

# MAKING CHANGES

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**In search of a learning model for modal innovations**

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# Introduction

- *Reanalysis* in the grammar of an e-language continuum is argued to be an innovative *analysis* of the input facts by a learner developing their mental grammar (Halle 1964; Kiparsky 1974; Lightfoot 1979, i.a.).
  - Diachronic reanalyses are thus “errors” on the part of the learner; inability to “correctly” characterize the input results in innovation.
  - Change appears to be non-random (=patterned), so learners are thought to be biased in their approach (e.g., Roberts and Roussou 2003; van Gelderen 2004, 2011, i.a.)
- **This proposal has not been explored in acquisition, using child language data.**

# Introduction

- At DiGS we tend to look at diachronic evidence and trends first, and then link to general principles of acquisition (=abductive analysis of strings)
- Acquisition evidence necessary for the viability of our diachronic theory
- We'd love to capture an innovator-in-action, but, well, you know...
  - Make more explicit relations between diachronic theory and L1 acquisition facts, looking for trends and biases in the learner

# PART 1

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Generative change theory and child error patterns

# Roadmap for Part 1

1. Common Changes (CC) and Common Errors (L1A)
2. Directionality of Cycles (CC) and of Development (L1A)
3. Parallel and Oppositional Patterns

*“THE LEARNING PROCEDURE LEAVES ITS FOOTPRINT IN THE MATURE LANGUAGE DESIGN”*

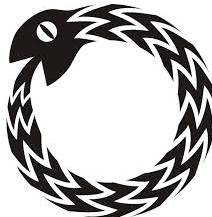
(GLEITMAN ET AL. 2005: 56)

# Common Changes

- The Linguistic Cycle (van Gelderen 2004, 2009, 2011)
  - Negation Cycle (e.g., Jespersen 1966)
  - Agreement Cycle (e.g., Givon 1976; Lambrecht 1981; Fuß 2005)
  - Tense/Mood/Aspect Cycles (e.g., Roberts 1993; Bybee et al. 1994)

**PHRASE → WORD/HEAD → CLITIC → AFFIX → Ø**  
**ADJUNCT → ARGUMENT → AGREEMENT → Ø**

- Do these biased changes reflect biases in the learner?



# Common “Errors”

## Phenomena:

- Omission (argument-drop, determiner-drop, etc.)
- Overgeneralization/Overextension (meanings, structures)
- 2L1 *Transfer* (local & limited; Hulk&Muller 2000, Dopke 2000)
  
- Can the persistence (non-correction) of these errors in individuals explain the common changes we see in the historical record?



# Directionality in Change

- *Upwards* in the tree: More functional, Higher Scope
  - Why would learners co-opt more contentful/lexical items to do more abstract/functional work, but not v.v.?
- Non-contracted to contracted
  - Why would learners prefer unanalyzed wholes over analyzable parts, but not v.v.? (c.f. Faarlund 2008, Diessel 2011)
- Etc...

*“IF CHILDREN USE ECONOMY PRINCIPLES IN BUILDING THEIR INTERNALIZED GRAMMARS, THERE SHOULD BE SOME EVIDENCE FOR THIS IN THE WAY LANGUAGE CHANGES.”*

(VAN GELDEREN 2011: 9)



# Directionality in Acquisition

- Simplex → Complex (e.g., Brown 1973; Bloom 1991)
  - ↑Input/Experience
  - Conceptual/Cognitive Development (e.g. Theory of Mind)
- Limited knowledge/resources → Adult knowledge/resources (e.g., Gleitman et al. 2005)
  - Processing ability improves
  - ↑ specified areas of the lexicon/grammar

## Biases leading to errors:

- Economy [BE FRUGAL]
  - Principles of Contrast, Mutual Exclusivity; Whole-Object Constraint
- Expressivity [BE CLEAR]

# Economy Principles

Economy (e.g. Lightfoot 1979's Transparency Principle)

- These principles characterize biases in the learner which give rise to specific types of diachronic changes.
  - Induced from changes observed (& theory), not from child biases

Van Gelderen 2011:

- **Late Merge Principle (LMP)**
  - “Merge as late as possible”
  - Lexical categories are acquired before functional (e.g., Josefsson and Hakansson 2000 in vG2011: 21-26); prepositions before complementizers, *for* or *like*
- **Head Preference Principle (HPP)**
  - “Be a head, rather than a phrase”
  - Initial preference for heads in children (e.g., Diessel 2004 in vG2011: 21-26) first relative pronouns are C (that)

