

LEARNING IS CHANGING:
MODELING AND TESTING THE ROLE CHILDREN
PLAY IN CHANGE ACROSS DOMAINS

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INTRODUCTION

Acquisition is an intuitive place to look for explanation for language change phenomena:

- Each child must learn their individual grammars via the indirect process of analyzing the output of others' grammars; (e.g., Andersen 1973; Lightfoot 1979; Hale 1998; Roberts & Roussou 2003; van Gelderen 2004; Kroch 2005, Kodner 2020).
- Necessarily involves social transmission (Lenneberg 1964) over many years. Sociolinguists have documented differences in language usage across generations and inferred a role for social learning in how young people participate in ongoing changes-in-progress (e.g., WLH 1968; Labov 2007; Tagliamonte & D'Arcy 2019; Smith & Holmes-Elliott 2018, 2022).

“The changes in language fulfil themselves in the **individual**...the main period for the exercise of such influence [from others] is the **time of the first acquisition - of the learning of language**”

- Paul 1920 [1880]:15

ABOUT ME & IN THIS TALK

A bit about me:

- Primarily a developmental psycholinguist, studying modality in LIA.
- But, I got into LIA because of work on historical syntax: proposals that learners are agents of change.

In this talk and my change-related research more broadly:

- Big Q: Can we render proposals about learning that were based on diachronic and sociolinguistic data testable experimentally in child populations?
- We will sketch a model of change with learning at it's center; then, we'll focus on **Incrementation**.



TERMINOLOGY

WHAT IS “CHANGE” ANYWAY? LET’S GET OUR DUCKS IN A ROW



TERMINOLOGY

Subfields do not agree on what *change* is, and typically focus on different facets:

- **LIA Change**: Learning is change over time in the individual. The child's grammar changes as they engage with their input experience over their learning path. Target knowledge is standardly assumed to be fixed.
- **Diachrony/Historical Change**: Two i-languages (individuals' grammars) in a descent relationship that differ in some respect >> "reanalysis".
- **Variationist Sociolinguistics Change**: Community-level variation over time (change-in-progress) that competes, then completes, leaving two stages of an e-language in a descent relationship.

How can we unite these, maintaining their insights, in a way that centers learning (so it is experimentally testable)?

“INNOVATION”

INNOVATION

ACTUATION

INCREMENTATION

An input-divergent analysis of any kind along the learning path

- Individual i-language, measurable *between* grammars only; usually overwritten with more learning time
- Gives a pool of candidates for changes, invites LIA research to the change table; **overregularization** is perhaps best example (e.g., Hudson Kam & Newport 2005; Yang 2016; Kodner 2020, i.a.)
- >> **ALL CHILDREN ARE INNOVATIVE** along their learning path (Cournane, 2015, 2017, 2019), as they dynamically respond to their input and productively communicate over developmental time.

“[A] general theory of change must provide an account for any change [=innovation], **regardless of whether or not it diffuses.**” - Hale (1998:6)

“ACTUATION”

INNOVATION

ACTUATION

INCREMENTATION

A process that occurs if an innovation is maintained (“catches on”) in a peer-group and survives into the e-language for linguists to measure;

- Rare (cf. innovation is a norm of learning). Labov et al. (1972). N.B. Weinreich, Labov, & Herzog (1968) – the “when” Q; see Walkden (2017) for recent discussion.
- >> **CHILD PEERGROUPS CAN BE ACTUATION SITES**

“Two characteristics hold of language acquisition: first, that children make errors in acquisition which take time to correct and second, **that errors propagate from one child to another**” - Kroch (2005:27)

“INCREMENTATION”

INNOVATION

ACTUATION

INCREMENTATION

The process of spread or extension of the actuated innovation within the grammar and/or the increase in frequency over historically older variants.

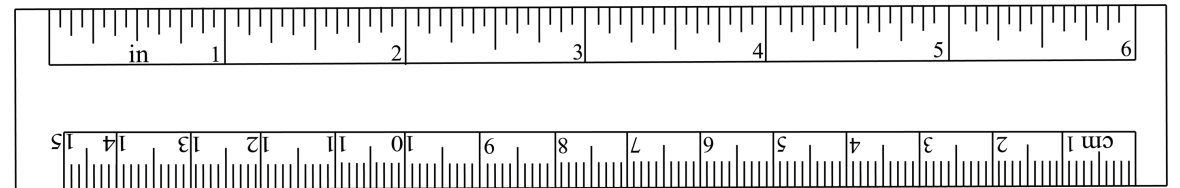
- Commonly, the innovative variant gradually overtakes the more conservative variant; grammar competition (e.g. Kroch 1989, i.a.) or gradual changes in e-language (e.g., Traugott 1989)
- Measurable by comparing individuals' usage patterns in real and apparent time
- **>> LEARNING CAN CREATE THE DIRECTIONAL SHOVE FOR C-in-P** (Cournane 2019)

“Incrementation may involve **increase in frequency, extent, or specificity** of a sociolinguistic variable” - Labov (2007: 346)



INCREMENTATION: CASE STUDIES

THE MOST MEASURABLE OF CHANGE FACETS IN LIA



“CLASSIC” INCREMENTATION

- Acquisition (complete, faithful), aligned to the caregiver, followed by incrementation (here for a vowel shift). (Labov 2001, 2007)
- “Vernacular reorganization” sometime after age 4, aligning to peers (e.g., Denis et al., 2019).
- Examples of this pattern: Labov (1989), Roberts (1997), Smith, Durham and Richards (2013), Miller (2013), Smith (2017)...

