Contributions of episodic memory abilities to adult L2 word learning

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INTRODUCTION

- Word learning may rely on the declarative memory system (Davis, Di Betta, Macdonald, & Gaskell, 2009; Davis & Gaskell, 2009; Gaskell & Ellis, 2009; Ullman, 2004, 2007, 2015, 2016).

- DM consists of two subsystems:
  - Episodic memory: underlies **initial learning** and representation of bits of information (e.g., words) and the associations between them, tied to context of learning.
  - Semantic memory: underlies **subsequent storage** and processing of those bits of information (e.g., words) and associations after consolidation.

- The Complementary Learning Systems (Davis et al., 2009; Davis & Gaskell, 2009; Gaskell & Ellis, 2009): early word learning should rely on fast learning of sparsely represented episodic word traces, which subsequently give way to more slowly learned, distributed neocortical word representations.

- For adult second language (L2) lexicon, (Jiang & Forster, 2001; Qiao & Forster, 2013, 2017; Qiao, Forster, & Witzel, 2009; Witzel & Forster, 2012) L2 words, unlike L1 words, are represented entirely episodically even at more advanced stages of L2 ability, but it is unclear whether this is language-specific episodic information or a part of a general episodic system.

- Neural data also show that episodic memory substrates are engaged in word learning (neuropsychological data: Kensinger, Ullman, & Corkin, 2001; neuroimaging data: Takashima, Bakker, van Hell, Janzen, and McQueen, 2017 & Breitenstein et al., 2005); however, these neural substrates also subserve other functions (e.g., spatial cognition), leaving open the possibility that word learning recruits these neural structures due to some common, non-memory function. Which can be solved with behavioral individual differences.

RESEARCH QUESTIONS

Two inter-related questions:

1) Do links between episodic memory and L2 word learning also appear at a behavioral individual differences level?

2) Is the contribution of episodic memory to L2 word learning domain-general (i.e., not purely linguistic)?

METHODS

Participants
- 22 total: 11 F, 11M
- Native English-speaking monolinguals
- 21.59 years old (SD: 2.73)

**Materials, Design, and Procedure**
Day 1: Word learning task
- Incidental, cross-situational word learning paradigm (Hamrick & Rebuschat, 2012)
- Learning phase: 10 pseudowords presented twice, once with correct referent, once with incorrect
- Test phase: pseudowords from learning phase in match-mismatch trials. Participants decided whether they matched or not
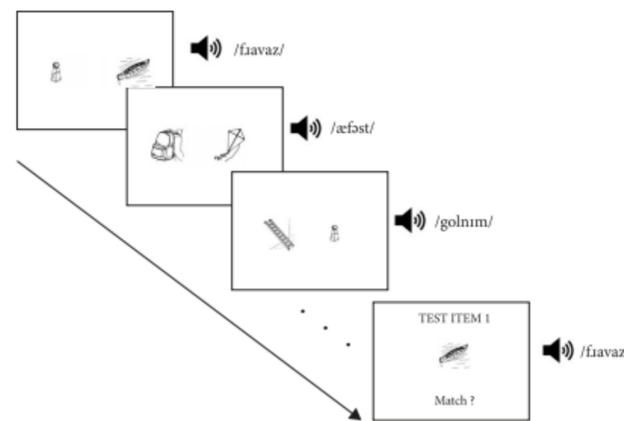
Day 2: Two days later, repeated test phase with different pseudorandomized order for trials
Within a week of the word learning task: Episodic memory task (CVMT) + demographic info
- Continuous Visual Memory Test (CVMT: Trahan & Larrabee, 1988)
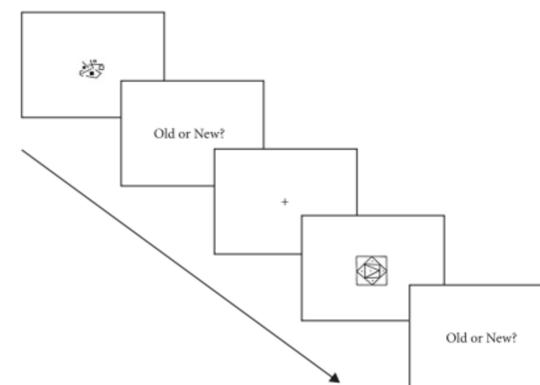
Analyses
- Logistic multilevel modeling following the procedure in Hamrick & Pandza (2019).
  - Fixed effects for baseline model: Accuracy on CVMT and word learning trial test type

RESULTS

- Episodic memory predicts L2 word learning at time 1, but not two days later at time 2

Table 1. Accuracy on CVMT and proportion of accuracy on word learning test phase at time 1 and time 2

	CVMT d'	Word Learning Time 1	Word Learning Time 2
M	1.18 (0.69)	0.60	0.57
SD	1.80 (0.26)	0.11	0.11
SE	0.39 (0.06)	0.02	0.09

Table 2. Best fitting model for word learning accuracy in session 1

Fixed effects	Estimate	SE	z-value	p-value
Intercept	0.389	0.184	2.118	0.034
CVMT Accuracy	0.328	0.148	2.210	0.027
Random effects	Variance	SD		
Intercept | Subject	3.79e-14	1.94e-07		
Intercept | Item	4.23e-01	6.50e-01		

Table 3. Best fitting model for word learning accuracy in session 2

Fixed effects	Estimate	SE	z-value	p-value
Intercept	0.289	0.153	1.880	0.060
CVMT Accuracy	−0.154	0.147	−1.045	0.295
Random effects	Variance	SD		
Intercept | Subject	0.215	0.463		
Intercept | Item	0.000	0.000		

DISCUSSION

- Initial word learning in adults is linked to domain-general episodic memory mechanisms.

- No significant effect two days later. Could be due to lack of power and/or words being integrated into L1 lexicon.

- Findings are consistent with several theoretical frameworks linking the lexicon to the declarative memory system more broadly (e.g., Davis et al., 2009; Davis & Gaskell, 2009; Gaskell & Ellis, 2009; Jiang & Forster, 2001; Qiao & Forster, 2013, 2017; Qiao, Forster, & Witzel, 2009; Ullman, 2004, 2016; Witzel & Forster, 2012).

- Findings resonate with a growing body of work demonstrating that elementary principles of episodic memory (and their neural substrates) play an important role in word learning.

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