Internal bias feeds incrementation: experimental evidence from *must* in child Toronto English

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• English functional modals (aux, semi-aux) are variable-meaning:

With bare verb:

1) Dinosaurio must eat lots of leaves...
   ...because his vet said so. Deontic (Root)
   ...because the trees are bare. Epistemic

With grammatical aspect:

2) Dinosaurio must have eaten Epistemic
3) Dinosaurio must be eating Epistemic

See Condoravdi 2002; Hacquard 2006; Klecha 2016; Rullmann & Matthewson 2017
Modal verbs show broad directional **syntactic** and **semantic** changes in the historical record (e.g., Lightfoot 1979; Roberts, 1985; Traugott, 1989):

*Lexical > Functional*

*Deontic > Epistemic*

- Grammatical change is cyclic, with newer forms or constructions encroaching on older ones, with long periods of co-existence among variants (e.g., Hopper & Traugott, 1993; van Gelderen, 2009)

- Crucial to us: the division of meaning labour between innovative and conservative modals

Introduction: Toronto English modals

In Toronto English (Tagliamonte & D’Arcy, 2007), like other dialects of English, functional modal usage is in prolonged flux (e.g., Krug 2000).

- **Must** remains variable-meaning for adult speakers, but deontic uses of *must* are proportionally few (2% of deontic necessity). Epistemic *must* is robust (55% of epistemic necessity).

- **Have to** has taken over most of the deontic necessity space (72%), and is likewise variable-meaning, with epistemic uses (18%).
Change theories appeal to child learners to explain:
- the source of innovations (e.g., Paul 1920; Andersen 1973; Lightfoot 1979; Roberts & Roussou 2003...),
- the thrust of incrementation (>5 years old).

"Incrementation may involve increase in frequency, extent, or specificity of a sociolinguistic variable" – and child learners are explicitly referenced as agents in this process – “successive cohorts and generations of children advance a change beyond the level of their caretakers and role models” (Labov 2007: 346).

- What meaning(s) do preschool Torontonians posit for must?
- Do they differ from adults in the direction ++epistemic for modal+bare verb constructions?
The Incrementation Hypothesis for L1A

- The incrementation hypothesis: in ambiguous contexts (*must* + bare verb) children will prefer epistemic interpretations at higher rates than young adults from the same speech community
  - + epistemic

- Competing hypotheses:
  - Adult-matching (children will match adult patterns)
    - = epistemic
  - Persistent Deontic Bias (production data) (Papafragou 1998; Cournane 2015; van Dooren et al. 2017, in prep)
    - - epistemic
Introduction: *must* and modal flavour in L1A

- Children begin to use modal verbs ~ age 2 with root meanings, epistemic uses follow soon after (van Dooren, Dieuleveut, Cournane, Hacquard, 2017; Cournane 2014, 2015; cf. Papafragou 1998)
  - Non-linguistic implicit measures show concepts (epistemic and deontic) are in place very early (e.g., Onishi & Baillargeon 2010; Cummins 1996)
  - Young children’s productions of *must* are root-biased, relative to the input, but they show variable-meaning from age 2 (Manchester Corpus; Theakston et al. 2011):

<table>
<thead>
<tr>
<th>Child:</th>
<th>it’s got mud over it.</th>
<th>Child:</th>
<th>my yellow one.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother:</td>
<td>I see. right.</td>
<td>Child:</td>
<td>can’t see it.</td>
</tr>
<tr>
<td>Child:</td>
<td><strong>must</strong>\textsubscript{root} wash it.</td>
<td>Child:</td>
<td><strong>must</strong>\textsubscript{epis} be gone.</td>
</tr>
<tr>
<td></td>
<td>(John, 2;08)</td>
<td></td>
<td>(John, 2;09)</td>
</tr>
</tbody>
</table>
1. Flavour Preference Task: 

**Picture Preference Task**, comparing root and epistemic interpretations of ModalOnly and ModalAspect sentences; TO manipulation

**Modal-Only Sentence**
1) Scott *must* [wear his rainboots]

**Modal-Aspect Sentence**
2) Scott *must* [be wearing his rainboots]  
   PROGRESSIVE

3) Jada *must* '[ve taken a bath]  
   PERFECT
1. Flavour Preference Task:

Participants:

- 54 monolingual English children, born and raised in the Toronto area, divided into three groups:
  - 3-year-olds (n=17, range: 36-47 mos, $M=41.9$, $SD=3.5$),
  - 4-year-olds (n=18, range: 48-59 mos, $M=53.3$ mos, $SD=3.1$), and
  - 5-6-year-olds ranging from (n=19, range: 60-77 mos, $M=66.8$ mos, $SD=4.2$).

- 10 dialect-matched young adults controls (age: 18-25); no exposure to a second language before 7.
1. Flavour Preference Task: methods

- 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)
1. Flavour Preference Task: **results**

Figure 2. Individual speakers plotted by the number of epistemic picture choices given to the modal-only and modal-aspect sentences.