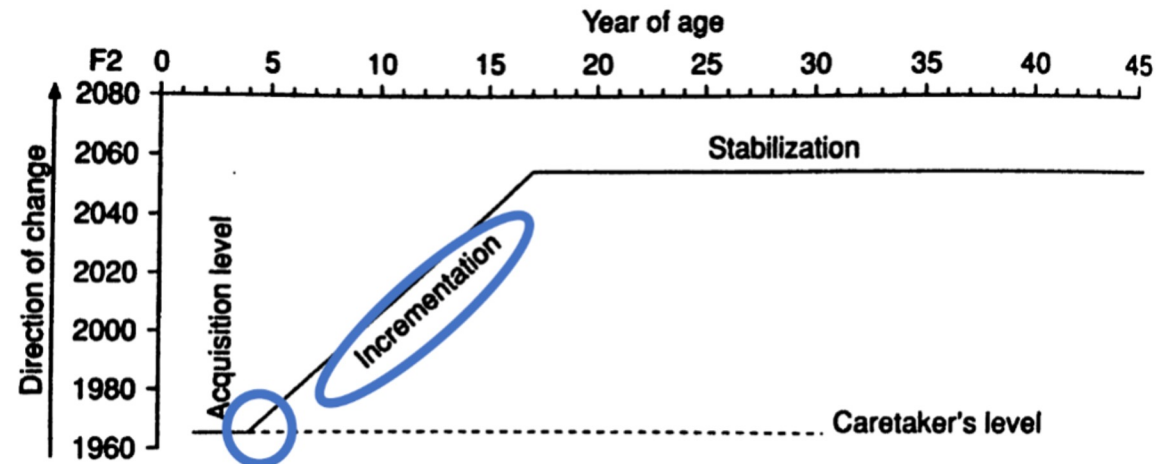


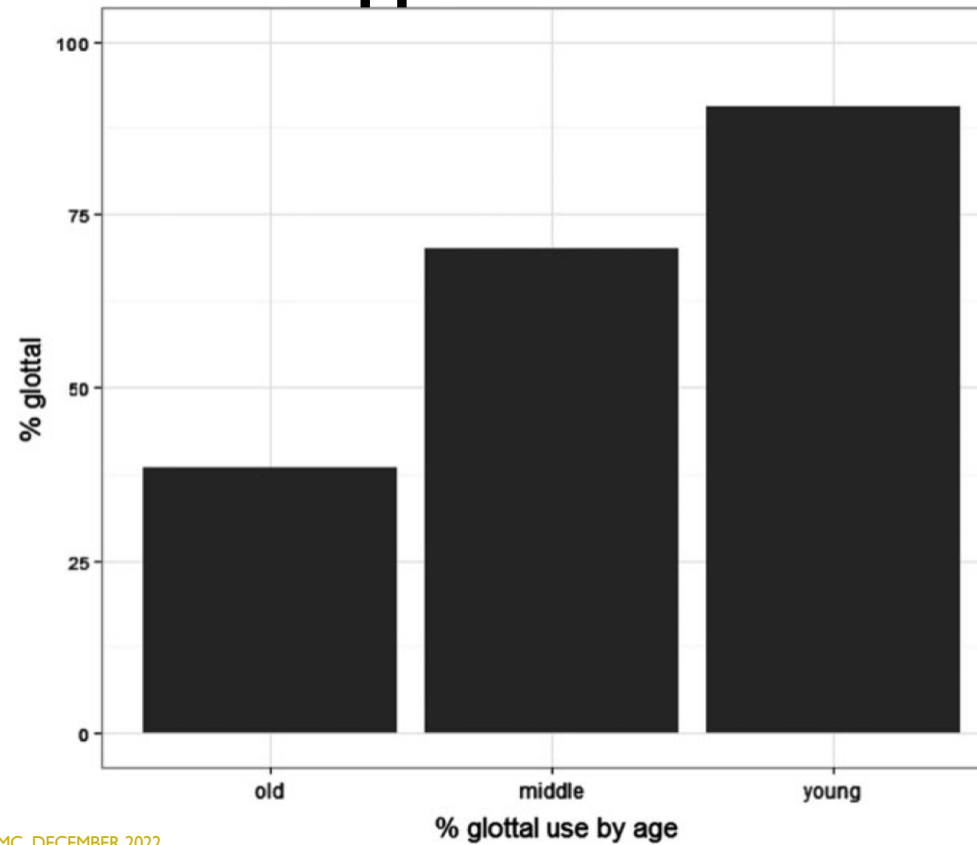
Figure 14.1 A linear model of incrementation for a single female speaker from 1 to 45 years of age

“[...] successive **cohorts and generations of children advance a change beyond the level of their caretakers and role models.**” – Labov (2007:346)

Incrementation starts “**at some point after age four.**” – D’Arcy (2015:588)

“CLASSIC” INCREMENTATION

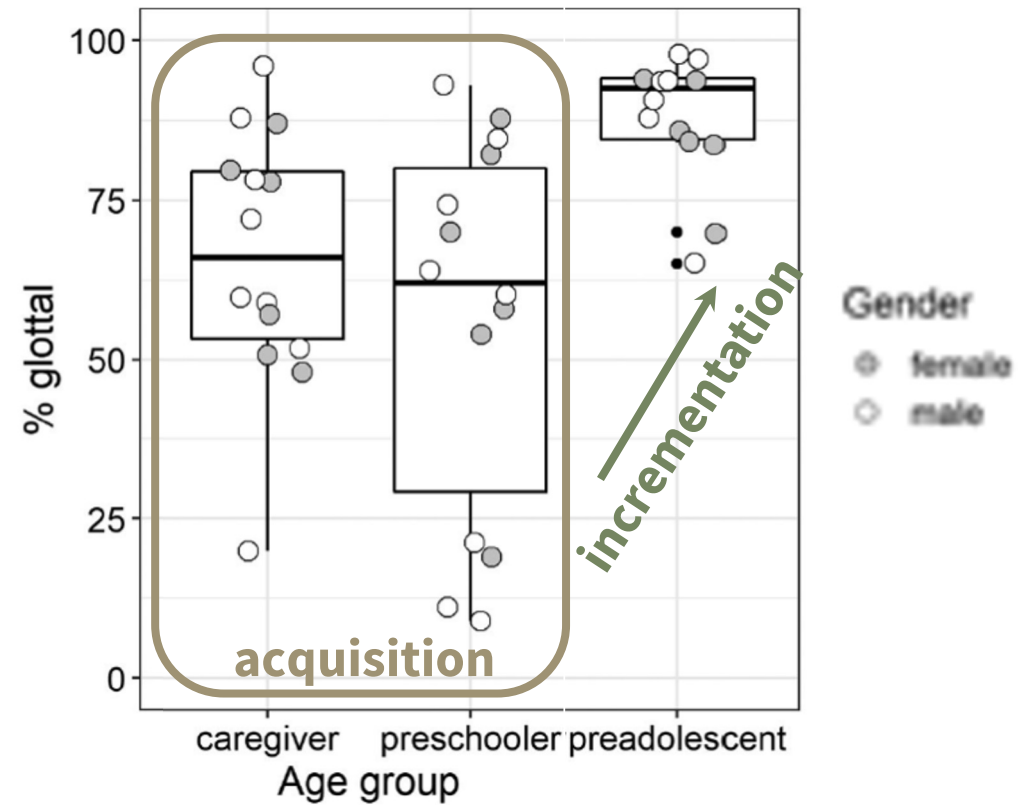
apparent time



AMC, DECEMBER 2022

(Smith & Holmes-Elliott 2018:10)

real time



(Smith & Holmes-Elliott 2022:107)

WHY DO CHILDREN INCREMENT?

HI. The “age vector” hypothesis: children recognize that younger and older people speak differently, and, in aiming to align with their peers' productions of a changing variant, end up exceeding it and pushing the change forward. *Children tune in to already ongoing changes-in-progress, LIA learning is inert.*

“[...] it must be the case that children infer the direction of change from the behavior of speakers of different ages in the speech community. That is, **children must be attuned to** what Weinreich, Labov, and Herzog (1968:184) observed is the ‘**continuous distribution through successive age levels of the population.**’”

– Denis et al. (2019:48)

“I would suggest that children are **keen observers of vectors** within the speech community [...] children appear to be **alive to the vector**, actively looking to those just a little older than themselves as models”

