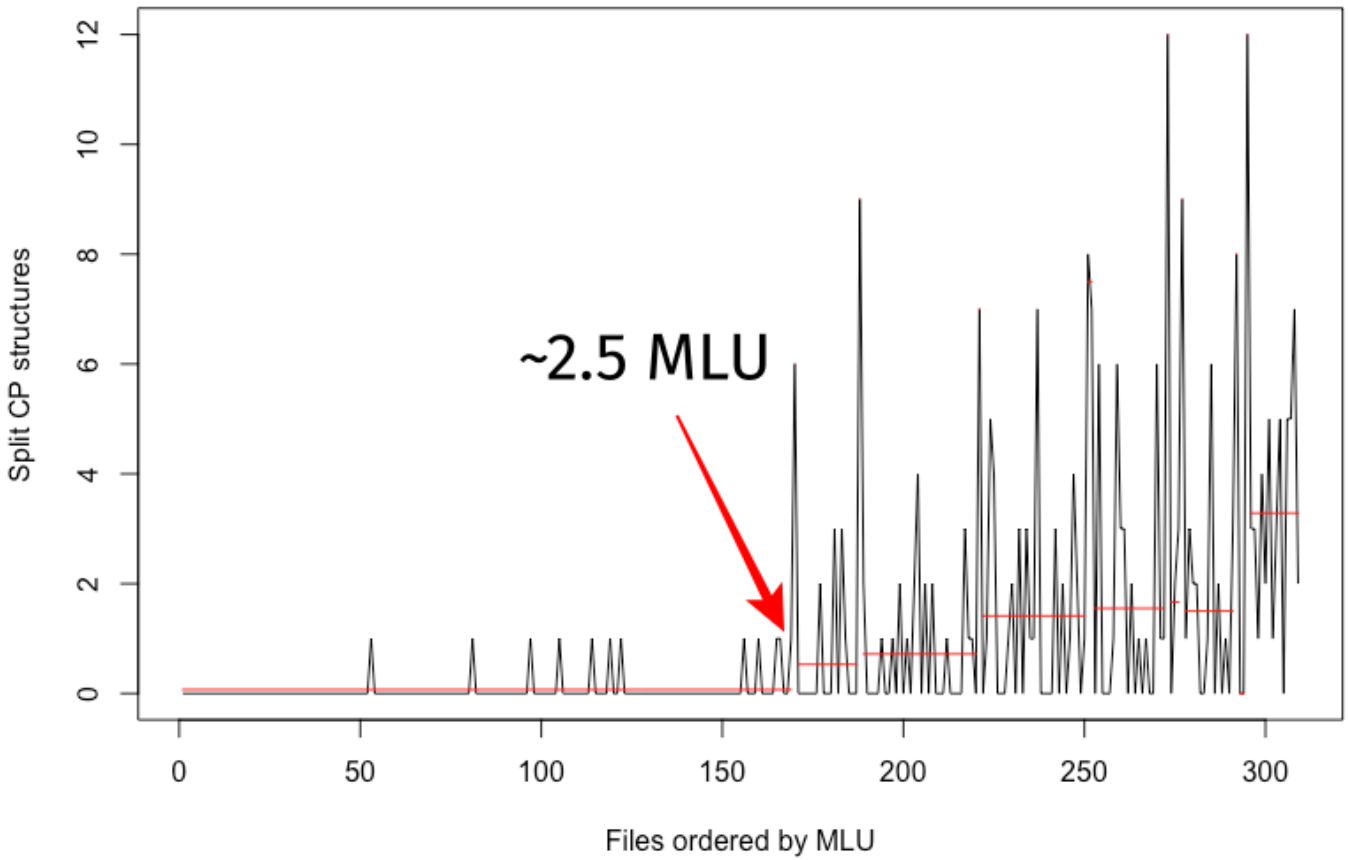
	CP-structures	**Split CP-structures**
Laura	1;10.22	3;03.21
	1.15 MLUw	2.54 MLUw
Gisela	2;04.25	2;08.00
	1.58 MLUw	2.61 MLUw
Martina	1;08.02	2;04.13
	1.57 MLUw	2.69 MLUw
Rosa	1;07.13	2;10.14
	1.27 MLUw	2.5 MLUw
Irene	1;04.16	1;11.13
	1.32 MLUw	2.95 MLUw
Koki	1;07.20	2;04.18
	1.96 MLUw	2.69 MLUw
Kerstin	1;10.03	2;09.11
	1.28 MLUw	2.32 MLUw
Simone	1;09.11	2;06.23
	1.54 MLUw	2.78 MLUw
Josse	2;00.07	2;11.09
	1.2 MLUw	3.57 MLUw
Sarah	1;10.05	3;00.19
	1.09 MLUw	3.52 MLUw

- Emergence is not just late, but ***sudden and 'explosive'*** in the production data (z = –2.949874, p = 0.003).