# Directionality Phenomena

## Parallel Examples



- Root > Epistemic Modality
  - Root earlier in child language
  - AND earlier in historical record
- Representation (LMP):
  - L1A: Lexical > Functional
  - CC: Lexical > Functional

## Oppositional Examples



- Dem > Comp
  - C<sup>0</sup> relative pronouns earlier in child language
  - BUT later in historical record
- Representation (HPP):
  - L1A: Heads emerge first
  - CC: Adjunct > Specifier > Head

Also WH-in-situ in French (Strik 2012) and Brazilian Portuguese (Grolla 2009)

# Different Errors for Different Changes

## Parallel Pathways

- Expressivity Forces
  - Widening
- The child learner extends an aspect of the adult input in order to advance the cycle.
  - L1A Overgeneralization
  - L1A Overextension

## Oppositional Pathways

- Economy Forces
  - Contracting
- The child learner disregards an aspect of the adult input in order to advance the cycle.
  - L1A Conservativity
  - L1A Feature Economy

# PART 2

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A model for learning modals

# Roadmap for Part 2

- A Parallel Case: Modals in L1A and CC
- Some evidence for Overextension: Cournane (to appear)
- A Model for Learning Modals
  - Synchronic basis: Event Relative Semantics
  - The **Upwards Overextension Model** (UOM)
    - Stages 1, 2 & 3
- Testing the Model (underway)
  - CHILDES & Truth-Value Judgement Task
- Conclusion

# Modals

- Semantically-defined functional category that qualifies events along a possibility↔ necessity continuum.
- Composed of:
  - **Quantification**:  $\exists$  or  $\forall$
  - **Flavour**: Root or Epistemic(Also called agent-oriented and speaker-oriented, respectively, e.g., Bybee et al. 1994)
    - 1) a. *David **can** swim better than a fish.*  
(Root: Ability)
    - b. *You **have** to take the Parc bus to get to Mile End.*  
(Root: Teleological)
    - c. *You **can** use my floss. You **should** floss more regularly.*  
(Root: Deontic)
  - 2) *Beth **must** want to go dancing, she's wearing her dancing shoes.* (Epistemic)

# Questions and Goals

- Are child learning pathways and errors for modals compatible with innovations along the modal cycle?
- Two distinct goals:
  - What learning model can account for (a) what is known about child acquisition of modals and, (b) also predict errors in the direction of known semantic changes?



# Parallel Pathways

The Modal Pathway (German; Fritz 1997):

O.H.G. *müssen*<sub>ability</sub> → M.H.G. *müssen*<sub>deontic</sub> → Mod.G. *müssen*<sub>epistemic</sub>

- The Modal Cycle (see Gergel 2009)
  - Semantic: Lexical → Root → Epistemic → Ø (Traugott 1989; Bybee et al. 1994, a.o)
  - Syntactic: V → T → C/Ø (e.g. Lightfoot 1979; Roberts 1985)
  
- Modal Development
  - Semantic: Lexical → Root → Epistemic (e.g. Wells 1985)
  - Syntactic: V → T → C
    - *want* precedes *can* precedes *must* precedes *actually* (Sarah; Brown 1973)
    - lexical precedes functional

# Modals in Acquisition

- Root modal meanings emerge around age 2, epistemic meanings after age 3 (Wells 1985; Stephany 1979; Papafragou 1998; a.o.).
  - These studies have focused on the emergence of lexical items in naturalistic speech.
  - Papafragou argues that epistemics are later because they require a more sophisticated *Theory of Mind* (=conceptual development)
    - 1) *Tree **can't** dance.* (Adam 2;08,16)
    - 2) *You **must** have pencil.* (Urging his mother to take a pencil, Adam 2;11,28)
    - 3) *He **must** be ready for his lunch.* (His baby brother is crying, Adam 3;05,01)



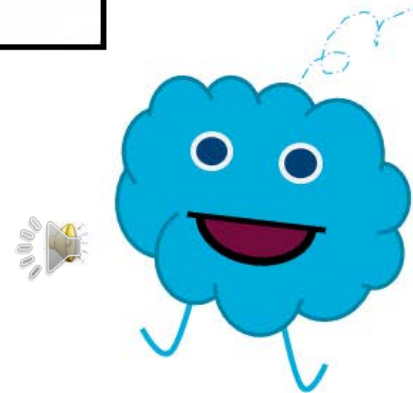
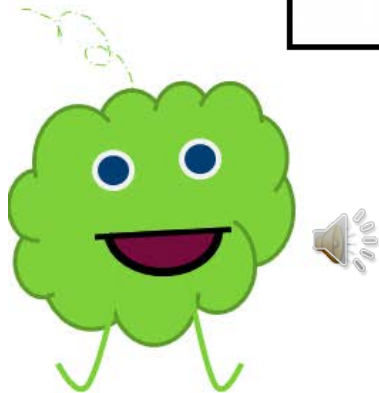
# Cournane (to appear)