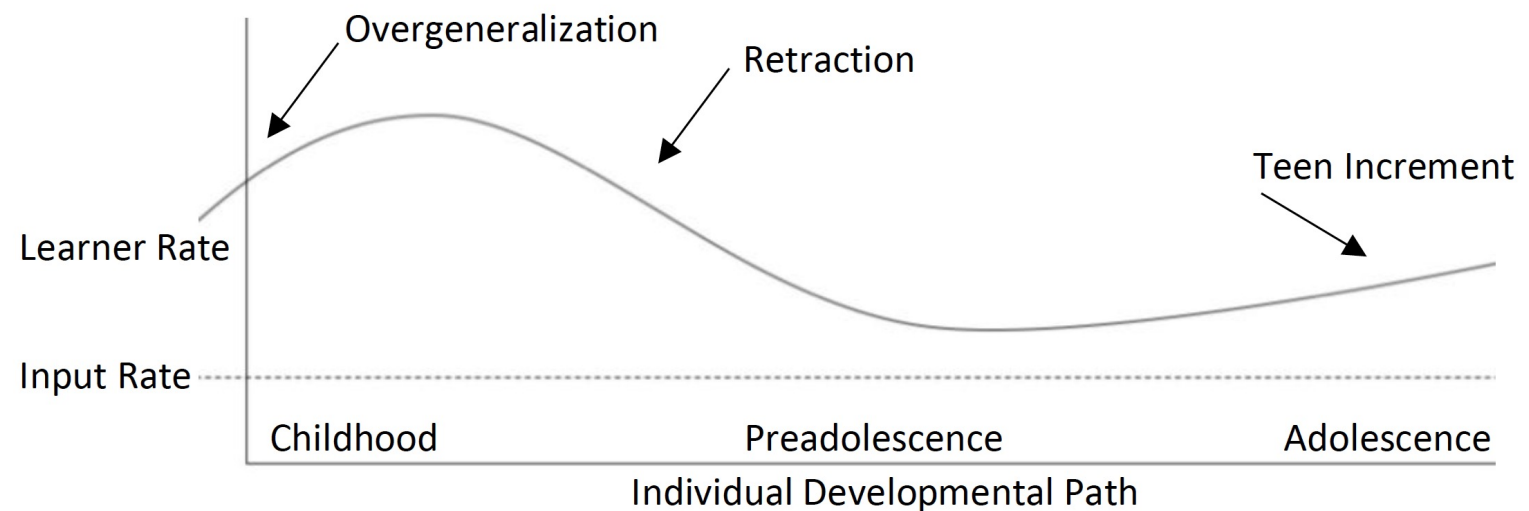
– Sankoff (2019:222)

WHY DO CHILDREN INCREMENT?

H2. The child-learning hypothesis: incrementation is set-off by the learning process itself, and proceeds directionally as input-divergent acquisition patterns continue to occur in peer groups over generational time (Cournane, 2015, 2019; Cournane & Pérez-Leroux, 2020; Hall & Maddeaux, 2020). *LIA learning is active, children drive and set the direction of (at least these) changes-in-progress.* Whatever makes children innovative during learning (phenomena-specific), also makes them increment.

Reverse “U-shaped”
incrementation →
(Cournane, 2019)



“Two steps forward, one
step back”
(Hall & Maddeaux, 2020)



PH- CASE STUDY: HALL & MADDEAUX 2020

- Directly compare children and their caregivers, for two vowel variables of Canadian English (Toronto): /u/-fronting (change-in-progress; Boberg 2010, i.a.) (and /æ/-raising (stable variation; Boberg 2008, i.a.)).
- Elicited production picture-naming; 106 monosyllabic words: 27 with /u/, 18 with /æ/, 61 to complete the vowel space.
- 19 families from Toronto, with 24 children (aged 4-12; balanced for age groups and gender); monolingual, typically-developing. 20 parents tested. 16 non-parent age-matched adults.
- Do young children match parents or overgeneralize in the direction of change-in-progress?



Prompt: <i>This is a...</i> (Expected answer: <i>cat</i>)	Prompt: <i>This face isn't happy, it's...</i> (Expected answer: <i>sad</i>)
	

PH- CASE STUDY: HALL & MADDEAUX 2020

“Our results for /u/-fronting do not follow the expected incrementation pattern. Instead, we find the opposite: **the youngest children are most advanced in the change**, followed by the middle age group, and then by the oldest.” – HM(56)

- Post-coronal/palatal – fronted as far as can be.
- Pre-/l/ - marginally fronter only for youngest.
- Elsewhere – here’s where the movement is happening! **moon, goose, boot**

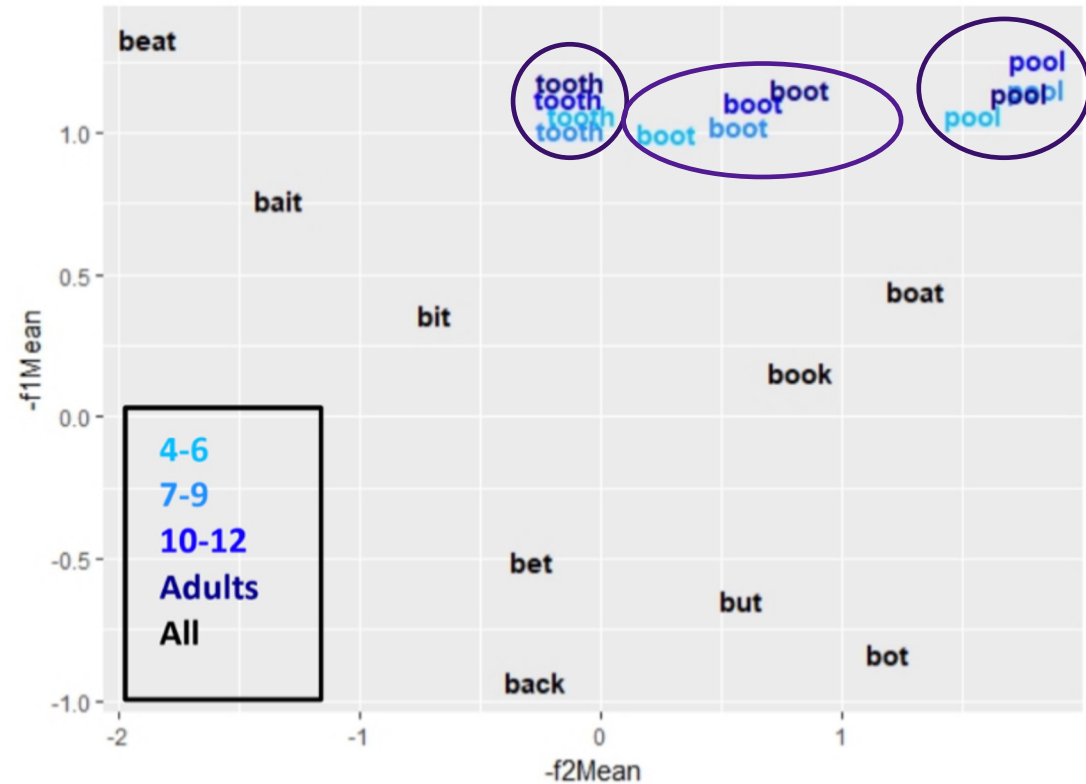
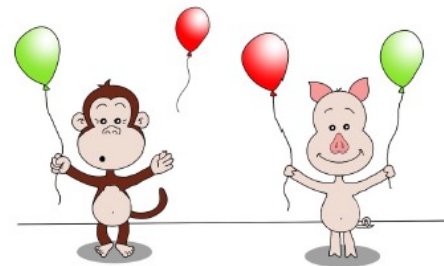
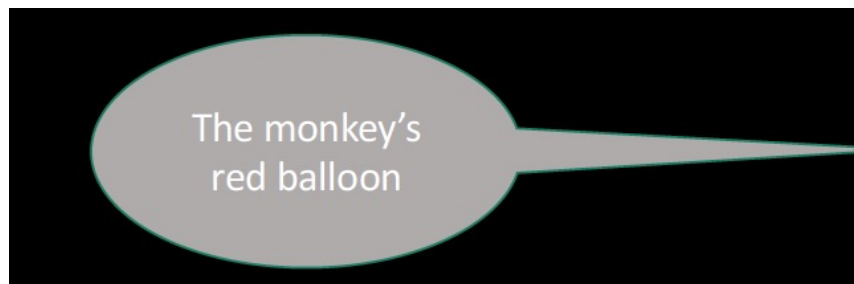


Figure 3: /u/ by age group + environment.