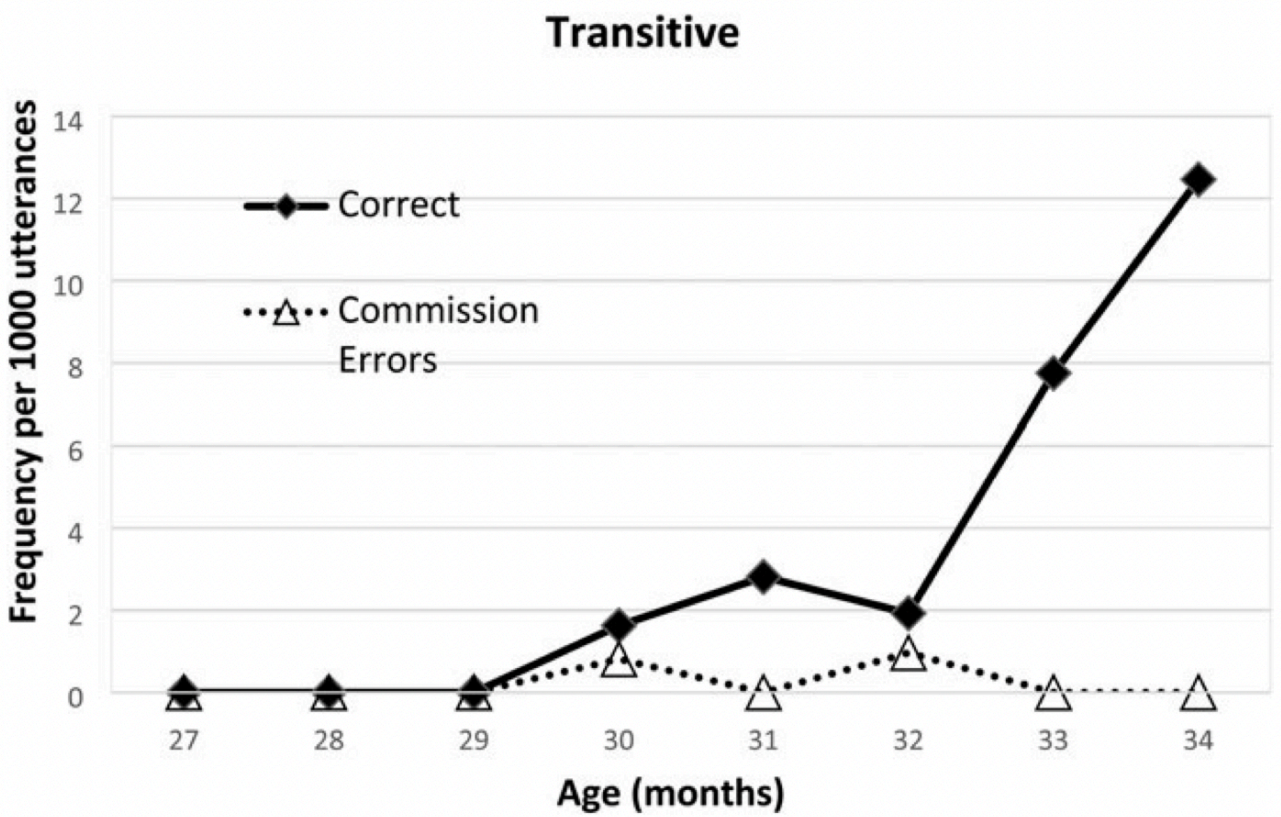
Table 9: Production of Split CP-structures before and after MLUw ~ **2.5**

	Before MLUw ~ 2.5	**After MLUw ~ 2.5**	%
Laura	1	20	4.8-95.2%
Gisela	0	9	0-100%
Martina	0	5	0-100%
Rosa	1	31	3.1-96.9%
Irene	0	85	0-100%
Koki	0	41	0-100 %
Kerstin	3	4	42.9-57.1%
Simone	2	7	22.2-77.8%
Josse	1	19	5-95%
Sarah	2	51	3.8-96.2%
Total	10	272	3.5-96.5%

- Detecting when the change occurs with change point analysis



- Similar **'explosive'** trend reported in Snyder (2007, 2021) for the development verb-particle constructions in English → also taken as evidence for a potential ***grammatical* change**.



- **So far:** Closer look at the development of left peripheral knowledge reveals two significant trends:
  - **CP knowledge** emerges **early**, and not in a way that recapitulates a cartographic spine bottom-up.
  - Evidence for **articulated CP structure** emerges **significantly late** (after TP and complex structures like subordination).

Interim summary

- **So far:** Closer look at the development of left peripheral knowledge reveals two significant trends:
  - **CP knowledge** emerges **early**, and not in a way that recapitulates a cartographic spine bottom-up.
  - Evidence for **articulated CP structure** emerges **significantly late** (after TP and complex structures like subordination).
- BUT:
  - Could this be explained by the **relative length** of these two groups of structures? (e.g., Split CP-structures may need higher MLUw)
  - Or **input frequency**?

