

Nonverbal Episodic Memory Predicts Lexical Knowledge in 4-Year-Olds: Distinct Roles of Initial Recognition and Overnight Retention

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Introduction The Declarative/Procedural (DP) model grounds lexical acquisition in a domain-general declarative memory system [1]. Declarative memory is often assessed via its episodic memory sub-component: the capacity to encode and retrieve context-rich events. However, using verbal memory tasks to predict vocabulary introduces a modality-specific confound. A more rigorous test therefore links vocabulary to nonverbal episodic memory [2]. Although nonverbal episodic memory predicts lexical outcomes in L2 learning [2], empirical research in L1 acquisition has struggled to find an association [3]. We argue this missing link stems from aggregating distinct receptive and expressive vocabulary modalities [4] and overlooking the temporal phases of episodic memory—even though robust 24-hour retention emerges around age four [5]. Different memory delays may differentially predict these modalities. Receptive vocabulary (hearing a spoken word and selecting its referent from picture alternatives) indexes decontextualized semantic knowledge and may benefit from systems-level consolidation that supports generalization beyond the learning episode [6]. Expressive vocabulary (picture-cued production without hearing the target word) requires the child to retrieve a phonological form from vision alone, heavily relying on the accessibility and fidelity of initial memory traces [7]. To investigate these distinct mechanisms, the current study examines whether initial recognition (short-delay access) and overnight retention contribute differentially to receptive versus expressive vocabulary in a cross-sectional sample of 4-year-olds.

Methods Ninety-six typically developing L1-dominant Cantonese-speaking preschoolers (48 girls; $M_{age} = 54.34$ months) completed an intentional nonverbal visual scene encoding task. Memory was assessed via separate 10-minute (initial recognition, Day 1) and 24-hour (overnight retention, Day 2) old/new recognition tests on non-overlapping studied/unstudied subsets, yielding independent d' scores. Lexical knowledge was measured with a Cantonese adaptation of the PPVT-4 (receptive) and the Hong Kong Test of Preschool Oral Language (TOPOL; expressive). Separate hierarchical regression models for receptive and expressive vocabulary were constructed by entering baseline covariates (age, nonverbal IQ, and gender) first, followed by the sequential addition of initial recognition and overnight retention as predictors.

Results For receptive vocabulary, covariates explained significant variance ($R^2 = .17$). Adding initial recognition explained additional variance ($\Delta R^2 = .04$, $\Delta F(1, 90) = 5.65$, $p = .020$). Crucially, adding overnight retention further improved model fit ($\Delta R^2 = .09$, $\Delta F(1, 89) = 10.92$, $p = .001$); in the final model, overnight retention predicted performance ($b = 2.27$, $p = .001$; Figure 1), whereas initial recognition became non-significant ($p = .96$). For expressive vocabulary, covariates explained significant variance ($R^2 = .13$). Initial recognition predicted expressive vocabulary ($b = 1.66$, $p = .023$, $\Delta R^2 = .05$; Figure 2). Overnight retention provided no further improvement ($\Delta R^2 < .01$, $\Delta F(1, 89) = 0.01$, $p = .92$). By parsimony, the model retaining initial recognition alone was treated as final for expressive vocabulary.

Discussion and Conclusion Nonverbal episodic memory was associated with early L1 lexical knowledge, in line with the DP model. Overnight retention predicted receptive vocabulary, consistent with consolidation supporting generalized semantic knowledge [6]. Initial recognition predicted expressive vocabulary, consistent with cue-poor production depending on the accessibility and fidelity of initial memory traces [7]. Initial recognition and overnight retention thus showed a domain-differentiated profile across early expressive and receptive vocabulary. Future research on individual differences and clinical assessment should jointly consider memory delay together with receptive versus expressive demands.

References

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Figures

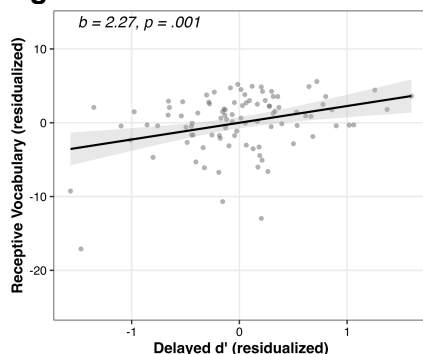


Figure 1. Overnight retention predicts receptive vocabulary. Partial-residual (added-variable) plot showing the unique association between overnight retention (Day 2 d') and receptive vocabulary (PPVT-4) in the full behavioral sample ($N = 96$), adjusting for covariates and initial recognition ($b = 2.27$, $p = .001$). Each point is one child; the line shows the linear fit with 95% confidence band.

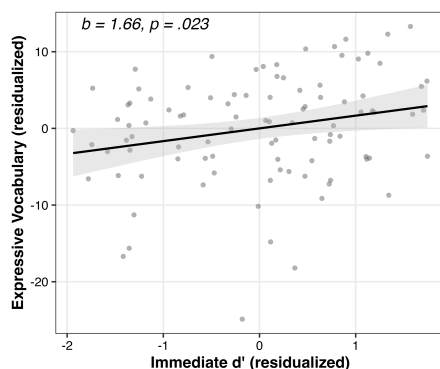


Figure 2. Initial recognition predicts expressive vocabulary. Partial-residual (added-variable) plot showing the unique association between initial recognition (Day 1 d') and expressive vocabulary (TOPOL) in the full behavioral sample ($N = 96$), adjusting for covariates ($b = 1.66$, $p = .023$). Each point is one child; the line shows the linear fit with 95% confidence band.