**The Neural Dynamics Underlying the Role of Sleep in Language Learning**

Research highlights the enduring plasticity of human language processing, as evidenced by the ability to learn new languages [1, 2], novel words [3], and to adapt to the constraints of typologically diverse phoneme combinations [4]. Studies suggest that language plasticity is supported by memory consolidation processes that occur during sleep [5]. In line with a broader literature on sleep and memory (for review: [6]), sleep has been shown to consolidate novel word meanings and their respective phonological forms by integrating them with the existing mental lexicon [7, 8]. In particular, slow wave sleep promotes novel speech production and recognition [7], and grammar generalisation [9], over and above that of time spent awake. However, it is currently unknown how sleep-dependent memory consolidation may extend to the complex combinatorics underlying sentence comprehension.

One aspect of incremental sentence comprehension is the assignment of semantic roles to noun phrases [10, 11]. Semantic role assignment strategies vary between languages [12]. Native speakers of English typically interpret the initial noun phrase (NP) as the actor and the second NP as the undergoer, irrespective of semantic cues. By contrast, in languages such as German and Turkish, semantic role assignment is based more strongly on other cues (e.g. case marking and/or semantic information such as animacy) [13]. These cross-linguistic dissociations with regard to incremental sentence comprehension are in line with proposals that assume qualitatively distinct combinatory mechanisms in the brain, namely sequence-based and dependency-based (sequence-independent) combinatorics [10, 14]. From this perspective, speakers of sequence-independent languages (e.g., German and Turkish) interpret sentences by combining features into successively more complex representations, facilitating the unification of relations between elements in a sentence. Conversely, speakers of sequence-dependent languages (e.g., English and Dutch) are posited to rely primarily on predictive sequence processing mechanisms for sentence interpretation [14, 15]. In this view, sequencing- and dependency-based combinatorics are basic components of the neurobiology of human language, which may be underpinned by the generalisation of linguistic sequence patterns and associative memory traces of schemata established during sleep [14, 16, 17].

Modified miniature language (MML) models are useful for examining the effect of sleep on language learning. In MMLs, participants learn the meaning of individual words via picture-word pairs, and then complete a recognition memory test of word-meaning [8, 18]. Participants with accuracy scores above a set threshold (e.g., >80%) are then exposed to a sentence-learning phase, in which they are presented with grammatical picture-sentence combinations. Sentence structures are based on a limited set of grammatical rules (hence: “miniature language”). After a delay period, participants are then tested on their ability to discriminate grammatical from ungrammatical sentences.

This study in progress aims to determine whether the role of sleep in language learning extends to the combinatorics underlying sentence comprehension in a modified miniature language (MML) modelled on Mandarin Chinese. Mandarin was chosen because: (a) it allows for a comparison of sequence-dependent and sequence-independent combinatorics via the use of word order restrictions and classifiers, respectively, and (b) typical study participants (Australian undergraduate university students) are unlikely to have had exposure to it. We will examine whether dissociable aspects of sleep neurophysiology underpin the consolidation of sequence-dependent and sequence-independent combinatory mechanisms, respectively. Effects of sleep will be examined using combined behavioural (response times and acceptability ratings) and electroencephalographic (EEG) measures (event-related brain potentials and oscillatory neuronal dynamics recorded during sentence learning and comprehension tasks).

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