  → Results from input analysis and fixed effects logistic regression suggest **(probably) not** – No space here, but ask us about this!

4. Theoretical account and implications

- Most theoretical approaches → 'fixed granularity', imposed by UG. Development accounted for by 'recapitulating' this spine, either bottom-up or inwardly.

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- Generalisations 1-3 generate a *contradiction* in current maturational approaches.
  - Early CP emergence → challenges bottom-up approaches.
  - Early topics/complementisers and late embedding → challenges a cartographic bottom-up approach.
  - Split CP is late → challenges any account with innate functional categories (either bottom-up or inward-growing, and continuity).
  - ? Early CP but late cartographic-type left periphery?

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  - ? Early CP but late cartographic-type left periphery?

Innate categories (fixed granularity) and directionality-based maturation lead to this 'deadlock'

- Our proposed solution here: *dropping innate categories*.
  - → Emergent categories lend us the flexibility needed to rationalise these patterns.
- Biberauer and Roberts (2015)'s **emergent categorial hierarchy**:
  - First, children access core '**macroparametric**' structural properties (see also work on 'Very Early Parameter-setting') → *basic* CP domain.
  - Once mastered, these enable ('unlock') more complex, increasingly '**micro-parametric**' refinements → *(part-)cartographic* structure.
  - Input *vs* intake discrepancies (Tsimpli, 2014; Gagliardi, 2012; Lidz and Gagliardi, 2015).
- Understanding the **contribution** of neo-emergentism:
  - ✓ Emergent categories → expect *departures* from strict directionality.
  - ✓ Emergent categories and increasing granularity go hand-in-hand.
  - ✓ Discrete change in representations → 'sudden' and 'explosive' emergence expected (aligning with Snyder, 2007, 2021).

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  - ✓ Emergent categories and increasing granularity go hand-in-hand.
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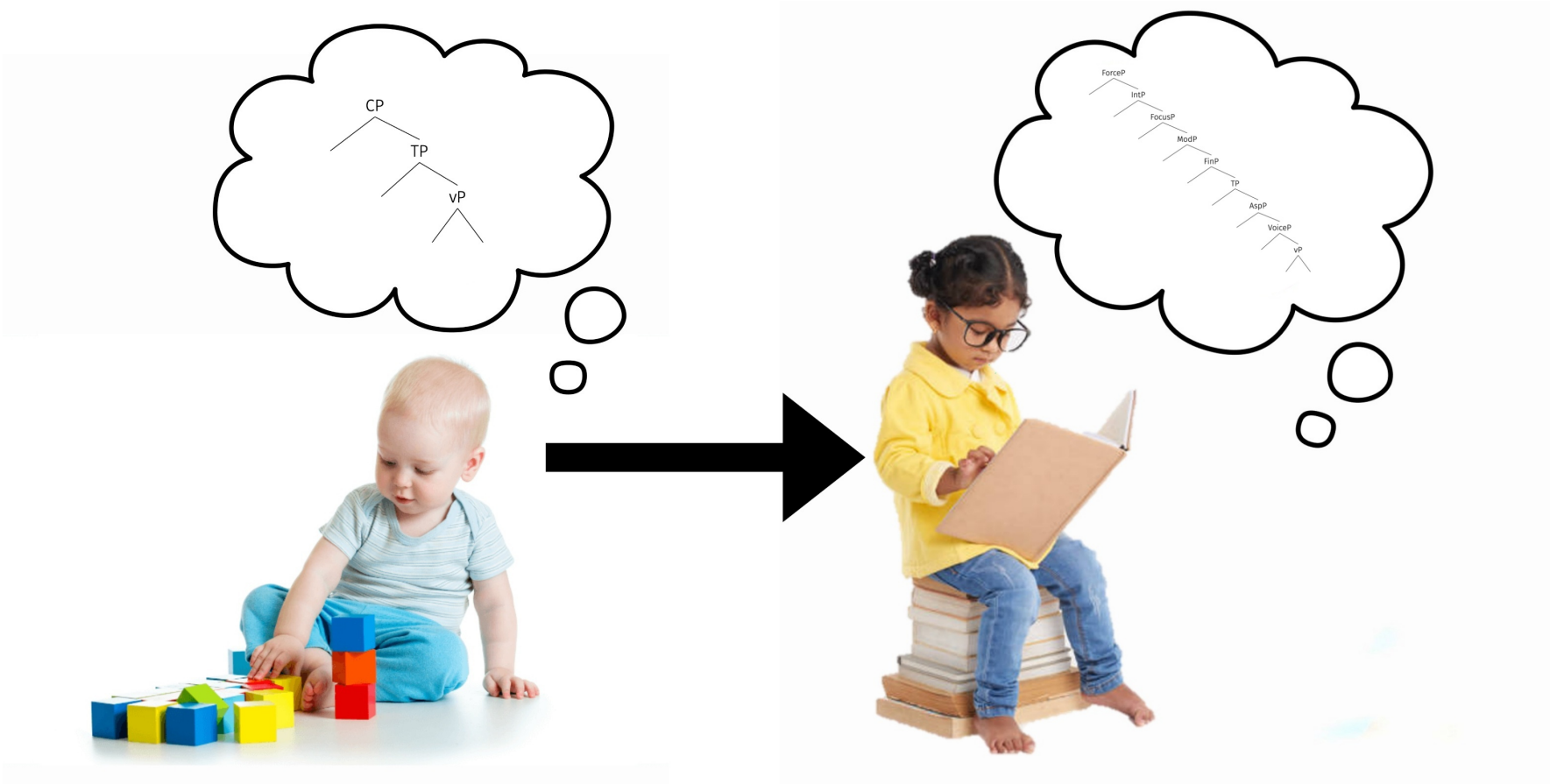
→ **This not just accommodates, but crucially *predicts*, the patterns observed**



