

# Identifying Areas of Difficulty in the Comprehension of Recursion

Implications for Bilingual and Monolingual Acquisition

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# Recap: Definition of Recursion

- Borrowed from mathematics during the 1940s and 50s (Tomalin 2007, 2011)
- At least 9 possibilities can be identified based on the originating literature and current research trends (Tomalin 2011)
- ➔ The most general sense, i.e. “a function defined in terms of itself,” encompasses an array of linguistic structures

# Recap: Types of Recursion

## 1. Merge (Chomsky et al. 2019)

Merge X and Y and create a set  $\{X, Y\}$

Merge another term Z with  $\{X, Y\}$  to create a new set

## 2. Coordination (Roepers 2011)

Merge items of the same type according to a single computational rule

Non-hierarchical

## 3. Indirect recursion (Roepers 2011; Pérez-Leroux et al., 2012)

Certain structures in a given language can be embedded within themselves

## 1. Recap: What is Recursion?

Definition

Types

## 2. Indirect Recursion

What it is

What is needed

When it is acquired

## 3. A Proposal

## 4. Derivation by Phase

## 5. Interfaces: Another Potential Challenge

## 6. Implications for Monolingual Acquisition

## 7. Implications for Bilingual Acquisition

## 8. Next Steps

# Indirect Recursion

## *What it is*

- Self-similar syntactic embedding (Pérez-Leroux et al. 2012; Tomalin 2007, 2011)
- Hierarchical
- Universally available but constrained within languages

e.g. Possessives

Left-branching: Cheylah's sister's bike

Right-branching: The cousin of the friend of Bryanna

e.g. Locatives

The cake on the plate on the hat on the cat on the ball



# Indirect Recursion

## *What is needed*

What syntactic knowledge is required to understand this phrase?