- Question: Are overextension errors in the same direction as innovations?
  - **LEXICAL → ROOT → EPISTEMIC**
  - Instructions for Innovation: erroneously use a root-restricted modal in an epistemic context (& don't correct it)

## Lexical Preference Task

- Design:
  - 16 monolingual English children (4;9 to 6;4,  $M = 5;5$ ,  $SD = 5.36$ ).
  - 16 adult controls (18-25 years old).
  - Based on lexical contrast
  - 8 trials with 4 epistemic contexts (2 with target *might*, 2 with *must*) and 4 root contexts (2 with target *can*; 2 with *have*).

# Cournane (to appear)



# Cournane (to appear)

Table 1

*Error Rates for Condition Across Groups in the Preference Task*

| Condition | Lexical Contrast                   | Sample Target Sentence                                  | Competitor Modal | Error Type | Error Rates                      |                           |                              |
|-----------|------------------------------------|---|------------------|------------|----------------------------------|---------------------------|------------------------------|
|           |                                    |   |                  |            | Adult                            | Child                     |                              |
| Root      | <i>must</i><br>~<br><i>have to</i> | “He <b>has</b> to put<br>choco-chips in<br>the batter”  | <i>Must</i>      | Down       | <i>must</i><br>in<br><i>have</i> | 12                        | 12                           |
|           | <i>might</i><br>~<br><i>can</i>    | “I don't want it,<br>you <b>can</b> drink<br>it”        | <i>*Might</i>    |            | <i>might</i><br>in<br><i>can</i> | 11                        | 10                           |
|           | Total                              |   |                  |            |                                  | <b>23</b><br><b>(18%)</b> | <b>22</b><br><b>(18%)</b>    |
| NonRoot   | <i>must</i><br>~<br><i>have to</i> | “He <b>must</b> be<br>scared of<br>snakes”              | <i>?Have to</i>  | Up         | <i>have in</i><br><i>must</i>    | 1                         | 9                            |
|           | <i>might</i><br>~<br><i>can</i>    | “She <b>might</b> 've<br>hurt herself on<br>the swings” | <i>*Can</i>      |            | <i>can</i><br>in<br><i>might</i> | 1                         | 9                            |
|           | Total                              |   |                  |            |                                  | <b>2</b><br><b>(2%)</b>   | <b>***18</b><br><b>(14%)</b> |

# Cournane (to appear)

## Results

- Logistic mixed-effects modeling showed that for upwards errors (Root > Epistemic; root modals used in epistemic contexts), *group* (Adult, Child) was highly significant (child,  $\beta = -2.624$ ,  $p=0.002$ ).
- The log odds indicate that **a child is 14 times more likely to pick the upwards-extended error than an adult.**
- The opposite direction (Epistemic > Root) was not significant and children behaved nearly exactly like adults.

“If I was Spiderman I could stick to buildings and wouldn’t **have to** fall off!!”  
Thomas, 5

# A MODEL FOR MODALS

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What learning model can predict this direction of errors?

# Kratzerian Modality

- Possible worlds semantics (Kratzer 1977, 1981, 1991, 2012)
- Modals include at least two components:
  - A Modal Base: a set of worlds that represent knowledge (epistemic), rules (deontic), beliefs (bouletic), etc., varying by flavour.
    - Modal flavour is context-dependent
  - A quantifier: either  $\forall$  or  $\exists$  (compare *must* vs. *might*)
    - Modal Force is lexically encoded (c.f. Matthewson et al. 2008)
- In sum, modals are quantifiers; flavour comes from contextually-salient worlds (Modal Base)



# Event-Relative Modality

- Hacquard (2006, 2009, 2010) argues modals are relative to events, not worlds
- Two major observations about ROOT vs. EPISTEMIC modals
  - I. Cross-linguistic syntactic height differences (e.g., Jackendoff 1972; Cinque 1999); epistemic high and root low
    - **two modals, two positions** ; **must<sub>1</sub>** and **must<sub>2</sub>**
  - II. Strong cross-linguistic within-language tendency for modal lexemes to express multiple flavours (e.g., Kratzer 1981, 1991)
    - **one modals, two meanings**; **must**
- Hacquard wants to predict semantics from syntactic position...

