MINIMAL RELATIONS LEAD TO SUPERIOR MEMORY

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Introduction The interweaving between memory and language gives rise to two intriguing phenomena: (1) when scrambled words are organized into grammatically-licit sequences, our memory capacity is dramatically enhanced (i.e., Sentence Superiority Effect, SSE, e.g., Baddeley et al., 2009; Bonhage et al., 2014). (2) our memory for language is not verbatim (e.g., Bransford et al., 1972) indicating that a format transformation en route to memory. While these two phenomena are well-documented, it remains mysterious why memory benefits from syntactic sequences and how linguistic information is stored in memory.

Syntax constructs linguistic units such as phrases and sentences and establishes relations among individual words. The established relations enable sentences to describe causal, temporal, and spatial relations among objects. For example, in the phrases like "*a book on a cup*" and "*fox's bag*", the individual objects (*book* and *cup*, *fox* and *bag*) are bound by spatial and possessive relation respectively.

This study explores a hypothesis that between-object relations are a critical factor for memory. In four experiments with English and Chinese participants, we examined whether the presence of minimal relations between objects leads to better memory performance.

Methods All experiments followed the 2×2 within-subject design with the independent variables: *TYPE (Phrase vs. Word-pair) and TEST (Immediate vs. Delayed).* Phrases are constructed by introducing the *spatial* (e.g., Exp 1: "*a cup on a book*", Exp 2: "杯子上的课本") or *possessive* relation (e.g., Exp 3: "*fox's bag*", Exp 4: "狐狸的书包") between two items. Participants were instructed to listen to a sequence of either four phrases or four word-pairs and then perform a written free recall task immediately or after completing a distractor task.

Results The key results (Fig 1) revealed that a better memory performance for phrases vs word-pairs was found, suggesting that memory favours complex objects (created via a relation of simple ones) over lists of unrelated objects.

Discussion The observed superior memory suggests that memory was facilitated by the introduction of minimal relations between the two individual objects. Syntax, represented by prepositions or possessive marker, plays a crucial role in establishing and conveying conceptual relations. The establishment of relations allows linguistic units that are larger than words, such as phrases and sentences, to describe and store entities as holistic units, which may more naturally fit into the memory data structures compared to unstructured word sequences.
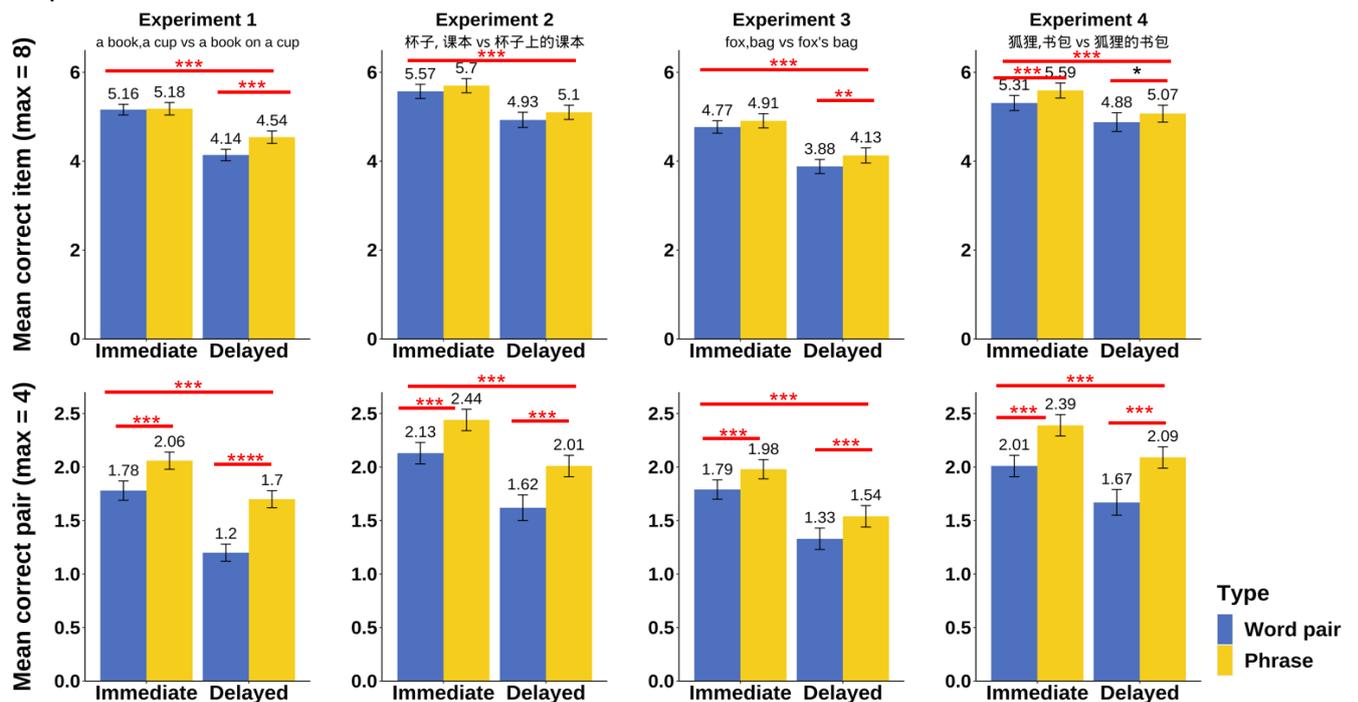

Fig 1 Generalized linear mixed models (GLMM) were applied to the data of 4 experiments.