 Overnight consolidation of declarative, procedural, and speech-perceptual memory in adults with developmental language disorder

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Introduction

Memory consolidation refers to the processes by which memory traces undergo enhancement processing speed, which may be better captured by tasks that assess procedural learning.

Thus, the goal of this study is to determine if the consolidation deficits in speech observed in adults with DLD could be attributed to deficits in either declarative or procedural memory consolidation.

Methods

Participants

N=72 monolingual, English-speaking adults (mean 21.53 years, SD 2.51 years; 45 F) with no hearing, attentional, social-emotional, or frank neurological deficits, participated in a 3-session study.

Participants were administered an initial language and reading test battery during the first session to determine language status. Participants were classified as having typical language (TD) or DLD based on criteria described by Fidler, Planté, and Vance (2013). Participants meeting criteria for developmental dyslexia (n=12) were removed, on the basis that dyslexia may reflect a qualitatively different deficit in phonological processing compared to typical children (e.g. Rams et al., 2013).

Analyses & Results

An initial Levine's test determined that the samples (possibly due to uneven sizes) violated assumptions of normality. Therefore, in order to conduct mixed within-between subjects ANOVA for each task, a subset of TD adults were matched to participants with DLD on baseline perceptual discrimination ability to serve as the comparison Group. We present the results of the mixed ANOVA on the resultant 28 participants (24 Group).

Declarative Learning Recognition memory

On average, there appears to be no difference in performance between adults with and without DLD.

Procedural Learning Serial Reaction Time

There is a main effect of Group, suggesting that those with DLD perform less well than typical adults on PM overall.

Speech Learning Nonnative contrast training

There appears to be no difference in performance across days/groups; however, there is a trend towards a Group difference in perceptual performance on day 2.

Conclusions

At face value, it appears that the consolidation of DM and PM do not differ across adults with and without DLD.

- A main effect of Group for PM, but not DM, suggests that the primary learning difference is in PM.
- Thus, there may be differences in the strategies employed during initial learning that are not observed until later.
- A lack of a Group x Time interaction in the DM and PM tasks must be interpreted with caution, however, as at n=14, we are only trending toward replication of our prior results (i.e. still underpowered) of our speech learning task.
- Moreover, the visual patterning of DM learning trajectory more closely resembles the speech learning pattern.

The learning challenges faced by adults with DLD therefore may not just be in PM (Procedural deficit hypothesis: Ultman & Paapori, 2005; Ultman et al., 2020), but may yet include challenges with offline system consolidation.

References


Correlations

In order to examine the relationships between DM, PM, and speech-perceptual memory, we ran a series of correlations between task performances on each day.

Similar relationships between PM and phonological processing and speech learning and phonological processing may be indicative of similar capacities underlying performance on all three tasks.

Correlations between experimental tasks

Associations between speech learning performance and both DM and PM (which appear to be uncorrelated) suggest a division of labor between memory systems for speech sound learning.

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