# Event-Relative Modality

- How is modality, a semantically defined category, articulated into the syntax?
  - **one modal, two positions**
  - Hacquard (2010:13) notes, “[t]he problem is not merely to let modals appear in two positions, but to ensure that the low position is reserved for roots and the high one for epistemics.”
- Modal lexemes are free for flavour (ROOT vs. EPISTEMIC)
  - They are quantifiers with event variables {e} which must be locally bound, like pronouns (c.f. Percus 2000 for world variables)
  - Contextual salience is tied to the syntax

# Event-Relative Modal Lexemes

- Modals can only be bound in one of two positions in the clause:
  1. Above VP for ROOT: [CP  $\lambda e_0$  [TP **Asp<sub>1</sub> Mod e<sub>1</sub>** [VP V e<sub>1</sub>]]] (Hacquard 2006)
    - The VP event anchors the modal to the subject and the time provided by Tense
  2. Above TP for EPISTEMIC: [CP  $\lambda e_0$  **Mod e<sub>0</sub>** [TP T Asp<sub>1</sub> [VP V e<sub>1</sub>]]]
    - The speech-act event anchors the modal to the speaker and the speech time

# The Restricted Selection Problem

- Event-relative modal lexemes are **free** for flavour
  - all modals should, in principle, appear in both modal positions in the clause: “**one modal, two positions**”
  - However, usage and diachronic and L1 development provide evidence that this is not the case.
    - *Must* is losing deontic ground in all dialects (Tagliamonte & D’Arcy 2007)
    - *Might* is only epistemic (see Hacquard & Wellwood 2012; c.f. Condoravdi 2002, metaphysical uses)

# The Restricted Selection Problem

- Can L1 errors create this pattern of diachronic restrictions on modal lexical items?
- And in turn, can diachronic steps create gaps in synchronic systems (e.g. PDE *might*)?
  - “[i]diosyncrasies of particular modals (e.g. *might*) are due to selectional properties hardwired into the lexical entries” (Hacquard 2010: 11 fn. 4).
- The event-relative model translates to acquisition pathways and to the modal cycle *because* modals are unrestricted for flavour.

# A 3-Stage Generative Learning Model

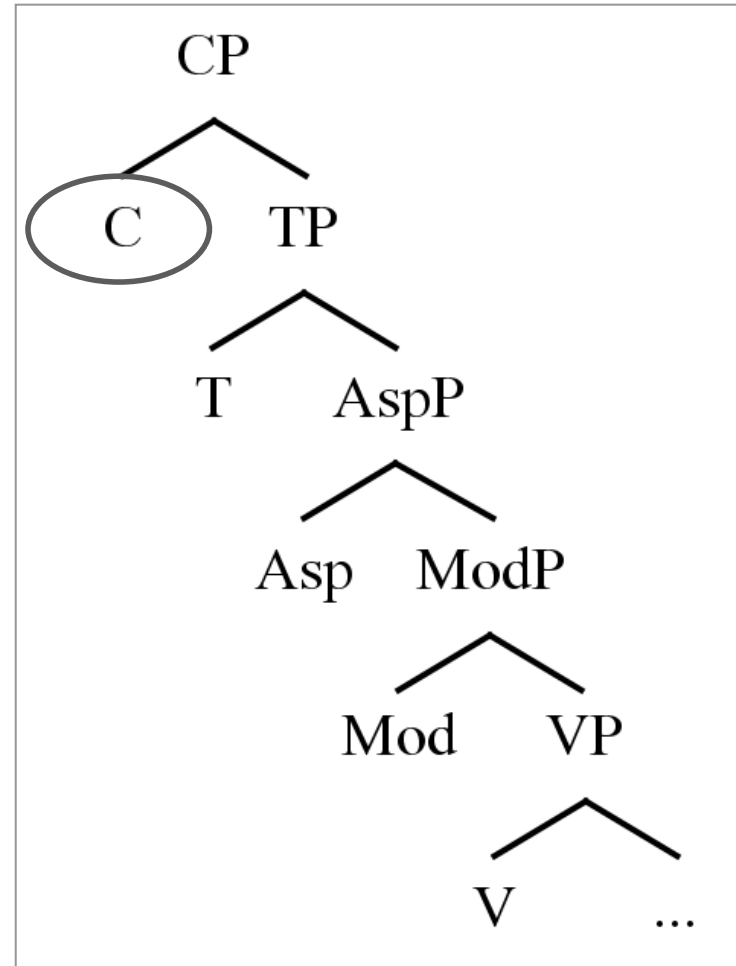
- I propose 3 stages in the learning process
  - Stage 1: Younger than  $\approx 3;0$
  - Stage 2:  $\approx 3;0$  to  $\approx 6;0$
  - Stage 3: Later than  $\approx 6;0$
- Assumptions
  - Children rely more heavily on discourse than adults (e.g. Roeper 2004)
  - Children make few substantive errors of co-mission (e.g., Snyder 2007), however, overgeneralization /overextension errors are relatively common (e.g., Bowerman 1972, 1982)
    - “*He giggled me*”, “*He disappeared the turtle*”
  - Generative architecture and statistical learning achieve the best results when coupled (e.g. Yang 2004, 2011; Trueswell et al. 2013)