Bigger tree, different granularity

5. Conclusion

→ **Novel generalisation**: early CP *vs* late Split CP knowledge, in production.

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- Generalisations 1-3 foreground three (largely) new challenges and requirements:
  - Early CP emergence.
  - A move away from exclusively directionality-centred approaches.
  - Potential role of granularity and categorial flexibility: neither fixed nor always fine-grained in development.
- **Further work** needed:
  - More children/languages, other structures and syntactic domains (work in progress!)
  - Comprehension/behavioural studies (although non-trivial to probe)
  - Alternative explanations for the patterns?

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☞ More generally, ***productive questions and patterns*** surface when probing acquisition through a **neo-emergentist** lens.

Thank you!

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Slides 💻→

6. Extra slides and Appendix

Results: the effect of MLUw and age

- Age is not a reliable predictive factor of timeline of emergence of structures, presenting high variance within each Stage (as in Friedmann et al., 2021). It's the stages that remain identical across children.

Table 10: Age of emergence across the three stages

	Stage 1	**Stage 2**	**Stage 3**
Laura	1;10.22	2;04.11	3;03.21
Gisela	—	2;04.25	2;08.00
Martina	1;08.02	1;10.29	2;04.13
Rosa	1;07.13	2;04.29	2;10.14
Irene	1;04.16	1;06.16	1;11.13
Koki	—	1;07.20	2;04.18
Kerstin	1;10.03	2;01.01	2;09.11
Simone	1;09.11	1;10.28	2;06.23
Josse	2;00.07	2;02.08	2;11.09
Sarah	1;10.05	2;00.17	3;00.19

Additional case studies

- 'Basic' before 'cartographic-type' patterns repeat themselves in other work:
  - De Lisser et al. (2017) on acquisition of the **TMA** field in **Jamaican Creole**
    - **Co-ocurrence** of TMA markers systematically at Phase 2 (MLU 2.5-3.49) or Phase 3 (MLU > 3.5) in the data reported. *No* examples at Stage 1 (< MLU 2.5).
  - Development of **PPs** (Sanfelici and Gallina, 2022) in **Italian**
    - **Bimorphemic** prepositions (such as *dentro a* 'inside', *sopra di* 'above') only in Groups 3 (MLU 2.50-2.99) and Groups 4 (3.0-3.49).
  - Mitrofanova (2018)'s **Underspecification of P Hypothesis**
    - Initial stage with a **coarse-grained prepositional category**, but without cartographic heads encoding fine-grained meaning distinctions (such as Svenonius's, 2006, 2008, AxialPartP).

Results: longer utterances or emergent knowledge?

- **But**, do Split CP structures emerge 'late' simply because lower utterance lengths cannot accommodate these constructions (even though the child's competence *does* capture them)?
  - **Likely not**. Arguments come from two domains: fixed effects logistic regression and comparison of production lengths across stages.

Results: longer utterances or emergent knowledge?

Mixed effects logistic regression

- Testing the likelihood of relative length of CP *vs* Split CP structures as the driving factor of the patterns → fixed-effects logistic regression model with length of (a sample of) the CP/Split CP utterances analysed, MLUw and Age as fixed effects.
- **Results:**
  - → The effect of ***mlu*** is **highly** *statistically significant* and positive (β = 1.23, $p < .001$)
  - → The effect of ***age*** is **highly** *statistically significant* and positive (β = 0.08, $p = .001$)
  - → The effect of ***length*** is ***not*** *statistically significant* and positive (β = 0.04, $p = .563$)

Results: longer utterances or emergent knowledge?

Patterns cannot be accounted for entirely by *length*. MLU (as an average length of *all* utterances and metric of syntactic development) is a much stronger predictor.

- NB: Importantly, length also cannot account for the 'suddenness' and 'explosiveness' with which Split CP structures emerge (growth of utterance length often isn't exponential).