S- CASE STUDY I: HALL & PÉREZ-LEROUX 2022

- Possessive *of*-s forms have competed since Middle English; in recent centuries –s has been overtaking *of* (e.g., Jankowski & Tagliamonte 2014).
 - ***The car's wheel*** vs. ***The wheel of the car***
- Variation is constrained by animacy, possessor length, possessor *final*-s, and relation type.
- Elicited production study with 72 Toronto-area children, aged 4-12, and 15 adult controls.
- 26 test items with 5 subject types (humans, animates, collectives, places, inanimates)
- Do children overgeneralize in the direction of change-in-progress?

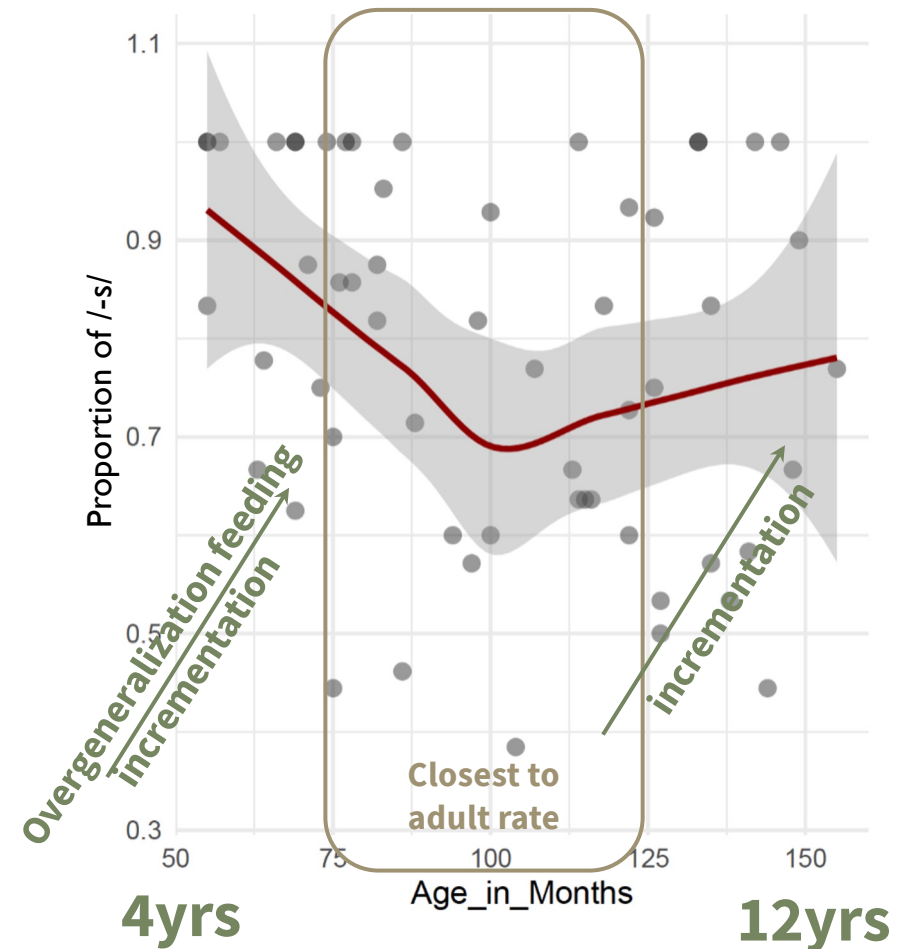


S- CASE STUDY I: HALL & PÉREZ-LEROUX 2022

- Children's responses show sensitivity to all the linguistic constraints on *-s/of*
- But those aren't hard-and-fast and not always operable. Where open:

Children show a small but significant early overgeneralization of *-s*, which subsides and moderately reignites before transition into adolescence."

– Hall & Pérez-Leroux (2021, s26)



S- CASE STUDY 2A: COURNANE 2015; COURNANE & PÉREZ-LEROUX 2020

English modal verbs (e.g., *must*, *could*) are **variable- 'flavour'** (**deontic**, **epistemic**).

✦ Syntactic distribution & semantic combinations affect interpretation:

With bare verb (ModalOnly):

1) Dinosaurio **must** eat lots of leaves...

...because his vet said so.

Deontic

...because the trees are bare.

Epistemic

With grammatical aspect (ModalAspect):

2) Dinosaurio **must** have eaten PERFECT

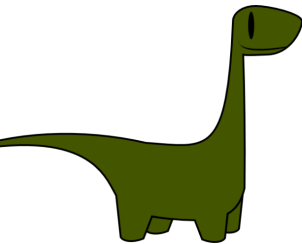
Epistemic

3) Dinosaurio **must** be eating PROG.

Epistemic

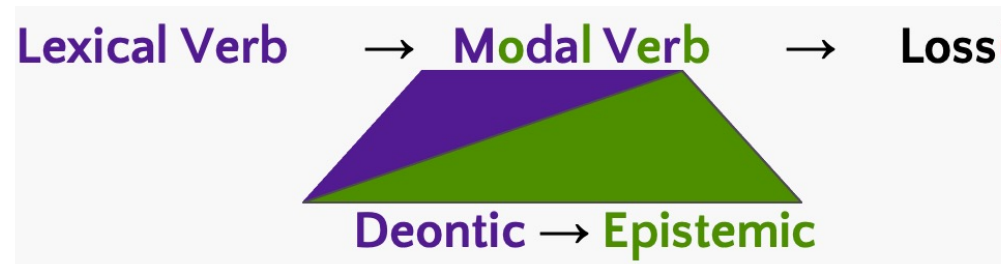
LF: [Subj [*must*_{EPISTEMIC} [Tense [Aspect [*must*_{ROOT} [...VP]]]]]]

Kratzer 1977, 1991, 2012; Condoravdi 2002; Hacquard 2006, 2010; Brennan 1993;
Ramchand 2018; Cinque 1999, i.a.



S- CASE STUDY 2A: COURNANE & PÉREZ-LEROUX 2020

- Modal verbs in English have been well-studied for all facets of change. Multi-century change-in-progress from **DEONTIC** > **EPISTEMIC** uses for modals in English.