# Empirical Questions

- Does the order of acquisition of modals reflect sense and structure development or frequency only?
- Are young children formally limited to root modalities?
  - N.B. Earlier studies lack sufficient sophistication; all pre-1991, focused on lexeme-emergence, and were conducted primarily by psychologists
- Does structural and featural development enable modal polysemy?
- Does epistemic modal meaning become available only after the development of propositional (TP) complementation?
- Do children overgeneralize modal meanings from root structures to epistemic structures, and not v.v.?

# Stage 1: Underspecified Trees

- Learners begin with root modals
  - They are linked to the argument structure (agent) of the main verb
- Why do learners begin with root, not epistemic?





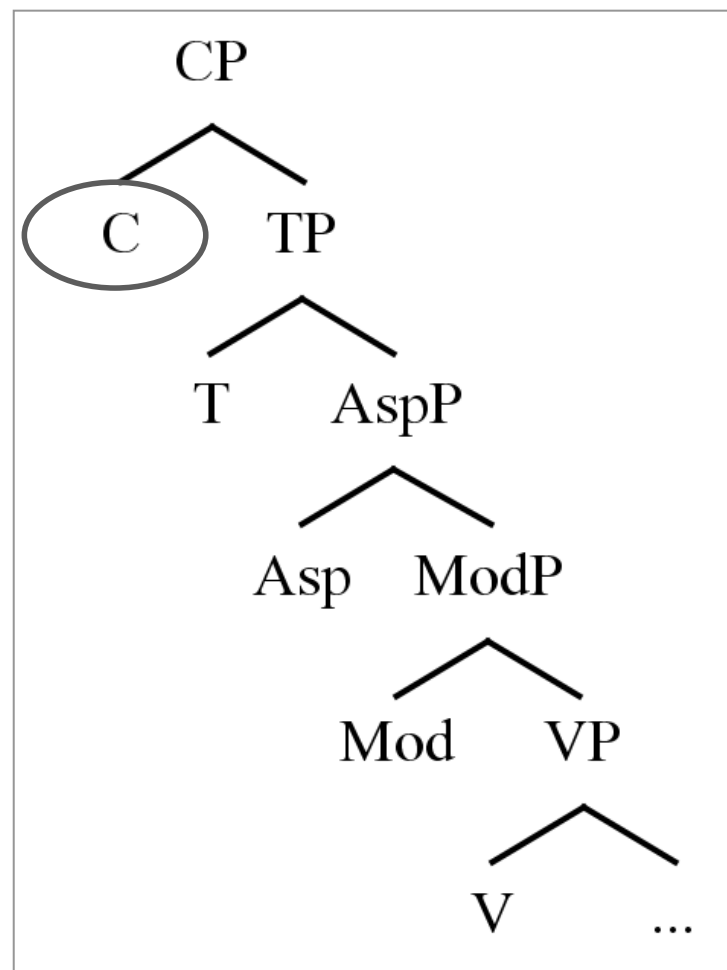
# Discourse-Linking & Head Underspecification on C<sup>0</sup>

Motivation:

- Young children lack formal specifications and thus over-rely on direct discourse linking; often argued that much of acquisition is learning to *formally* link to the discourse (e.g., Roeper 2004)
  - Discourse linking
    - **Direct Linking** – “Cookie” when nodes are empty
    - **Formal/Grammatical Linking** – “That cookie” when features present in D
- Head Underspecification (Hoekstra & Hyams 1996, 1998)
  - “The value of a functional head is not grammatically determined”
  - They argue that Number underspecification gives rise to optional:
    - Root Infinitives, Pro-Drop, Determiner Drop
  - Once Number specification is acquired, direct discourse linking is blocked