Corpus data: comparison across stages

- Structures at Stage 1 or Stage 2 can occasionally be as long as or even longer than those at Stage 3, raising problems for utterance length as a complete account of the patterns.

(6) a. Aquest, on va? (Catalan, Gisela – Stage 3)
this where go.3SG
'This one, where does it go? / This one, where is it going?'

b. Jo tinc un petit suisse (Catalan, Gisela – Stage 1)
I have.1SG a petit suisse
'I have a petit suisse.'

c. No, jo em vull treure els patins (Catalan, Gisela – Stage 2)
no I CL.REFL want.1SG take.off.INF the skates
'No, I want to take off the skates.'

(7) a. Nog ik heb het gegeven (Dutch, Josse – Stage 3)
yet I AUX.HAVE.1SG it give.PTCP
'Yet I gave it.'

b. Wat doet ie nou? (Dutch, Josse – Stage 1)
what do.3SG he now
'What is he doing now?'

c. Kan niet zo een zwembad maken van de duikplank (Josse – Stage 2)
can.1SG not so a pool make.INF from the diving.board
'I can't jump to the swimming pool from the diving board.'

Corpus data: comparison across stages

- Derivational Complexity accounts (e.g., Jakubowicz, 2005, 2011) offer a partial account at best:
  - Many Split CP-structures do not require more movement (more derivational complexity) than CP-structures → they thus fall outside the definition of 'complex' in these approaches (see the Derivational Complexity Metric in Jakubowicz, 2011).
- For more in depth discussion, see the note in Bosch (2023a).

Full tables (from Bosch, 2023b)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.20	1.03									
1;09.07	1.09									
1;10.22	1.15							✓		
1;11.12	1.15							✓		
2;02.05	1.35							✓		
2;02.13	1.3					✓				
2;04.11	1.44				✓	✓				
2;05.08	1.64									
2;06.25	1.76				✓	✓				
2;07.20	1.78	✓		✓	✓	✓		✓		
2;08.30	1.88			✓	✓	✓	✓	✓		
2;11.17	1.98	✓	✓		✓	✓	✓	✓		?
3;00.02	2.42	✓		✓	✓	✓	✓	✓	✓	
3;03.21	3.47	✓		✓	✓	✓	✓	✓	✓	✓
3;05.13	2.54	✓		✓	✓	✓	✓	✓	✓	✓
3;10.00	2.97	✓		✓	✓	✓	✓	✓	✓	✓
3;10.01	2.91	✓		✓	✓	✓	✓	✓	✓	✓
3;11.12	3.0	✓		✓	✓	✓	✓	✓	✓	✓
4;00.10	3.18	✓	✓		✓	✓	✓	✓	✓	✓

Table 11: Production of structures by Laura (Catalan)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.14	1.04									
1;08.03	1.02									
1;08.24	1.13							✓		
1;09.00	1.16									
1;10.07	1.14									
1;11.11	1.09									
2;01.23	1.53									
2;02.06	1.5									
2;04.25	1.58		✓		✓			✓		
2;06.23	2.32	✓		✓		✓		✓		
2;08.00	2.61	✓		✓	✓	✓	✓	✓	✓	✓
2;09.16	2.68	✓		✓	✓	✓	✓	✓	✓	
2;11.00	2.6	✓			✓		✓	✓	✓	
3;00.29	2.63	✓		✓	✓		✓	✓		
3;05.15	2.66			✓	✓	✓	✓	✓	✓	✓
3;06.28	3.51	✓	✓	✓	✓	✓	✓	✓	✓	
3;10.02	2.95	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;11.14	2.71	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;00.24	2.22	✓		✓	✓		✓			
4;02.03	3.41	✓			✓	✓	✓	✓	✓	✓

Table 12: Production of structures by Gisela (Catalan)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.18	1.26				✓					
1;08.02	1.9					✓		✓		
1;08.17	1.57					✓	✓			
1;09.01	1.59									
1;10.29	1.66				✓	✓	✓			
1;11.02	1.99				✓	✓		✓		
1;11.20	1.99	✓			✓	✓	✓		✓	
2;01.12	1.86				✓	✓	✓	✓		
2;03.01	2.55	✓				✓		✓	✓	
2;03.22	2.64	✓			✓	✓			✓	
2;04.13	2.69	✓			✓	✓	✓	✓		✓
2;05.21	2.37				✓	✓	✓	✓	✓	✓
2;07.15	2.55	✓		✓	✓	✓	✓		✓	✓

