

# Formalising labelling

Background and tentative proposals

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1. (Meta-)Theoretical Context
2. On formalisation
3. A brief history of labelling
4. Prospects
5. Conclusions

# Summary

1. The Minimalist Programme (MP) makes sense as a way of studying I-language.
2. Taking MP seriously means that we need to be precise when formulating the computational procedure for I-language ( $C_{HL}$ ).
3. Labelling is a particularly productive process to formalise, in order to reduce over-reliance on stipulated primitives.

# 1. (Meta-)Theoretical Context

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- 1.1 Background
- 1.2 The Galilean Challenge
- 1.3 Linguistic Minimalism

# 1. (Meta-)Theoretical Context

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## 1.1. Background

Chametzky (1996, p. xviii) proposes a tripartite distinction:

1. **Meta-theoretical:** what makes a good theory?
2. **Theoretical:** “deployment of metatheoretical concepts”; construction of primitives and theorems.
3. **Analytical:** applying theory to data (most ‘theoretical linguistics’ is really analytical in this sense).

## Background II: definitions

- I-language: knowledge of language (Chomsky, 1986); internal to an individual; intensional (=generative)
- $C_{HL}$ : the generative procedure, typically assumed to contain *MERGE*, *AGREE*, *LABEL*?

(Not worrying about FLN/FLB, see Martins & Boeckx, 2016, p. 12, cf. Balari & Lorenzo, 2012.)



# 1. (Meta-)Theoretical Context

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## 1.2. The Galilean Challenge

# The Galilean Challenge I

*“[Sagredo:] But surpassing all stupendous inventions, what sublimity of mind was his who dreamed of finding means to communicate his deepest thoughts to any other person, though distant by mighty intervals of place and time! Of talking with those who are in India; of speaking to those who are not yet born and will not be born for a thousand or ten thousand years; and with what facility, by the different arrangements of twenty characters upon a page!” (Galilei, 1632/1967, p. 105)*

# The Galilean Challenge II

Two aspects to the challenge (cf. Chomsky, 2017):

1. Discrete infinity + infinite creativity (cf. Descartes, Humboldt; Chomsky, 1966)
2. Treating language as part of the natural world, subject to investigation as with any other science, and with all the usual caveats.
  - This is really what MP is all about.
  - The idea goes back to the start of the generative enterprise; see Chomsky (1995a, 2006, i.a.)

Nature is simple; it is our job to find out how (see Galilei, 1632/1967, p. 397).

# 1. (Meta-)Theoretical Context

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## 1.3. Linguistic Minimalism

# Minimalism I: The Basic Property

- The Basic Property: “each language provides an unbounded array of hierarchically structured expressions that receive interpretations at two interfaces, sensorimotor for externalization and conceptual-intentional for mental processes” (Chomsky, 2016, p. 4); cf. Berwick and Chomsky (2016, p. 1).
- Cf. Aristotle “sound with meaning”.
- The Strong Minimalist Thesis (SMT): I-language is an optimal solution to interface conditions (Chomsky, 2001, p. 1).

## Minimalism II: Mobbs (2015)

Logically independent proposals within the *argument of linguistic Minimalism*:

1. **Methodological minimalism (MM)**: choose the more parsimonious explanation (i.e. Occam's Razor).
2. **Ontological minimalism (OM)**: assume the SMT—avoiding pre-theoretic assumptions about the nature of I-language (i.e. don't be functionalist)
3. **SMT and evo-devo**: certain facts about language require innate competence.
4. **Primacy of CI**: language is optimised for thought, not externalisation.
5. **Variation**: diversity of languages is restricted to externalisation.

## 2. On formalisation

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2.1 Why formalise?

2.2 Collins and Stabler (2016)

## 2. On formalisation

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### 2.1. Why formalise?



# Why formalise? I

- Chomsky (1957, p. 5): “a formalised theory may automatically provide solutions for many problems other than those for which it was explicitly designed”, avoiding reliance upon “[o]bscure and intuition-bound notions”.
- Chris Collins (p.c.): we’ve got to formalise labelling, “since otherwise we don’t really understand what we are doing”.

## Why formalise? II

- MM: how do we evaluate which theory is actually simpler/more 'optimal'?
- Chomsky (1995b, p. 233): avoiding “the temptation to offer a purported explanation for some phenomenon on the basis of assumptions that are of roughly the same order of complexity of what is to be explained”
- OM: can we reduce postulates to 'third factors' (see Chomsky, 2005)?
  - More accurately, the interaction between first and third factor properties (cf. Boeckx, 2014b, f.n. 12).

# Marr's Levels of Analysis

Marr (1982):

1. **Computational:** what is the goal of the computation?
2. **Algorithmic:** what are the algorithms and the (symbolic) representations?
3. **Implementational:** what's the physical realisation [in the brain]?