Note. *Quadrant a* is ‘contrarian’ to target for both sentence conditions. *Quadrant b* is ‘epistemic dominant’. *Quadrant c* is ‘deontic dominant’. *Quadrant d* is ‘target-oriented’.

(glmer, Epistemic~AgeGroups+(1|Participant), AGEGROUPFIVE-YEAR-OLDS β=1.818, <0.001**)
1. Flavour Preference Task:

discussion

- Adults differ by sentence type (ModalOnly, ModalAspect): epistemic pictures for modal-aspect, deontic pictures for modal-only
- Children *do not* discriminate interpretations by sentence type. Instead, children shift from an overall slight root obligation bias to an overall epistemic bias, including for **modal-only sentences**
2. Modal Detection Task:

A sentence-preference task focusing on **must** in obligation contexts

Questions:

- Do preschoolers pay attention to the presence of the modal? Modal Detection
- Do older preschoolers have root interpretations for **must**? Or, do older preschoolers abandon root meanings altogether?

1) The boys [wash their hands with soap].
   - No-**must** sentence
2) The boys **must** [wash their hands with soap].
   - **Must**-sentence
2. Deontic

Task:

methods

Experimental Design:

- Training pre-test, followed by 10 test trials equally divided by context (actual, deontic), interspersed with 5 distractors. Two mirror-image orders.
2. Deontic must

Task: methods

Participants:

- 52 monolingual English children, born and raised in the Toronto area, divided into three groups:
  - 3 year-olds ($n = 20$, range: 38-47 mos, $M = 42.2$ mos, $SD = 3$),
  - 4 year-olds ($n = 15$, range: 48-56 mos, $M = 50.9$, $SD = 2.2$),
  - 5-6 year-olds ($n = 17$, range: 60-77mos, $M = 66.5$, $SD = 4.9$).
- 10 dialect-matched monolingual English adults (age: 18-22) with no exposure to a second language before 7.
2. Deontic Detection Task: results

Fig. 5: Aggregate *must*-sentence choices given by picture condition, by age group. 3yos (n = 20, M = 42.2mos, SD = 3), 4yos (n = 15, M = 50.9mos, SD = 2.2), 5-6 year-olds (n = 17, M = 66.5mos, SD = 4.9). Adults (n=10).

(glmer, MustChoice~Condition+(1|Participant)+(1|Item), PICTUREACTUAL: β = -0.622, < 0.003**)
2. Deontic
must
Task:
results

- Imageable obligations that 3yos will know rely on societal norms, so we got a weakened signal.
- Memory demands were high in this task.
- We anticipated, we also systematically probed for qualitative data, asking “Why Frog/Shark?”:

  - **They must draw on paper but they’re drawing on the wall.**
    - 5yo, Deontic, must
  - **You wear slippers in ballet class.**
    - 3yo, Deontic, must
  - **Must means have to.**
    - 4yo
  - **Not different because must means maybe they will.**
    - 5yo, Actual, both
2. Deontic must
Task: discussion

- In contrast to adult categorical performance, children’s choice of *must-sentence* for the deontic context is reliable but not strong.
- Most importantly at present, even the oldest group – who systematically chose epistemic interpretations in Study 1 – appear able to access & justify deontic interpretations of *must*-sentences, and to associate to other deontic modals.
Why might older preschool children overgenerate epistemic *must*?

- Epistemic functional modals interpreted above Tense and Aspect, root functional modals below (see Brennan 1993; Cinque 1999; Hacquard 2006, 2010, i.a.).

LF: [Subj [must\textsubscript{EPISTEMIC} [Tense [Aspect [must\textsubscript{ROOT} [...VP]]]]]]

- In English, *must* sentences with grammatical aspect show *must* overtly above aspect marking: once kids reliably acquire aspect, they overgenerate high epistemic interpretations.

- Learners show robust widespread biases towards isomorphism (Musolino, 1998, i.a.), one-to-one mapping (Clark, 1973 i.a.), and regularity (Hudson-Kam & Newport, 2009, i.a.)
Some Concluding Questions

- What is the role of formal registers (...reading, school...) in maintenance of conservative deontic must?
  - Not the only factor; compositional semantic universals (see Hacquard 2013) for functional modal interpretation crosscut registers

- What is the role of other modals in the system – not just other functional modals, but also epistemic markers like probably or know?

- Our data are comprehension but incrementation theory is based on production (see Tagliamonte & D’Arcy 2009, for s-side overview). What to do?
  - Hirzel, Cournane, Hacquard (in prep) have a production task with possibility, necessity x teleological (root), epistemic, based on Cournane (2014); running on 3yos & adults in M.D, plans to run teenagers. (So far, zeromust!)
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