Table 13: Production of structures by Martina (Italian)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.13	1.27					✓				
1;09.11	1.5					✓				
1;10.08	1.44					✓				
1;11.24	1.39				✓	✓				
2;01.14	1.41					✓				
2;01.29	1.5				✓[2]	✓				?
2;02.11	1.54					✓				
2;04.23	1.75					✓	✓			
2;04.29	1.78				✓	✓	✓			
2;05.25	2.14	✓		✓	✓	✓	✓			
2;06.29	2.6				✓	✓			✓	
2;07.00	1.34					✓				
2;07.26	2.78	✓			✓	✓	✓		✓	
2;09.04	2.87	✓		✓	✓	✓	✓	✓	✓	
2;09.24	2.54				✓	✓	✓	✓	✓	
2;10.14	2.5				✓	✓	✓		✓	✓
2;11.12	3.03				✓	✓	✓		✓	
2;11.30	2.6	✓			✓	✓	✓		✓	✓
3;00.24	3.07	✓			✓	✓	✓	✓	✓	✓
3;01.29	2.89	✓			✓	✓	✓		✓	✓
3;03.23	3.24	✓		✓	✓	✓	✓	✓	✓	✓

Table 14: Production of structures by Rosa (Italian)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
0;11.01	1.42									
1;01.25	1.08									
1;01.28	1.05									
1;02.05	1.27									
1;04.16	1.32					✓				
1;04.17	1.0									
1;05.01	1.59									
1;05.15	1.53									
1;05.27	1.43									
1;06.01	1.57									
1;06.16a	1.61	✓								
1;06.16b	2.15									
1;07.05a	1.84									
1;07.05b	1.69					✓				
1;07.05c	1.8									
1;07.22a	1.94	✓								
1;07.22b	1.94	✓								
1;07.22c	3.0									
1;08.09a	1.88							✓		
1;08.09b	2.24						✓			
1;08.26	2.28					✓				
1;09.10	3.28				✓	✓			✓	
1;09.28a	2.53					✓		✓	✓	
1;09.28b	3.09						✓	✓		
1;10.16	2.62				✓	✓			✓	
1;10.29a	2.36					✓				
1;10.29b	2.22					✓				
1;11.01	3.09					✓	✓	✓	✓	
1;11.13	2.95				✓	✓	✓	✓	✓	✓
1;11.30	3.22			✓	✓	✓	✓	✓	✓	✓
2;00.13	3.09			✓	✓	✓		✓	✓	✓
2;00.28	3.11				✓	✓		✓	✓	
2;01.18	4.94	✓		✓	✓	✓	✓	✓	✓	✓
2;01.29	3.24				✓	✓	✓	✓	✓	
2;02.14	3.96			✓		✓	✓	✓	✓	
2;02.29	3.08				✓	✓		✓	✓	
2;03.13	3.44				✓	✓	✓	✓	✓	✓
2;03.28	3.44				✓	✓		✓	✓	
2;04.13a	4.2	✓			✓	✓			✓	
2;04.13b	2.7			✓		✓	✓		✓	
2;04.28	2.99	✓			✓	✓	✓	✓	✓	✓
2;05.13a	3.0				✓	✓		✓	✓	✓
2;05.13b	2.83			✓		✓	✓	✓	✓	
2;05.27	3.99			✓	✓	✓		✓	✓	
2;06.12	5.12	✓		✓		✓		✓	✓	
2;06.26	4.12			✓	✓	✓	✓	✓	✓	✓
2;07.09	4.12	✓			✓	✓	✓	✓	✓	✓
2;07.28	4.41			✓		✓	✓	✓	✓	✓
2;08.14	2.59				✓	✓		✓	✓	✓
2;08.27	3.45				✓	✓	✓	✓	✓	✓
2;09.11	3.65		✓	✓	✓	✓	✓	✓	✓	✓
2;09.26	3.23	✓		✓	✓	✓	✓	✓	✓	✓
2;10.13	4.74				✓	✓	✓	✓	✓	✓
2;10.28	5.13	✓		✓	✓	✓	✓	✓	✓	✓
2;11.11	3.19	✓		✓	✓	✓	✓	✓	✓	✓
2;11.27	4.01		✓	✓	✓	✓	✓	✓	✓	✓
3;00.24	3.52					✓	✓	✓	✓	✓
3;01.22	3.11		✓	✓		✓	✓	✓	✓	✓
3;02.19	3.38	✓		✓	✓	✓	✓	✓	✓	✓

Table 15: Production of structures by Irene (Spanish)

Age	MLU	S-Neg-V	S-Adv-V	S-Cl-V	Aux	Wh-Q	Top/Foc	Illoc	Embed	Split CP
1;07.20	1.96						✓			
1;09.18	2.54	✓		✓	✓					
1;11.25	2.47	✓			✓	✓	✓		✓	
2;01.29	2.51	✓			✓	✓	✓			
2;02.27	2.47				✓	✓	✓	✓	✓	
2;03.21	2.07				✓	✓	✓	✓		
2;04.18	2.69	✓		✓	✓	✓	✓		✓	✓
2;05.24	3.08	✓	✓	✓	✓	✓	✓		✓	✓
2;06.10	2.71	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;07.10	3.61	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;08.09	2.75	✓	✓	✓		✓	✓	✓	✓	✓
2;09.14	2.93			✓	✓	✓	✓		✓	
2;11.14	3.38	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 16: Production of structures by Koki (Spanish)