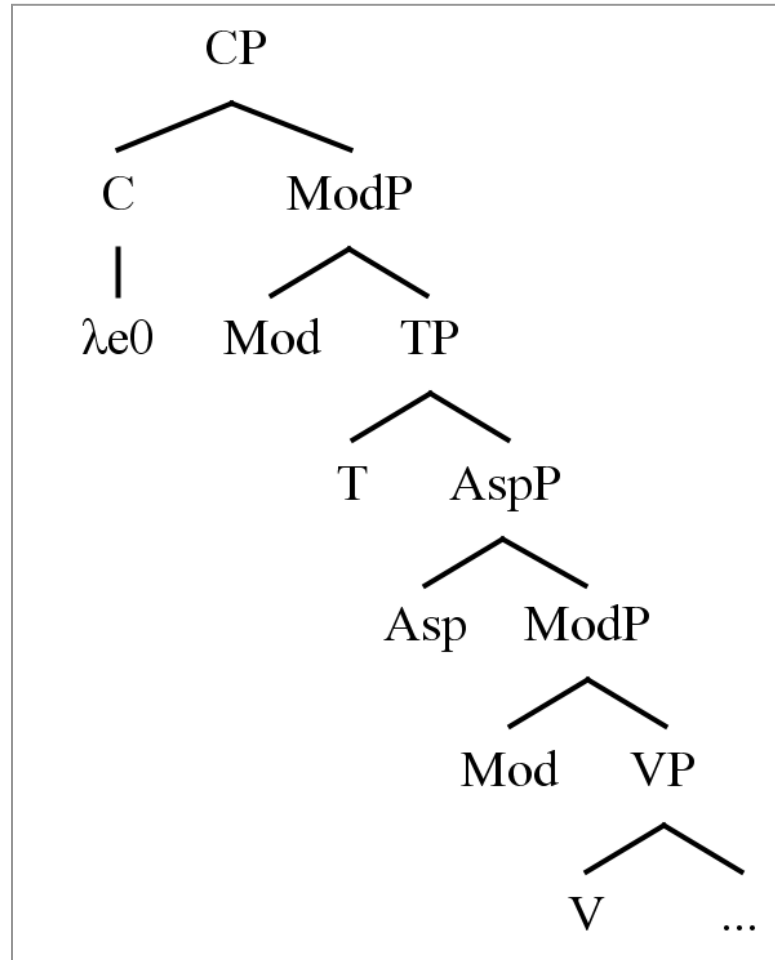
# Stage 1: Underspecified Trees

- Early L1 overreliance on direct-linking to the discourse
  - The speech act is not formally encoded on C (yet)
    - **High epistemic modals cannot be bound**
- **$\lambda e0$**  is not encoded by early learners (i.e. the conceptual ability is not yet present) , who do not yet think of sentences as formal objects (c.f. Piaget)



# Stage 2: Specified Trees and Overextension

- Child formally encodes the speech-act event
  - $\lambda e_0$  binds the event variable when the modal is in the high position (Hacquard 2006).



