

Pragmatic inference facilitates word retention in school-aged children

Previous literature has shown that children can leverage social cognition to learn sound-meaning mappings through pragmatic inference. However, the focus has been on in-the-moment meaning mappings rather than meaning retention (Frank & Goodman, 2014; Gollek & Doherty, 2016; Zosh et. al., 2013). In our prior work on adults, we found novel words learned through pragmatic inferences were better retained than those learned through direct mappings and were associated with individuals' social cognition. These results suggest a specific link between social cognition and meaning retention in adults. Here, we examine how children between 4 and 8 years old, a prime stage for social cognition development, learn and retain novel words from an inferential context versus direct-mapping context.

Children ($M_{\text{age}} = 6.0$ years, $SD_{\text{age}} = 1.3$ years, $N = 61$) learned eight novel words during a toy-store tour (see Fig.1 for the overview of the design and the example sentences). During the learning phase, children learned words which could either be mapped to one unique novel object on the display – the Direct Mapping Condition (DMC) – or required pragmatic inference for referential disambiguation – the Inference Condition (IC). The two conditions were manipulated in a blocked design. The attainment of the novel words was tested in a four-alternative-forced-choice (4-AFC) task immediately after each learning block. After completing both learning blocks, children completed a Theory of Mind (ToM) task (Richardson et. al., 2018) via Zoom, lasting an average of 15 minutes, followed by a second recall task testing the retention of all eight novel words in the same 4-AFC task (Fig. 1). The experiment ended with an assessment of children's executive function (EF) skills (Flanker Task).

Learning rates were highly accurate in both conditions, with DMC having a mean of 0.96 (CI = + 0.02) and IC a mean of 0.69 (CI = + 0.04). Children performed above chance for DMC and IC in both the recall and retention tests as well. However, unlike adults (Fig. 2B), children showed no difference between the conditions when all children are accounted for (Fig. 2C & 2D). The advantage of IC on retention only emerged in children older than 6 years ($N = 28$, $MIC = 0.55$; $MDMC = 0.41$, estimate = -0.6094, $z = -2.158$, $p = 0.0309$). For retention in IC over the full age range, age uniquely contributed to variance (Fig. 3), even while taking dependent variables EF, IC immediate recall accuracy, and IC learning accuracy into account (beta = 0.09, $t = 2.624$, $p = 0.0114$). Moreover, the effect of age on IC retention was partially mediated by ToM, explaining 16% of the variance ($F(2,58) = 5.66$, $p = 0.0018$), while the direct effect of age after removing the effect of ToM was no longer significant ($p = 0.1$). There were no significant predictors for retention in DMC or for immediate recall in either condition.

Our findings demonstrate that while children can successfully map and retain meanings learned via pragmatic inference, the facilitation of the pragmatic inference on meaning retention grows with development: children show better memory for pragmatically inferred words than directly mapped words, an adult-like pattern, only after they reach 6 years old. Such a developmental shift in consolidation mechanism is possibly mediated by children's developing ToM skills.

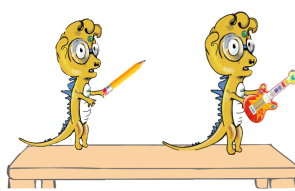


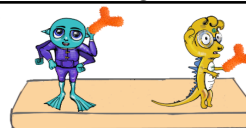
Practice (x2) Which toy does Mary like?	Condition	Learning Phase: 2 trials per word 4 word per condition	Immediate Recall (x4) 15-min break (ToM Task) Retention (x8) 4-min wrap up (Flanker)
	Inferential context	 "Look! I like this dinosaur! It is holding a MEL !"	
	Direct mapping	 "Look! I like this BINK ! It is on the dinosaur!"	
"Look! I like the dinosaur that's holding a guitar!"		"Look! I like this BINK ! It is on the dinosaur!"	"Which one is a BINK ?"

Fig. 1: Experimental procedure for word learning.

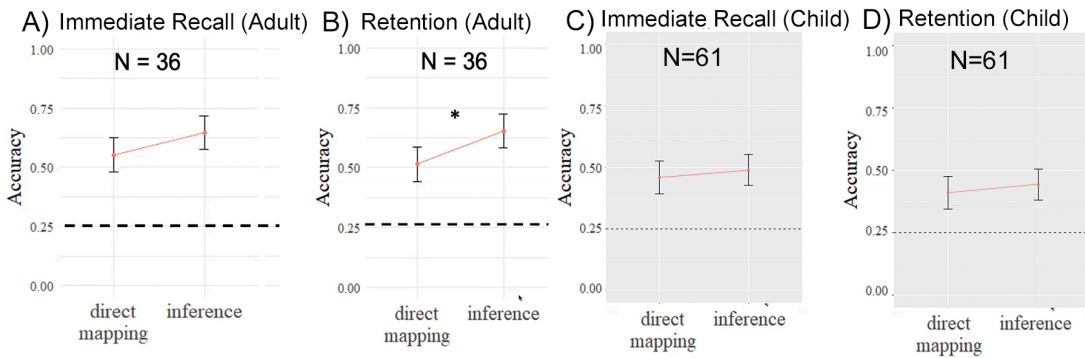


Fig. 2: A comparison of accuracy for both adults, as previously reported, and children. The dashed lines represent the chance levels

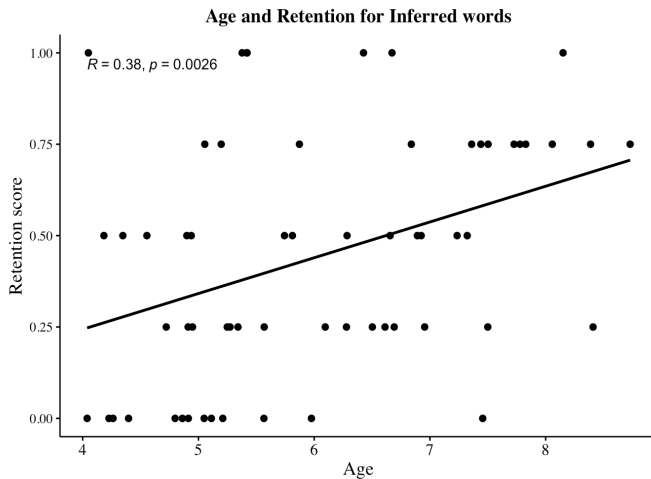


Fig. 3: Correlation of age with retention of the words in the inference condition.

References:

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