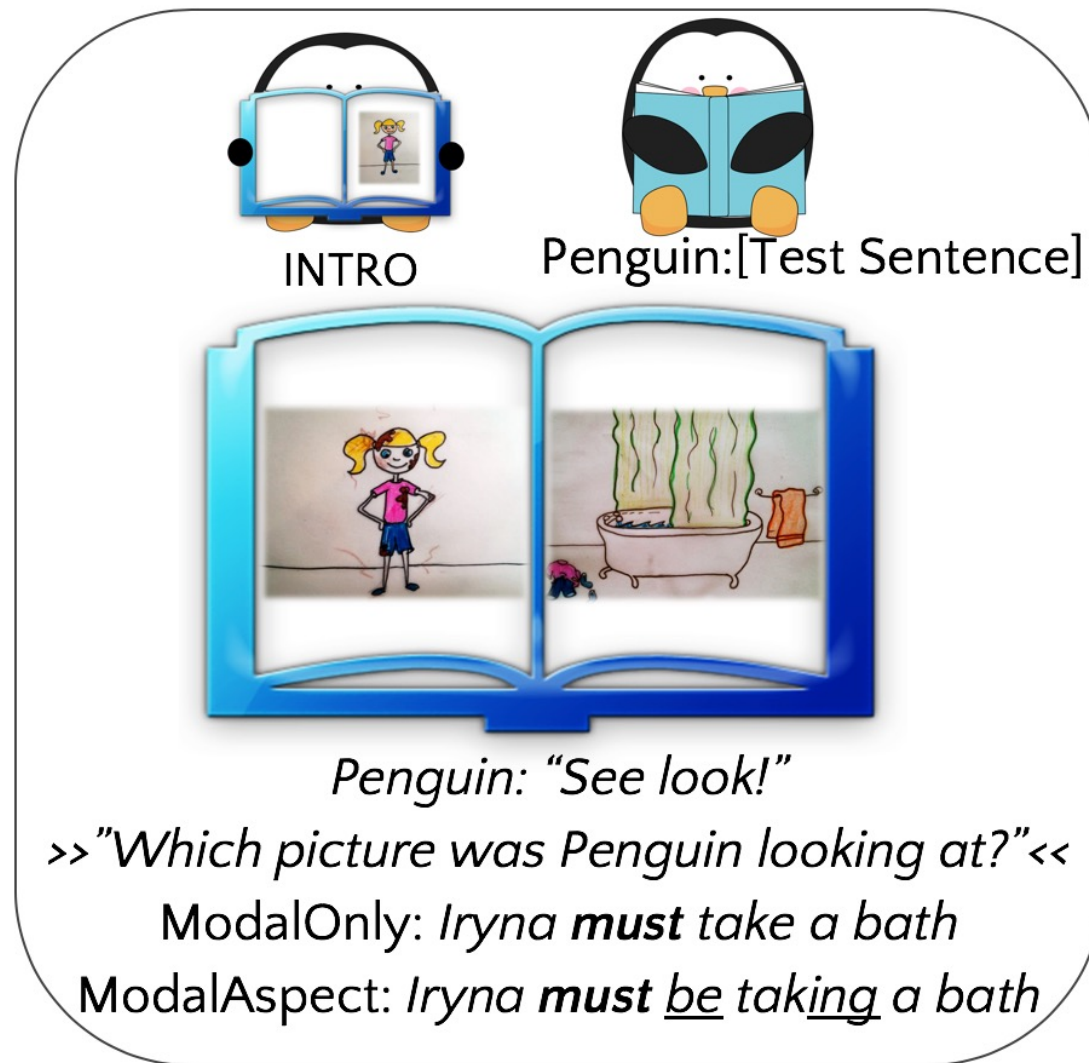


Here we focus on *must*.


- Picture-preference task for deontic (root) vs. epistemic interpretations of *must*-sentences
- 54 monolingual Toronto English children, aged 3-5, and 10 dialect-matched adults
- Do children overgeneralize the more innovative interpretation (epistemic)?



Sample Item & Design



INTRO Penguin:[Test Sentence]



Penguin: "See look!"

>> "Which picture was Penguin looking at?" <<

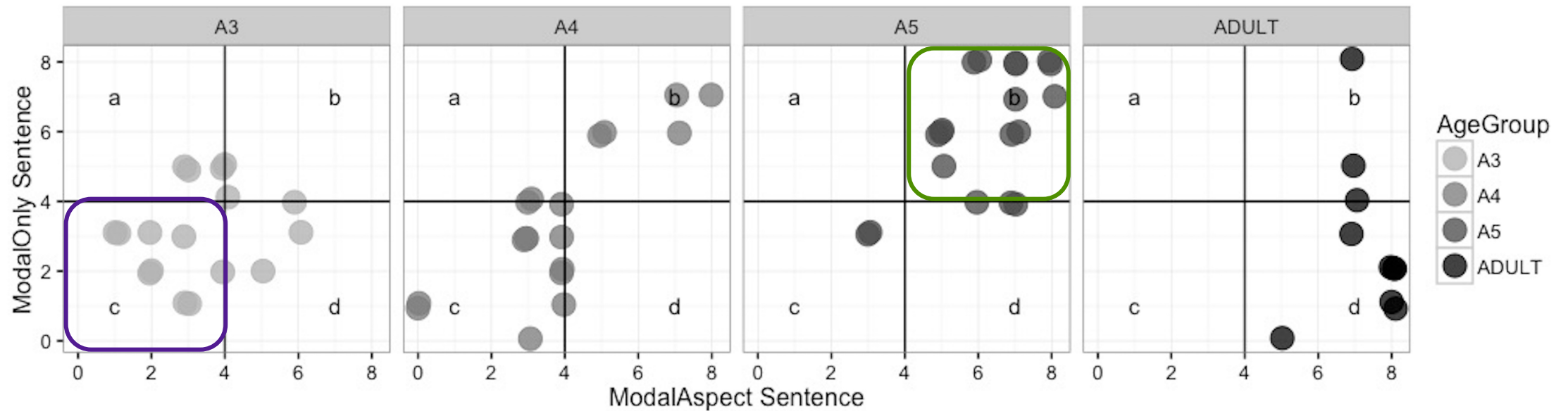
ModalOnly: Iryna **must** take a bath

ModalAspect: Iryna **must be taking** a bath

- Presented on MATLAB_R2014a, with Psychtoolbox (Brainard & Vision, 1997)
- 3 training items, 16 test items (8 ModalOnly; 8 ModalAspect), 8 fillers; randomized
- Counterbalanced (aspect condition (perfect, progressive), story ~ sentence, picture side)
- Qualitative prompts, "How come that picture?"/"How do you know?"

S- CASE STUDY 2A: COURNANE & PÉREZ-LEROUX 2020

- Adults show syntax-semantic constraints; no child group does
- 3yos show weak deontic bias. By 5, strong epistemic bias in the direction of change-in-progress for the ambiguous *must* + bare verb sentences



S- CASE STUDY 2B: COURNANE & VESELINOVIĆ 2022

- Wait, but why? English explanations are confounded: *must* is mostly used epistemically in the input (van Dooren et al. 2022; also Tagliamonte & D’Arcy, 2007), modals are always in INFL (Pollock 1989,i.a.) overtly in their high above-aspect position (Hacquard 2006, i.a.), and there’s a pragmatic “if you must, you” do inference too (Traugott & Dasher 2005)...
- We ran the same study in Bosnian/Croatian/Serbian BCS with *morati V.* ‘must’. *Morati* is overwhelmingly root in the input (Veselinović & Cournane, 2020), and has distinct syntax for root vs. epistemic uses (Veselinović 2017).

For root: MONOCLAUSAL: *Subj Mod*._{SUBJφ} *DA V*._{PFV}

For epistemic: BICLAUSAL: *Mod*._{3SG} *Subj DA V*._{IPF}

- 44 monolingual BCS speakers from Sarajevo, aged 3-6, and 9 dialect-matched adults.