Age	MLU	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
1;03.22	1.09									
1;04.13	1.31									
1;05.03	1.38									
1;05.06	1.38									
1;05.17	1.58					Wh-less				
1;05.24	1.36					✓				
1;06.06	1.45									
1;06.13	1.46									
1;06.20	1.37									
1;07.09	1.58					✓				
1;07.10	1.39					✓				
1;07.24	1.34									
1;08.07	1.2									
1;08.22	1.4									
1;08.26	1.12									
1;10.03	1.28					✓				
1;10.05	1.38				✓	✓				
1;11.20	1.53				✓					
2;00.05	1.76				✓			✓		
2;00.10	1.68				✓		✓	✓		
2;01.01	1.59			✓	✓	✓		✓		
2;01.02	1.58		✓		✓	✓	✓			
2;02.20	1.72		✓		✓	✓	✓			
2;02.21	1.65	✓	✓		✓	Wh-less				
2;03.01	1.81				✓	✓				
2;03.02	1.86		✓		✓	✓	✓	✓		?
2;04.14	1.98		✓		✓			✓		
2;04.16	1.67		✓	✓	✓	Wh-less	✓	✓		?
2;05.12	1.8	✓	✓	✓	✓	✓	✓	✓		
2;05.14	1.78	✓			✓			✓		?
2;06.02	2.25	✓	✓		✓	✓	✓	✓		
2;06.03	1.62		✓		✓					
2;07.23	2.13	✓	✓	✓	✓	✓	✓	✓	✓	
2;09.11	2.32	✓	✓	✓	✓	✓	✓	✓		✓
2;10.27	2.38		✓	✓	✓	✓	✓	✓	✓	
3;02.08	2.68	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;04.03	2.89	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 17: Production of structures by Kerstin (German)

Age	MLUw	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
1;09.11	1.54					✓				
1;10.20	1.62				✓	✓		✓		
1;10.21	1.69				✓	✓		✓		
1;10.22	1.71				✓	✓		✓		
1;10.27	1.52									
1;10.28	1.94		✓		✓	✓		✓		
1;11.13	1.53		✓		✓	✓				
1;11.14	1.88		✓		✓	✓				
1;11.23	2.21		✓	✓	✓	✓		✓		
2;00.01	2.27		✓	✓	✓	✓				
2;00.03	2.28		✓		✓	✓		✓		
2;00.05	2.31		✓		✓	✓		✓		
2;00.23	2.31	✓	✓		✓	✓	✓	✓		
2;00.26	1.98	✓	✓		✓	✓		✓		
2;01.12	1.93	✓	✓	✓	✓	✓	✓	✓		
2;01.16	1.63			✓	✓	✓		✓		
2;01.18	1.72			✓	✓	✓		✓		
2;01.19	1.78		✓	✓	✓	✓		✓		
2;01.20	2.03				✓	✓				
2;01.21	1.79	✓			✓	✓		✓		
2;02.03	1.71			✓	✓	✓		✓		
2;02.04	1.94		✓	✓	✓	✓		✓		
2;02.07	1.66	✓	✓	✓	✓	✓		✓		
2;02.18	2.22			✓	✓	✓				
2;02.19	2.0					✓				
2;02.20	2.09	✓	✓	✓	✓	✓	✓	✓		
2;02.21	1.99	✓	✓	✓	✓	✓		✓		
2;04.17	1.82	✓			✓	✓		✓		
2;04.19	1.89			✓	✓	✓				
2;04.20	1.96			✓	✓	✓		✓	✓	
2;04.21	1.92		✓	✓	✓	✓		✓		
2;05.13	2.52		✓	✓	✓	✓		✓	✓	
2;05.16	2.35				✓	✓		✓		
2;05.19	2.62	✓		✓	✓	✓		✓	✓	
2;05.22	2.67			✓	✓				✓	
2;06.10	3.35			✓	✓	✓		✓	✓	
2;06.16	4.04			✓	✓	✓		✓	✓	
2;06.23	2.78		✓	✓	✓	✓	✓	✓	✓	✓
2;06.24	2.27			✓	✓					
2;06.26	2.88	✓	✓	✓	✓	✓		✓	✓	
2;06.28	3.43				✓			✓		
2;07.04	4.89	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;07.19	4.0	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;07.23	2.67	✓		✓	✓	✓	✓	✓	✓	✓
2;08.08	2.97		✓		✓	✓	✓	✓	✓	
2;08.09	2.9		✓		✓	✓	✓	✓	✓	
2;08.15	2.5	✓	✓	✓	✓	✓		✓	✓	
2;08.16	2.0				✓		✓			
2;09.10	3.47		✓		✓	✓		✓		
2;09.26	2.85	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;09.28	3.46		✓	✓	✓	✓		✓	✓	