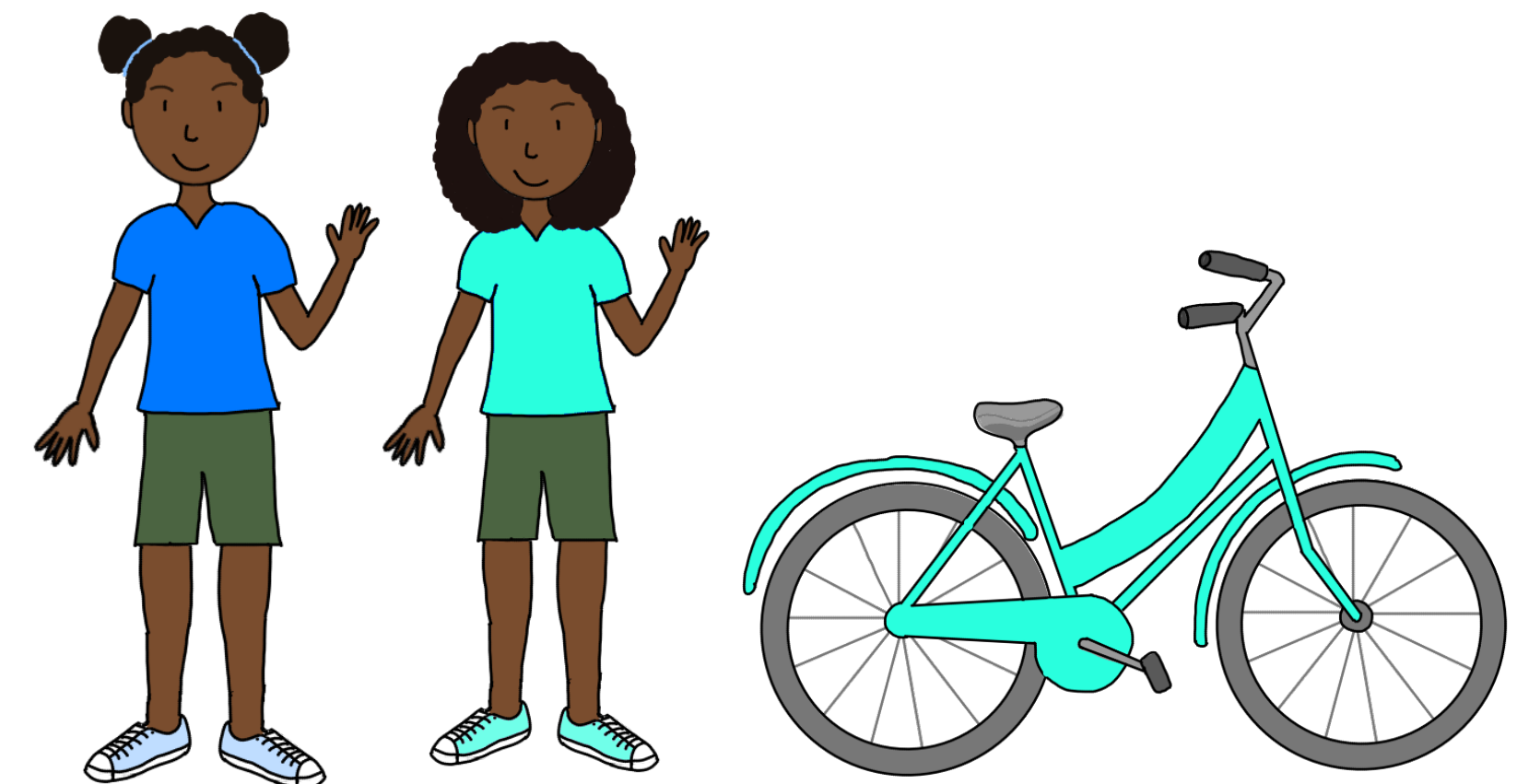
Cheylah's sister's bike

Language-specific morphosyntactic properties (i.e. how possession is expressed in English: 's or *of*)

➡ Comprehension and production by 24 months old (Blake & Harris 2011)

Merge (which we assume is recursive by nature)

➡ Multiword utterances by 20 months (Nelson 1973)



# Indirect Recursion

## *When it is acquired*

...and yet

Brown/Sarah/021011.cha line 133

Age 2;10.11

MOT: Sarah (.) what's my Mummy's name ?

CHI: Nana .

MOT: and what's my Daddy's name ?

CHI: Grampy .

MOT: and what's Daddy's Mumma's name ?

MOT: huh ?

CHI: peebe@b .

MOT: no .

MOT: what's Daddy's Daddy's name ?

CHI: &-uh .

MOT: what's Daddy's Daddy's name ?

CHI: &-uh .

MOT: what is it ?

MOT: what'd I tell you ?

MOT: Arthur !

CHI: Arthur !

CHI: dat [: that] my cousin .

MOT: oh (.) no (.) not your cousin Arthur .

MOT: Grampy's name is Arthur .

MOT: Daddy's Daddy's name is Arthur .

CHI: no (.) dat [: that] my cousin .

MOT: oh .

MOT: what's your cousin's Mumma's name ?

MOT: what's Arthur's Mumma's name ?

CHI: &-uh .

MOT: thinking ?

CHI: 0 .

MOT: oh .

MOT: what's her name ?

MOT: don't you know Arthur's Mumma's name ?

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# Indirect Recursion

## *When it is acquired*

Age of acquisition for recursive possessives:

- 6;0 – Mandarin (Li et al. 2020)
- 7;0 – Wapichana/English (Leandro & Amaral 2014)

Age of acquisition for recursive locatives:

- 4;0 – Mandarin (Mao et al. 2021)
- 7;0 – English (Nelson 2016)

Phase = “self-contained subsection of the derivation, beginning with a numeration and ending with Spell-Out” (Legate 2003)

Each DP is its own phase (Svenonius 2004)

Derivations occur phase-by-phase (Chomsky 2000)

In indirect recursion, new derivations must occur **while keeping previously-Spelled-Out constituents active in the work space** (Arsenijevi & Hinzen 2010; Pérez-Leroux et al. 2018).

➡ Why is that problematic?