Sample Item & Design

Mede vole da se igraju. Ponekad se u igri isprliaju, ali vole i da budu čisti.
 Vidi, evo ih na igralištu!
 'The bear cubs like to play. Sometimes, while playing, they get dirty, but they also like to be clean. Look, here they are at the playground.'

A. Set-Up Screens

B. Test Sentences (IV)

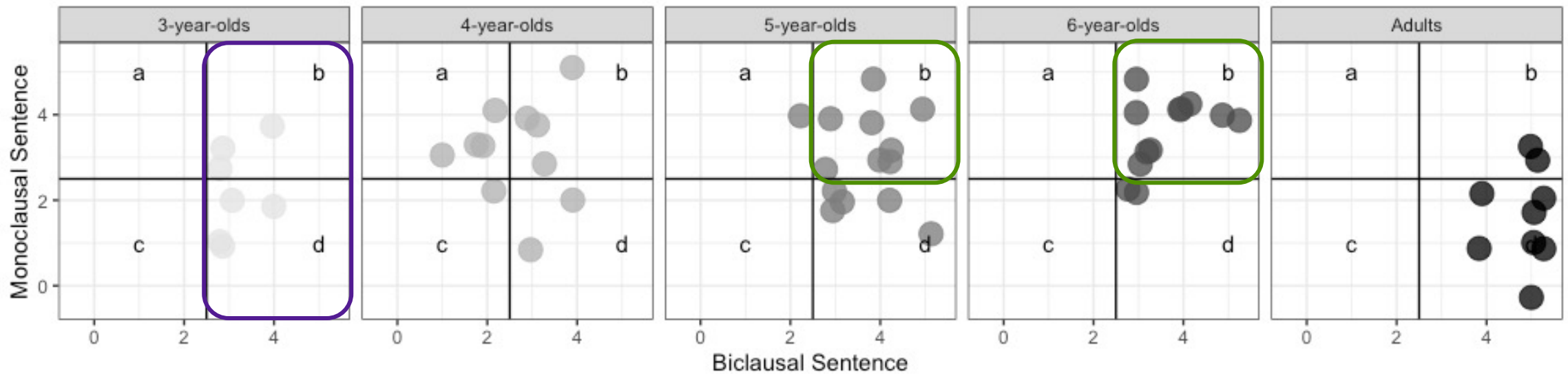
MONOCLAUSAL	BICLAUSAL
Mede mora-ju da se o-kupa-ju bear.cub _{PL} must-3PL.PRS DA SE PFV-bathe-3PL.PRS 'The bear cubs must take a bath'	Mora-∅ da se mede kupa-ju must-3SG.PRS DA SE bear.cub _{PL} bathe-1PF-3PL.PRS 'The bear cubs must be taking a bath'

C. Screen with Test Pictures (DV)

- Presented on MATLAB_R2014a, with Psychtoolbox (Brainard & Vision, 1997)
- 4 training items, 10 test items (5 Monoclausal; 5 Biclausal), 5 fillers; randomized
- Counterbalanced (sentence condition, story ~ sentence, picture side)
- Follow-up prompts, as in English. With, “Kako znaš?”

S- CASE STUDY 2B: COURNANE & VESELINOVIĆ, 2022

- Adults & 3yos show syntax-semantic constraints; other child groups do not
- 5 & 6-year-olds show a strong epistemic-picture bias, including for deontic-only sentences. Adults even show some unexpected selections in that direction.

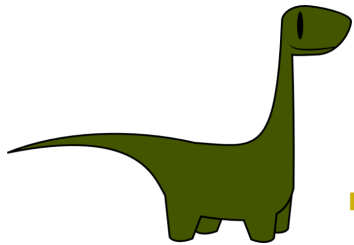


WORKING OUT WHY CHILDREN INCREMENT: MODAL VERBS

- With English we are seeing a child pattern consistent with **incrementation**, because we can relate the direction of online preferences to ongoing changes-in-progress.
- With BCS we're not (no known change-in-progress; categorical syntax-by-flavour) >> children can't be "tuning in" to an existing change.
- What is happening with English and BCS older preschoolers? It seems like it's the **SAME** phenomenon...
 - The raw input rates by flavour can't be the whole story (reverse in the two languages)
 - The fixed high overt syntax can't be either (doesn't hold in BCS)
 - This brings us back to diachronic theory...

WORKING OUT WHY CHILDREN INCREMENT: MODAL VERBS

One theory argues that deontic uses have epistemic “invited inferences” and with usage these become semantic (Traugott & Dasher 2002; Traugott 1989). This can capture what we’re seeing in both BCS & English.



“Alex **must**_{deontic} walk the dog”

→ The dog **must**_{epistemic} get walked

- However, they argue adults do this, suggesting children are pragmatically too immature (p.41). Our results show **children are significantly more likely** to do this, consistent with developmental psychology literature about deontic cognition in preschoolers (Smetana 1989; Kalish 1998; Cornelius & Kalish 2007; Shtulman & Philips 2018).

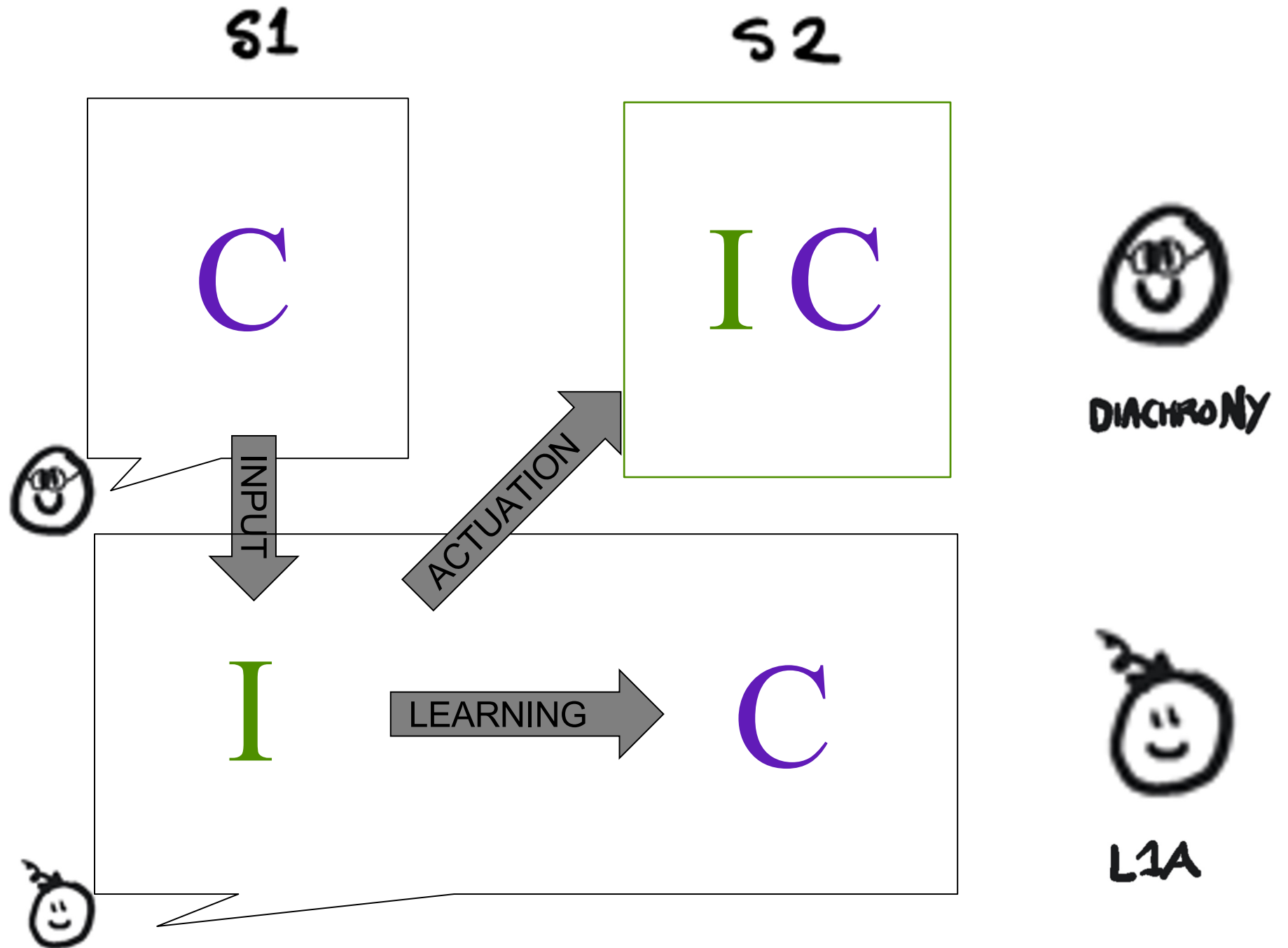
Suggestion: innovation comes from learners encoding this inference as part of the semantics; incrementation is pushed by continued over-adherence (and encoding?) of this inference (i.e., *must* will initially be flavour-variable, but biased-root...that’ll decrease as more often children treat it as epistemic)