Table 18: Production of structures by Simone (German)

Age	MLU	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
2;00.07	1.2				✓	✓				
2;00.21	1.44				✓					
2;01.12	1.55				✓					
2;01.26	1.59				✓	✓				
2;02.08	1.69		✓		✓	✓				
2;02.22	1.74				✓	✓				
2;03.28	1.94	✓			✓	✓	✓	✓		
2;04.11	2.14		✓		✓	✓	✓	✓		?
2;04.25	1.9				✓	✓		✓		
2;05.11	1.59				✓		✓	✓		
2;06.01	2.17			✓	✓	✓		✓		
2;06.22	2.11	✓	✓		✓	✓	✓	✓		
2;07.06	2.19		✓	✓	✓	✓	✓	✓		
2;07.20	2.46		✓	✓	✓	✓	✓	✓		?
2;08.04	2.25		✓	✓	✓	✓	✓	✓		
2;08.18	2.55		✓	✓	✓	✓	✓	✓		
2;09.02	2.42	✓	✓	✓	✓	✓	✓	✓	✓	
2;09.16	2.8		✓	✓	✓	✓	✓	✓		
2;11.09	3.57	✓	✓	✓	✓	✓	✓	✓	✓	✓
2;11.23	2.98	✓	✓	✓	✓		✓	✓	✓	
3;00.06	3.06	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;00.20	4.01	✓	✓	✓	✓	✓	✓	✓	✓	
3;01.10	3.91	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;01.24	3.78	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;02.15	3.95	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;02.29	3.19	✓	✓	✓	✓	✓	✓	✓	✓	
3;03.27	3.39	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;04.17	3.2	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 19: Production of structures by Josse (Dutch)

Age	MLU	S-Neg-V	S-Adv-V	Aux	V2	Wh-Q	Y/N-Q	Top/Foc	Embed	Split CP
1;06.16	1.12									
1;07.21	1.17					Wh-less				
1;08.28	1.07									
1;09.10	1.17					Wh-less				
1;10.05	1.09				✓					
1;10.13	1.17				✓					
1;11.01	1.25				✓					
1;11.15	1.37				✓	Wh-less				
2;00.17	1.68	✓			✓		✓	✓		
2;01.10	1.88		✓	✓	✓		✓	✓		
2;02.18	2.11	✓	✓		✓	✓	✓			
2;03.16	2.05		✓	✓	✓	✓	✓			
2;04.02	2.53	✓	✓	✓	✓	✓	✓	✓		
2;04.09	2.34			✓	✓	✓	✓			
2;04.27	2.46	✓	✓	✓	✓	✓	✓	✓		?
2;05.09	2.47	✓	✓	✓	✓	✓	✓	✓		?
2;05.22	2.59		✓	✓	✓	✓	✓	✓		?
2;06.04	2.74		✓	✓	✓	✓	✓	✓		
2;06.11	2.45	✓	✓	✓	✓		✓	✓		
2;06.18	2.8		✓	✓	✓	Wh-less	✓	✓		
2;07.16	2.51	✓	✓	✓	✓	✓	✓	✓		
2;08.06	2.66		✓	✓	✓	✓	✓	✓		
2;08.19	2.97	✓	✓	✓	✓	✓	✓	✓		
2;09.02	2.59	✓	✓	✓	✓	✓	✓	✓		
2;09.07	3.15	✓	✓	✓	✓	✓	✓	✓		
2;10.18	2.88	✓	✓	✓	✓	✓	✓	✓		
2;11.03	2.87	✓	✓	✓	✓	✓	✓	✓		
2;11.27	3.64	✓	✓	✓	✓	✓	✓	✓		
3;00.19	3.52	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;01.17	3.06		✓	✓	✓	✓	✓	✓	✓	✓
3;02.13	3.82	✓	✓	✓		✓	✓	✓	✓	✓
3;03.21	3.05	✓	✓		✓	✓	✓	✓	✓	✓
3;04.13	3.15	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;05.30	2.89	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;07.25	3.24	✓	✓		✓	✓	✓	✓	✓	
3;10.07	3.71	✓	✓	✓	✓	✓	✓	✓	✓	✓
3;11.04	4.07	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;00.11	3.81	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;00.30	4.08	✓	✓	✓	✓	✓	✓	✓	✓	
4;01.11	4.66	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;03.04	5.37	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;04.28	4.28	✓	✓	✓	✓	✓	✓	✓	✓	
4;05.29	4.7	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;06.12	5.06	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;07.25	4.62	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;08.03	5.03	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;09.13	6.07	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;09.29	5.2	✓	✓	✓	✓	✓	✓	✓	✓	✓
4;11.15	4.01	✓	✓	✓	✓	✓	✓	✓	✓	✓
5;02.13	4.92	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table 20: Production of structures by Sarah (Dutch)

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