Incremental development of incremental processing:
Anticipatory interpretation of novel sentential combinations in adults and children.

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There is a host of evidence that adults and children rapidly integrate information from sentential agents and actions to incrementally generate expectancies for upcoming language (Borovsky, et. al., in press; Kamide, et. al., 2003; Nation, et. al., 2003). These relationships require going beyond simple lexical associations, and involve sensitivity to higher-order contingencies between agents, actions, objects, locations, etc. (Matsuki et al., 2011). However, relatively little is understood as to how this combinatorial knowledge is initially acquired and used.

We explore this question in 65 children (aged 3-10) and 64 adults by measuring the degree to which sentences depicting recently learned connections between agent, actions and objects lead to anticipatory eye-movements to the objects. Participants first heard stories accompanied by pictures portraying two agents (e.g. dog, monkey), who each complete the same two actions (e.g. eating, riding) and with different objects (e.g., the monkey rides in the car, and eats the candy, while the dog rides in the bus and eats the apple). All plausible combinations of agent, actions and objects were rotated across versions. In order to determine if this initial story presentation was sufficient to support subsequent incremental sentence interpretation, we then measured eye-movements to the objects of these novel relationships while participants heard sentences like "The monkey eats the candy." In addition to the Target picture (CANDY), the participants also saw the other four objects that served as Agent-Related (CAR), Action-Related (APPLE), or Unrelated (BUS) distractors.

Combinatory information about the agent and action yielded anticipatory eye-movements to the Target object in both adults and most children. Broadly, our findings suggest that adults and school-aged children can "fast-map" agent-action-object relationships and rapidly activate this knowledge in subsequent language processing. However, there were important developmental differences in the acquisition and activation of this knowledge.   As expected, adults were faster than children (by 140ms) to generate anticipatory fixations to the target, but for children, the pattern of anticipatory fixations changed across development.   3-4 year old children's fixations reflected a simple association to the currently spoken item (e.g. fixations reflected look to the agent-related and action-related items as the agent or action was mentioned, respectively), but they failed to integrate the combinatorial information within the sentence. School-aged children's (aged 5-10 years) fixations mirrored the adult pattern; anticipatory fixations to the target were launched upon hearing the agent and action. Within this school-aged group, the timing of anticipatory fixations improved with age. The 5-6 year olds were relatively slower (by >100ms) to generate anticipatory fixations to the target than the older children (aged 7-10 years).   In all groups, the looks to the action-related item was larger than seen in prior work that has measured anticipatory looks to well-known sentential relations. This indicates that the representation of these fast-mapped relationships might still be fragile, and the online activation of these connections may change with additional exposure.

References

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