Formalisation = going from computational to algorithmic.

See Poeppel and Embick (2005) and Embick and Poeppel (2015) on (3).

## 2. On formalisation

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### 2.2. Collins and Stabler (2016)

- *A Formalisation of Minimalist Syntax*
- The perennial 'programme not a theory' problem.

- What C&S do do:
  - Merge
  - Select
  - Transfer
  - Occurrences
  - Workspace (cf. Chomsky, 2021)
  - Labels
  - Convergence

- What C&S don't do:
  - Head movement
  - Pair-Merge (adjunction)
  - Quantifier Raising
  - Agree (but see Milway, 2021)
  - Locality conditions
  - Feature inheritance

# Where to go with labelling?

- C&S labelling theory effectively adapts 'locus' from Collins (2002).
- Is labelling required at the interfaces? If not, this poses an OM problem.
- Why would labelling be required within syntax?
- Can we 'do more' with labelling?
  - Replacing *AGREE*
  - Movement



## 3. A brief history of labelling

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3.1 From rewrite rules to BPS

3.2 POP era

## 3. A brief history of labelling

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### 3.1. From rewrite rules to BPS

- Labels are:
  - built into the rules.
  - required to formulate rules.
  - arbitrary symbols.

- (1) a.  $NP \rightarrow Det N$   
b.  $\beta \rightarrow \epsilon \gamma$

# X-bar theory

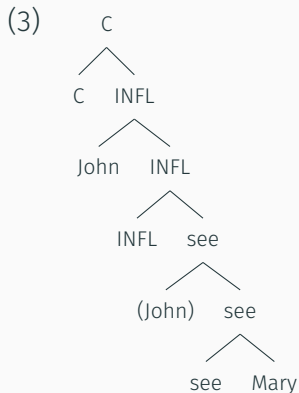
- Labels are:
  - built into the X-bar schema (the projection principle).
  - required to formulate rules.
  - category features (or more complex?).

- (2) a.  $\beta' \rightarrow \beta \text{ COMP}$   
b.  $\beta P \rightarrow \text{SPEC } \beta'$

(ignoring adjuncts)

# Bare Phrase Structure (BPS)

- Labels are:
  - built into Merge?
  - heads (lexical items)



(4)  $Merge\{X, Y\} = \{K, \{\alpha, \beta\}\}, K \in \{\alpha, \beta\}$

## 3. A brief history of labelling

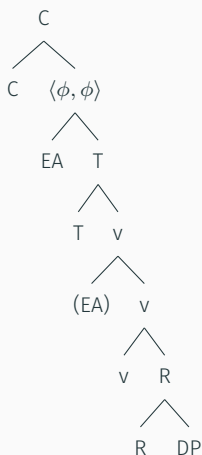
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### 3.2. POP era

# Problems of Projection (POP)

- Labels are:
  - determined by a Labelling Algorithm (LA)
  - features?

(5)



(6)  $Merge\{X, Y\} = \{\alpha, \beta\}$

## 4. Prospects

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4.1 Do we need labels?

4.2 Minimal search



## 4. Prospects

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### 4.1. Do we need labels?

## Do we need labels internally?

- We should abandon the traditional projection principle, following Borer (2005) and Boeckx (2014a).
- If Merge is symmetrical, where does asymmetry come from?
- *Dynamic Antisymmetry* (Moro, 1997) can be adapted into labelling (Moro, 2009)—labelling can drive A-movement (Chomsky, 2013, 2015) and A'-movement (Blümel, 2017).

## Are labels needed at the interface?

- Collins (2002) doesn't think so.
- Phonological rules don't usually make reference to e.g. VP vs NP (do they?).
- These questions are very dependent on the timing of transfer from narrow syntax to the interfaces, and thus on a precise notion of phases. Hence making precise formalisation all the more important.

## 4. Prospects

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### 4.2. Minimal search

# Minimal search

- Reducing labelling to minimal search would allow labelling to conform to OM (being a third-factor interaction), and formalisation would demonstrate MM.
- Milway (2021) formalises Agree in terms of minimal search algorithms.
- Similar approach could be taken with labelling.
- Epstein et al. (2020) show that formalisation of labelling depends crucially on how a 'path' is defined, and how this can relate to the notion of accessibility (and thus the locus).


## 5. Conclusions

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# Conclusions






- The argument for linguistic Minimalism suggests a number of useful heuristics that can aid linguistic theory construction.
- Following the argument entails that we need to be very careful about the formal devices we are positing.
- Labelling is an area which needs formal attention.
- Taking labelling seriously entails asking a number of questions:
  - What features can label? How are they found? (minimal search)
  - Can LA 'trigger' other operations?
  - Does LA make Agree redundant?

