Sentence revision and executive control in French-speaking children and adults: Evidence from wh-questions with filled-gaps

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1. BACKGROUND

- Sentence processing is incremental, i.e. interpretations are generated before the sentence entirely unfolds [1], and requires revision if the subsequent input is incompatible with the initial interpretation, e.g. in garden-path sentences like “Put the frog on the napkin in the box” [2]
- Revision takes time in adults and often dramatically fails in children [2,3]
- Adult’s revision abilities improve when cognitive control is trained [4]
- Cognitive control, i.e. domain-general mechanisms of regulation allowing flexible and adaptive behavior during complex tasks (e.g., Stroop), matures slowly until adolescence [5]

→ Hypothesis: Cognitive control ability plays a role in sentence revision processes

2. LIMITATIONS OF PREVIOUS RESEARCH

- Restricted set of syntactical structures (mostly PP-attachment and mainly in English)
- Only one study of revision performance and cognitive control ability with adults – and none with children

3. AIMS OF THE PRESENT STUDY

We examine the link between performance from 30 French-speaking children (mean age 6;8) and 30 adults in 2 tasks:
- (a) Sentence comprehension task measuring the ability to revise garden-path wh-questions
- (b) Cognitive control task measuring inhibition (Dimensional Change Card Sorting Task/DCCST)

Prediction: If cognitive control plays a role in revision, we expect to find a systematic link in adults and children

4. METHODS

SENTENCE COMPREHENSION TASK: Question-after-Story paradigm [3]:
- Questions of 2 types:
  (1) Ambiguous: the wh- can be attached to the main verb/MV or the embedded verb/EV, but MV attachment should be preferred due to active gap-filling
  (2) Filled-gap with overt locative PP as revision cue: the wh- can only be attached to the EV

- Story with 3 locations: main clause (e.g., explaining), embedded clause (e.g., butterfly-catching), and distractor location
- Measure: offline responses + child RTs via touch screen

COGNITIVE CONTROL TASK: DCCST [6]:
- Sorting game: objects must be sorted according to their shape (block1) or color (block2) or both intermixed (block3)
- Measure: conflict cost
  - Difference score calculated on accuracy between congruent trials (color and shape converge) and incongruent trials (color and shape diverge and one dimension has to be inhibited)
  - Low conflict cost = strong cognitive control
  - High conflict cost = weak cognitive control

5. RESULTS

SENTENCE COMPREHENSION

CHILD
- Ambiguous: MV attachment preference (active gap-filling)
- Filled-gap: MV attachment preference, no revision

ADULT
- Ambiguous: MV attachment preference (active gap-filling)
- Filled-gap: Less MV attachment than with Ambiguous

LINKING SENTENCE COMPREHENSION AND COGNITIVE CONTROL

CHILD
- Children with strong cognitive control take longer to select the MV response (non-revision)

ADULT
- Adults with strong cognitive control show more EV responses (revision)

6. DISCUSSION AND CONCLUSIONS

- Active gap-filling in French speaking children and adults: This first demonstration of active gap filling in French brings novel support to the few existing evidences for incremental sentence processing in children.
- Revision failure in children & poor revision performance in adults: We report a new case of kindergarten-path, confirming children’s striking difficulty to revise their initial wh-MV attachment. Surprisingly, revision difficulties appear also in adults and could be due to i) the presence of an alternative grammatical parse (where-about interpretation), and/or ii) the option of leaving the wh- in situ in French, often adopted in the spoken language, reducing the opportunities for the parser to revise in long-distance dependencies. Current follow-up studies aim to clarify this remaining question.
- Link between revision ability and cognitive control skills: Adults with strong cognitive control revised more, while children with strong cognitive control took longer to provide the (incorrect) MV response to the filled-gap question, suggesting possible attempts to revise it. The data support the hypothesis of a tight link between cognitive control and sentence revision.