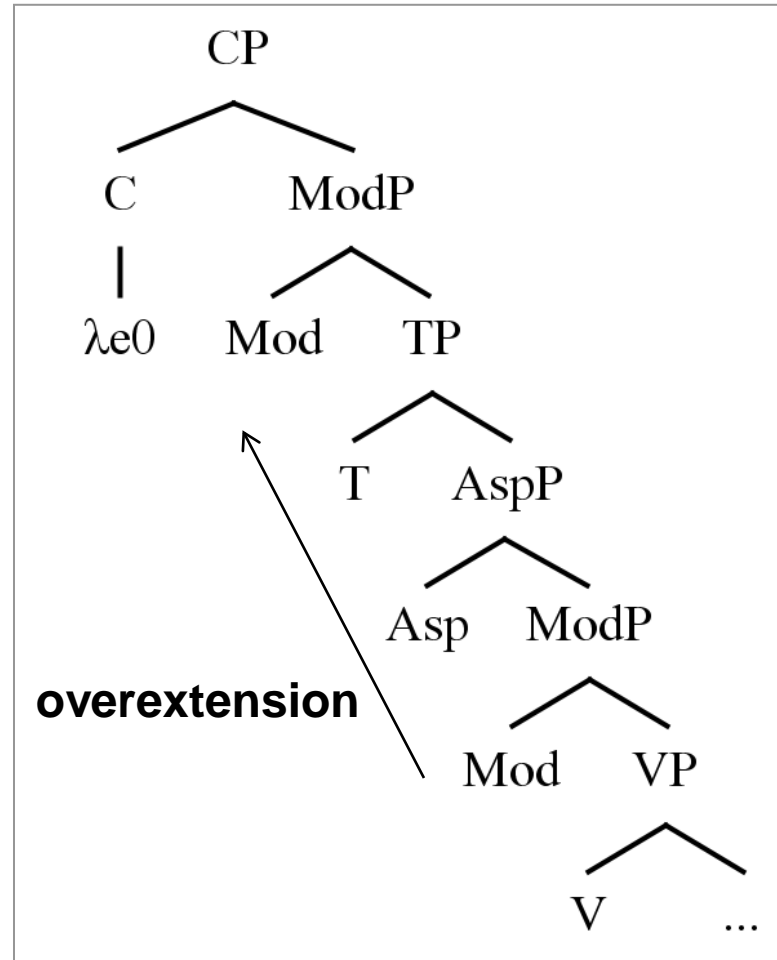
# Triggers for $\lambda e0$ on $C^0$

- Complementation Development
  - Epistemic modals require propositional content (Hacquard 2006)
    - Sentential Complements develop (unequivocally) after 3;0 (Diessel and Tomasello 2000), as do epistemic modals
      - *[I wish[that I could play with this]]* (Adam 3;5)
- Expletive Subject Development
  - *That might be*
    - Can't be agent-oriented for root reading
- Conceptual development (e.g. Piaget, Papafragou 1998)

# Stage 2: Specified Trees and Overextension

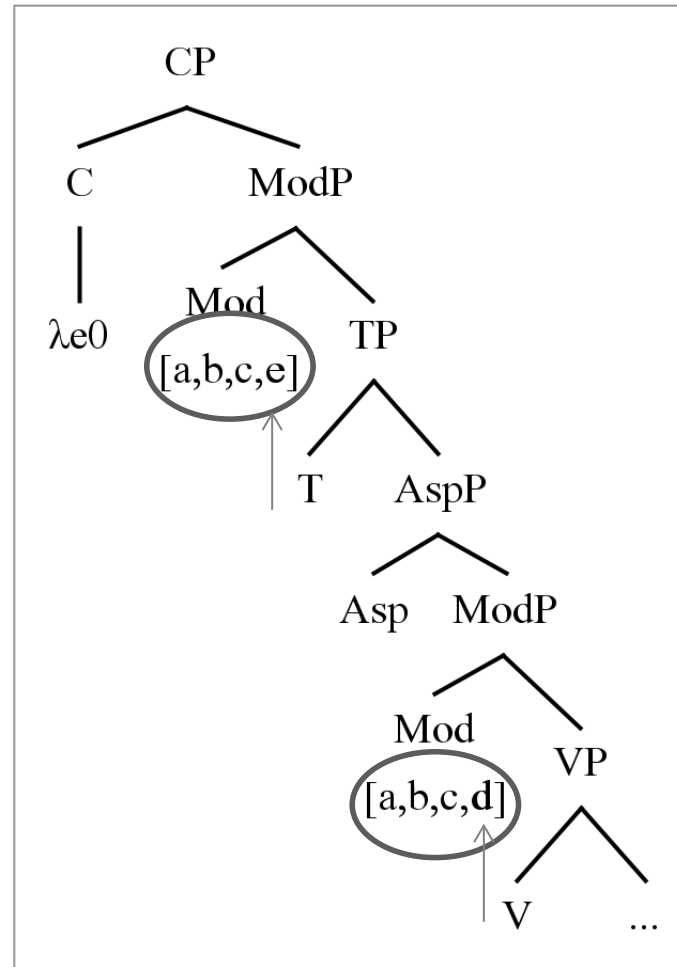
- Modals extend to both positions
  - Modal lexemes are free to merge in either position
  - Root-only modals erroneously overextend.

“She can have hurt herself”



# Stage 3: Statistical Learning

- In the final stage, the child must recover from overextensions and refine her mental lexicon
  - i.e. restrict modals to root modality when no evidence that a modal is epistemic arises.
  - “lexical hardwiring” of Hacquard (2010)