INCREMENTATION ACROSS DOMAINS



Model Sketch:

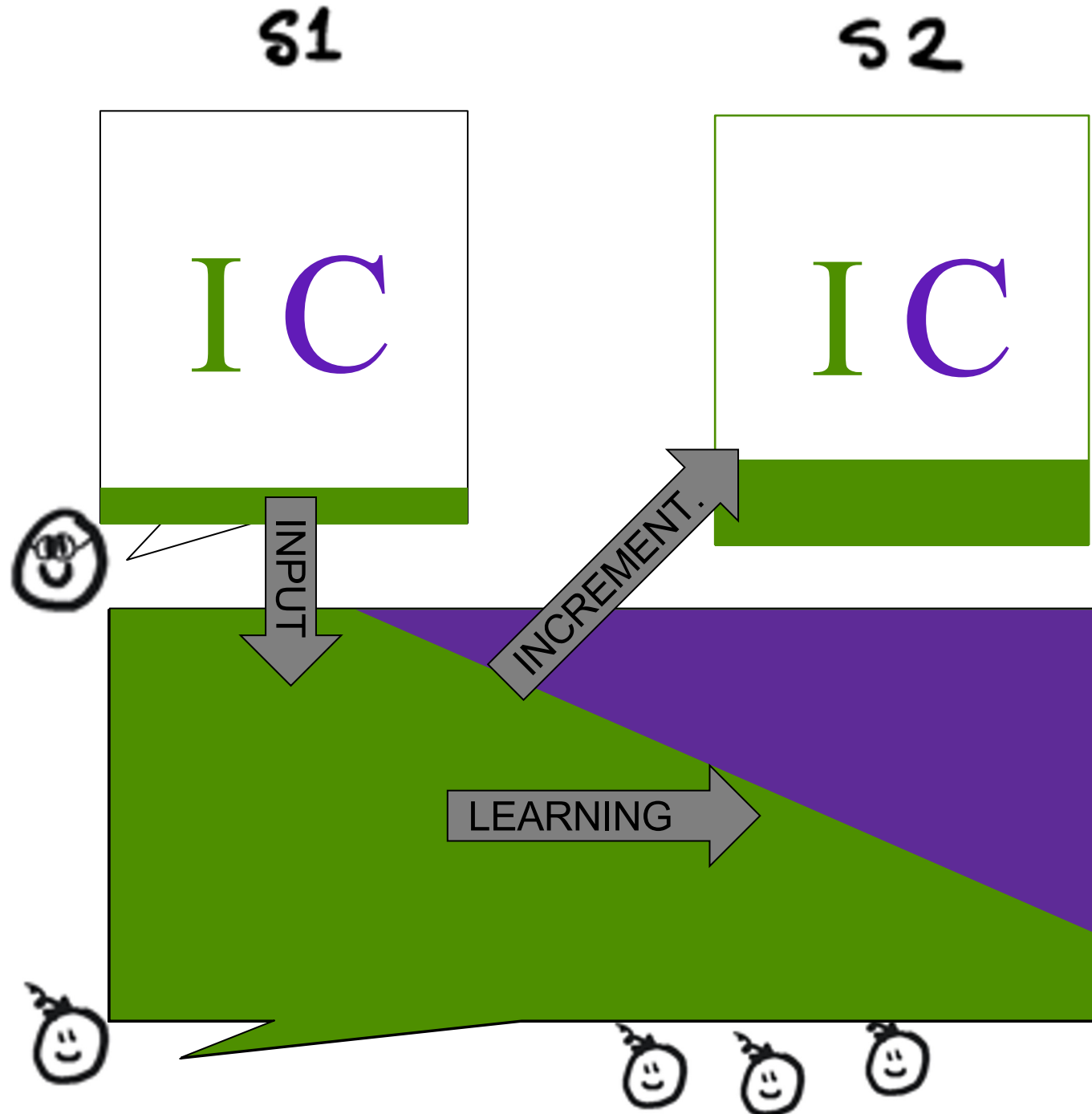
Representations of variants over time and individuals



Model Sketch:

Usage rates of variants over time and individuals

post-actuation



DIACHRONY

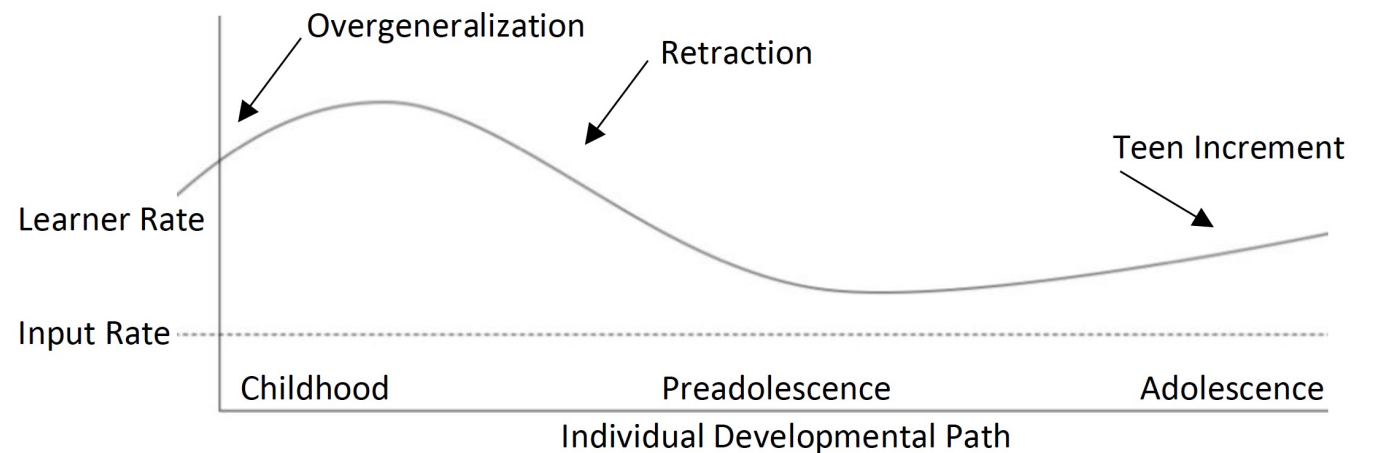
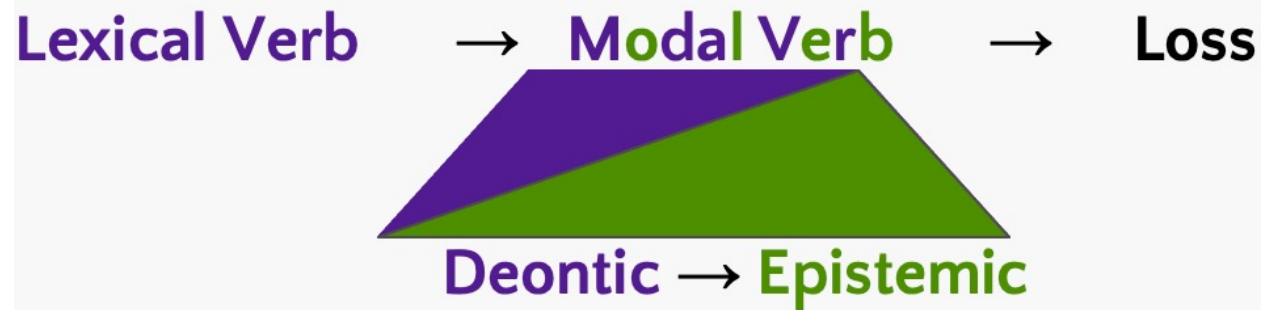
L1A

E-LANGUAGE & I-LANGUAGE IN REAL TIME

- In the language we observe gradual increase in the innovative variant
- In the individual we observe input-divergence as part of the LIA process; learning continues and the divergence effect weakens; it may boost again, as peers uses the variant that is more their generations'

e-language (usage)

i-language (usage)



CONCLUDING THOUGHTS



TAKING STOCK OF INCREMENTATION ACROSS DOMAINS

When children acquire variants in changes-in-progress:

- Some phenomena show **input-matching, followed by later incrementation** (preadolescent, adolescent) in the classic Labovian sense of the term (e.g., Smith & Holmes-Elliot, 2018)
 - So far, to the best of my knowledge, overwhelmingly ph- (e.g., see variation in patterns by domain in Smith et al. 2007, 2013)
- Some phenomena show **preschoolers overusing one variant in the direction of change-in-progress**
 - Across domains: ph- (even Roberts & Labov 1995), morphosyntax, semantics

TAKING STOCK OF LINGUISTIC VARIATION ACROSS

DOMAINS: OPEN QUESTIONS

- Is it about the LIA timeline for the particular phenomenon? The complexity of the patterns to be learned?
- Is it about kind of variable (e.g., discrete vs. continuous)? Is it about the kind of contrast carried by variants (e.g., partial semantic, social only)? If the meaning contrast is only social, is that when we see the first pattern?
- How do data collection methods affect results? Over-X-ing is fore-fronted in targeted experimental work, input-matching is observed primarily in natural samples.
- Are children tuning-in to age-stratification and aligning in some cases (former; H1) and creating and augmenting the variation in others (latter: H2)? Are these processes at work in concert with each other in some cases?

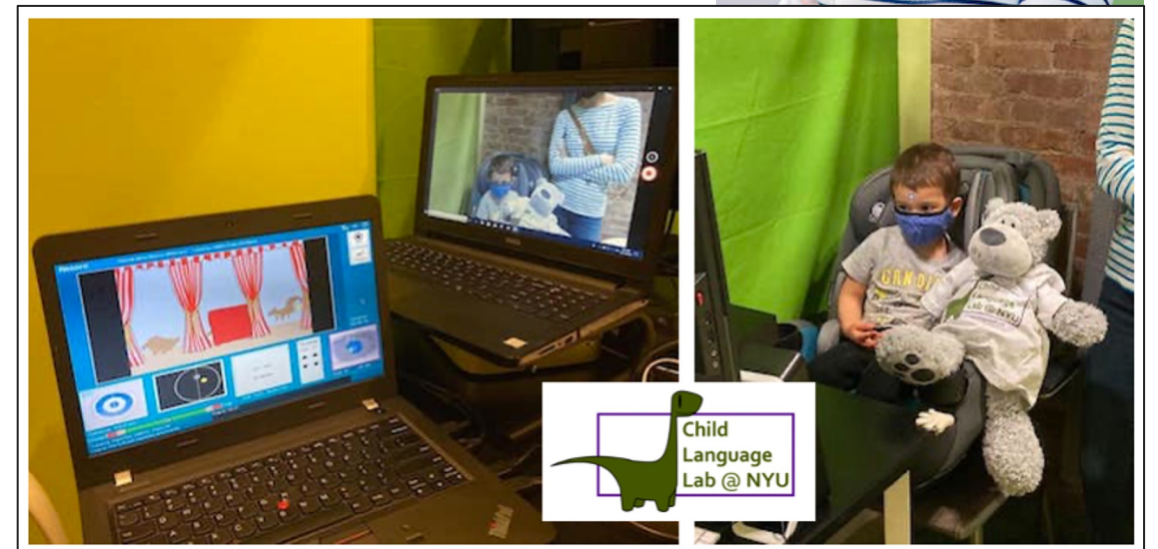
TESTING INCREMENTATION THEORY (COURNANE & MACKENZIE, IN PREP, NWAIV2022)

The “age vector” hypothesis (HI) for *why* incrementation happens assumes that post age-4 child language learners are perceptually aware of age stratification of changes in progress and align themselves to the vector.

Is there evidence for this? (as yet, no; though see E. Johnson’s lab, UToronto Psych)

This can only be addressed with **perception-comprehension data** with preschoolers aged 3-5 (or broader window).

Our proposal: An eye-tracking study to test whether children perceive age stratification of variants.



LEARNING IS CHANGING

- While both (mostly generative) historical and sociolinguistic approaches theorize key roles for children, the former has focused on syntax and grammatical knowledge, and the latter has focused on phonetics and usage patterns.
- Meanwhile, language acquisition research has standardly ignored change phenomena altogether, by assuming fixed learning targets; rarely looking at variable input, and more rarely *moving* variation
 - A. Newport, C.L. Hudson Kam, K. Schuler, K. Miller, N. Shin, ...
- **Much collaborative work remains to bridge gaps in theories & data-types in order to operationalize testable hypotheses targeting whether, when, and how the child language acquisition process and child peer-groups may contribute to language change phenomena.**
 - C.Yang, E.Hall, J.Kodner, J.Smith, S.Holmes-Elliot, M. Westergaard, A. Pérez-Leroux, C. Heycock, J. Wallenberg...



Thank you!



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