## References i








-  Balari, S., & Lorenzo, G. (2012). *Computational phenotypes: Towards an evolutionary developmental biolinguistics*. Oxford University Press.
-  Berwick, R. C., & Chomsky, N. (2016). *Why only us: Language and evolution*. MIT Press.
-  Blümel, A. (2017). *Symmetry, shared labels and movement in syntax*. De Gruyter.
-  Boeckx, C. (2014a). *Elementary syntactic structures: Prospects of a feature-free syntax*. Cambridge University Press.







## References ii

-  Boeckx, C. (2014b). What Principles and Parameters got wrong. In M. C. Picallo (Ed.), *Linguistic variation in the Minimalist framework* (pp. 155–178). Oxford University Press.
-  Borer, H. (2005). *Structuring sense volume I: In name only*. Oxford University Press.
-  Chametzky, R. A. (1996). *A theory of phrase markers and the extended base*. SUNY Press.
-  Chomsky, N. (1957). *Syntactic structures*. Mouton.
-  Chomsky, N. (1966). *Cartesian linguistics: A chapter in the history of rationalist thought*. Harper and Row.





## References iii

-  Chomsky, N. (1986). *Knowledge of language: Its nature, origin, and use*. Praeger.
-  Chomsky, N. (1995a). Language and nature. *Mind*, 104(413), 1–61.
-  Chomsky, N. (1995b). *The Minimalist Program*. MIT Press.
-  Chomsky, N. (2001). Derivation by phase. In M. J. Kenstowicz (Ed.), *Ken Hale: A life in language* (pp. 1–52). MIT Press.
-  Chomsky, N. (2005). Three factors in language design. *Linguistic Inquiry*, 36(1), 1–22.
-  Chomsky, N. (2006). *Language and mind: Third edition*. Cambridge University Press.
-  Chomsky, N. (2013). Problems of projection. *Lingua*, 130, 33–49.





## References iv

-  Chomsky, N. (2015). Problems of projection: Extensions. In E. Di Domenico, C. Hamann & S. Matteini (Eds.), *Structures, strategies and beyond: Studies in honour of Adriana Belletti* (pp. 29–42). John Benjamins.
-  Chomsky, N. (2016). *What kind of creatures are we?* Columbia University Press.
-  Chomsky, N. (2017). The language capacity: Architecture and evolution. *Psychonomic Bulletin & Review*, 24(1), 200–203.
-  Chomsky, N. (2021). Minimalism: Where are we now, and where can we hope to go. *Gengo Kenkyu*, 160, 1–41.





## References v

-  Collins, C. (2002). Eliminating labels. In S. D. Epstein & T. D. Seely (Eds.), *Derivation and explanation in the Minimalist Program* (pp. 42–64). Blackwell.
-  Collins, C., & Stabler, E. (2016). A formalization of minimalist syntax. *Syntax*, 19(1), 43–78.
-  Embick, D., & Poeppel, D. (2015). Towards a computational(ist) neurobiology of language: Correlational, integrated and explanatory neurolinguistics. *Language, Cognition and Neuroscience*, 30(4), 357–366.
-  Epstein, S. D., Kitahara, H., & Seely, T. D. (2020). Unifying labeling under minimal search in 'single-' and 'multiple-specifier' configurations. *Coyote Papers*, 22.

## References vi

-  Galilei, G. (1967). *Dialogo sopra i due massimi sistemi del mondo* [Dialogue concerning the two chief world systems] (S. Drake, Trans.; 2nd ed.). University of California Press. (Original work published 1632)
-  Marr, D. (1982). *Vision: A computational investigation into the human representation and processing of visual information*. Freeman.
-  Martins, P. T., & Boeckx, C. (2016). What we talk about when we talk about biolinguistics. *Linguistics Vanguard*, 2(1), 1–15.
-  Milway, D. (2021). *Agree as derivational operation: Its definition and discontents*.

## References vii

-  Mobbs, I. (2015). *Minimalism and the design of the language faculty* (Doctoral dissertation). University of Cambridge. Cambridge, UK.
-  Moro, A. (1997). Dynamic antisymmetry: Movement as a symmetry-breaking phenomenon. *Studia Linguistica*, 51(1), 50–76.
-  Moro, A. (2009). Rethinking symmetry: A note on labeling and the EPP. *Snippets*, (19), 17–18.
-  Poeppel, D., & Embick, D. (2005). Defining the relation between linguistics and neuroscience. In A. Cutler (Ed.), *Twenty-First century psycholinguistics: Four cornerstones* (pp. 103–118). Taylor & Francis Group.