# Derivation by Phase

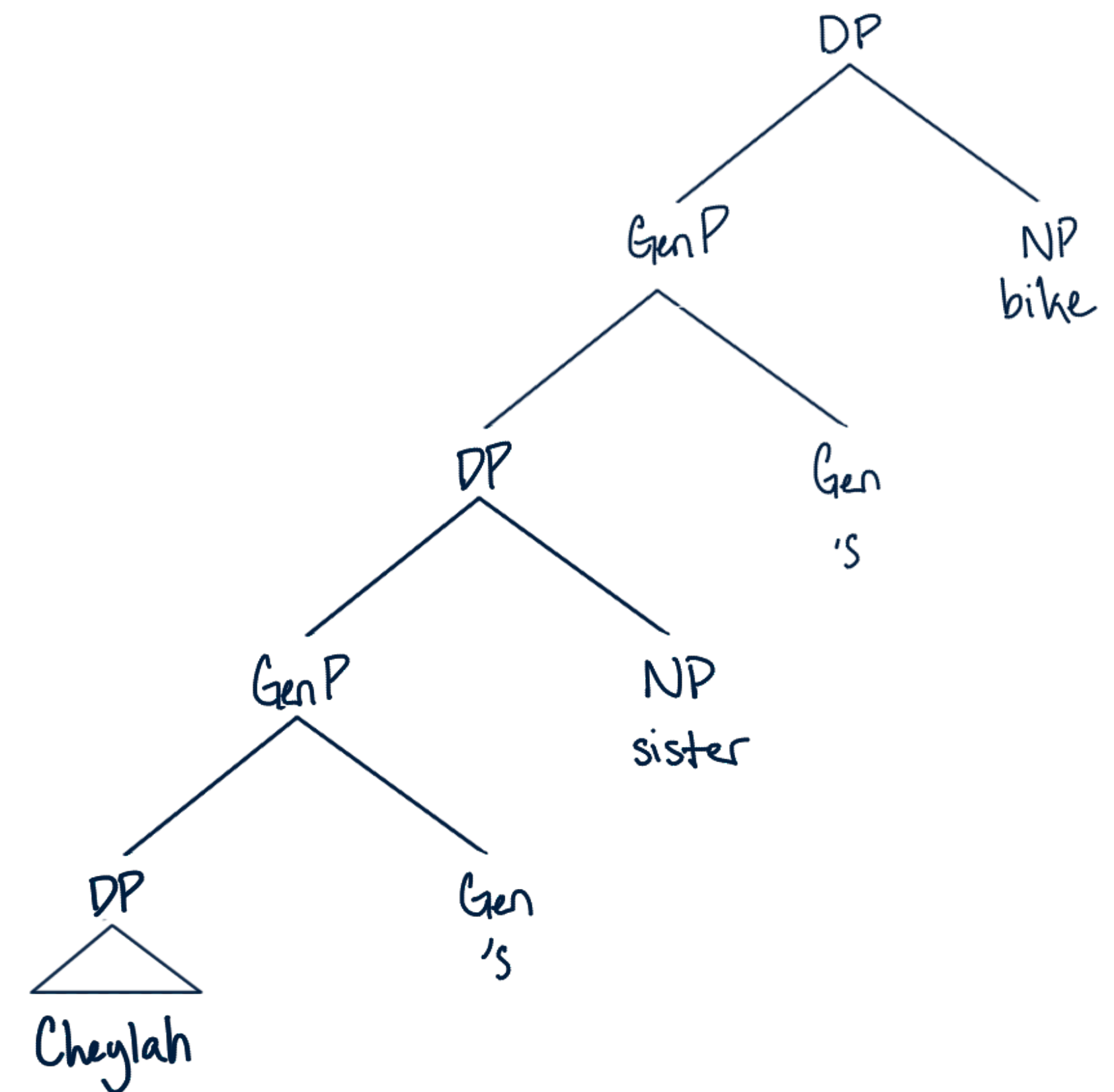
## Challenges for acquisition

### Cheylah's sister's bike

Phase 1 Phase 2 Phase 3

In a recursive possessive structure, the meaning of Phase 1 must remain available to Phase 2 (Pérez-Leroux et al. 2018)

- ➡ There needs to be a “work space” where phases can be stored after they have been interpreted, in case the rest of the derivation needs to refer back to them
- ➡ The capacity of this work space could be constrained by working memory (Pérez-Leroux et al. 2018)



# Another Potential Challenge

## *The role of interfaces*

Interfaces are links between:

1. Submodules of language (e.g. syntax-semantics) (Ramchand & Reiss 2007)
2. Language and cognition (e.g. language-theory of mind) (Ramchand & Reiss 2007)

Transferral of a phase requires interfaces between syntax and other linguistic/cognitive modules

➡ Indirect recursion involving DPs demands resources beyond narrow syntax, i.e. interfaces

# Interfaces in Recursion

*Where problems could arise*

## **Morphology-semantics** (possessives)

Possessive structures can express different kinds of relationships, e.g.

*Cheylah's sister* = inalienable, semantic (i.e. *sister* requires a possessor) (Ortmann 2018)

*sister's bike* = alienable, pragmatic (Ortmann 2018)

➔ Integration of multiple possessive relationships could pose a problem

## **Syntax-semantics-cognition** (possessives and locatives)

Duality: children must know that a possessee can simultaneously be a possessor and a Ground can also be a Figure

➔ Viewing a single entity as having two roles could pose a problem

Indirect recursion in language integrates knowledge from multiple linguistic and cognitive domains, not just syntax

➔ Children must acquire the prerequisites in all these domains before they can comprehend recursive structures:

- Merge
- Morphosyntax (e.g. *'s*, *of*, *in*, *on* etc. and branching direction)
- A work space capable of storing previously Spelled-Out phases
- Notional relations (e.g. possession, location)
- Specific mapping between notions and the target language



Tsimpli (2014) distinguishes between interface phenomena and narrow syntax and compares their acquisition in bilingual vs. monolingual children

Age of acquisition for interface phenomena:

- Is later than narrowly syntactic phenomena (Tsimpli 2014)
  - Does not differ between eL2 and 2L1 (Tsimpli 2014)
  - Are sensitive to input and length of exposure (Schulz & Grimm 2019)
  - Reflects processing limitations on the coordination of syntactic and contextual information (Sorace & Serratrice 2009)
- ➔ Bilinguals should be delayed in their acquisition of indirect recursion compared to monolinguals

## Open questions:

- Which interface(s) are the most important for comprehending recursion?
- How can we best define a work space? What role does working memory play?
- Which of the prerequisites for indirect recursion in one language can be transferred to the other language?
- Are there any prerequisites for the comprehension of indirect recursion that I have neglected thus far?
- Can we expect differences between recursive possessives and recursive locatives?

## Next steps:

- Finish designing and pilot the experiment on bilingual children
- Collect data this coming summer

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