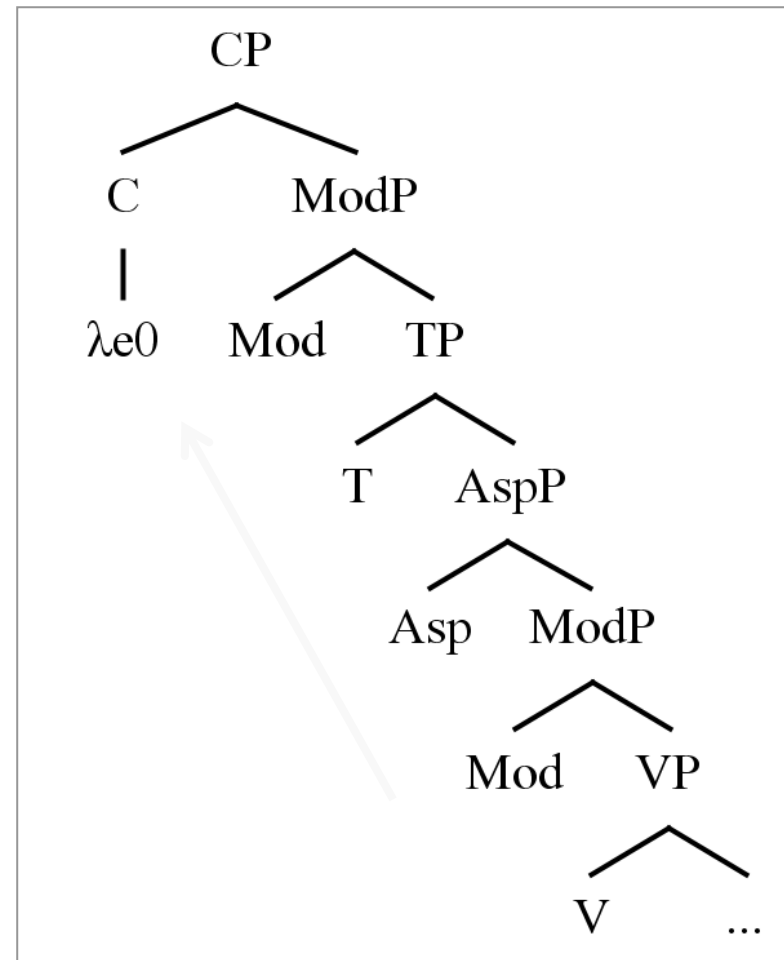


# Recovering from Overextension Errors

- Recovering from overextension occurs via statistical learning;
  - No negative evidence necessary
- **Entrenchment** strengthens a particular structure and **preemption** provides alternative competing (or blocking) structures.
- Brooks et al. (1999); Brooks and Tomasello (1999); statistical learning of this type kicks in late.
  - a. #*He **can** be scared of snakes*(Overgeneralization)
  - b. *He **might** be scared of snakes* (Pre-empting) **discourages**
  - c. *He **can** dance* {SUB *can* V} (Entrenching) **reinforces**

# Learning Errors and the Modal Cycle

- L1 errors become innovations when and if entrenchment/preemption fails to limit the overextension errors
- Upwards Reanalysis (Roberts & Roussou 2003; see also van Gelderen 2004 Late Merge)
  - In configurational semantics
  - N.B. Overextension may appear first in some constructions, e.g., negatives, or perfectives, etc...





# Testing the Model (underway)

## CHILDES Corpus Study (Sarah 2;3-5;1; Brown 1973)

- Allows evaluation of frequency effects, syntactic development (tense, aspect, complementation, negation, etc.), and to a lesser degree, semantic flavour.
- 2500 modals

## Truth-Value Judgement Task (Crain and Thornton 1996)

- Allows access to truth-value judgements of young children (semantic judgements)
- The way to test if children below a certain age have epistemic meanings (rather than just lexical items) is this.
- My TVJT is based on Epistemic Containment restrictions (von Stechow and Trudgill 2003)
  - Quantifiers cannot scope over epistemic modals

# What about *might*? Why up, not down?

Why does *might* not get keyed back down to the Root position in Stage 2? Why is loss bottom-up?

## Up not Down

- Economy *within* Expressivity; Blocking effects due to “Crowding Out”
- Once high, less expressive value; neither economical NOR expressive to move it down.
- (Tentative) *Might* is low in the input, so learners make decisions about its properties *after* they’re grammar can handle it.
- Epistemic-only modals don’t appear at all in Sarah (Brown 1973), who was recorded past age 5
  - They do occur in a Sentence-Repair study I conducted, among children >5;0

# Conclusions

- Different L1A error-types match-up with different types of reanalysis; cycles are advanced by learners either due to economy or expressivity pressures (simply put)
- Modals are a case of parallel pathways, so child errors are expected to be of the overextension type in order to advance the Modal Cycle
  - Some evidence for overextension from Root > Epistemic in L1A
  - In parallel alignments of CC and L1A, directionality comes from expressivity (bound also by economy)
    - Widening Scope/Widening Meaning Coverage
    - Lack of Error-Correction



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Thank you!

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***“EVERY THEORY  
ABOUT LANGUAGE ACQUISITION  
ALSO MAKES PREDICTIONS ABOUT THE  
NATURE OF LANGUAGE CHANGE.”  
NIYOGI (2004: 462)***