The Relationship between Implicit and Explicit Processing in Statistical Language Learning

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Introduction

- Statistical learning refers to the *discovery of patterns in the input*
- The learning of word boundaries can occur through an implicit computation of transitional probabilities, which are statistically predictive relationships between syllables (Saffran et al., 1996)
- It is widely accepted that statistical learning contributes to word segmentation, however the cognitive mechanisms under operation in this process remain poorly understood (Romberg & Saffran, 2010)
- Statistical learning is considered a domain-general resource (Kirkham et al., 2002), although domain-specific interference effects have not been investigated in detail
- Past research has failed to reliably demonstrate whether explicit processing can impair the implicit functioning of statistical language learning (Ludden & Gupta, 2000; Saffran et al., 1997; Torro et al., 2005)
- The present study examined how explicit domain-general and -specific working memory tasks with low or high demands impaired the statistical learning of word boundaries in an artificial language

Method

Participants

110 young adults
English first language; normal hearing/vision

Procedure

- Participants exposed to an artificial language for **28 minutes** while concurrently engaged in a working memory task

Artificial Language Stimuli

- Similar to Saffran et al. (1997), the language contained **six trisyllabic "words"** generated from 12 CV syllables

putibu, bupada, pidadi, dutibu, dutaba, tutibu

- Words presented in random order with no repeats; recorded from a native English female speaker

Explicit Working Memory Task Stimuli

n = 22/group

Implicit Learning Test Phase

- "Word"/nonword pair:
  "Which sounds more like something you heard in the language?"
- Trisyllabic **nonwords** with transitional probabilities of zero

budata, bitapa, patubi, tipabu, dupitu, batipa

Results

TABLE 1:

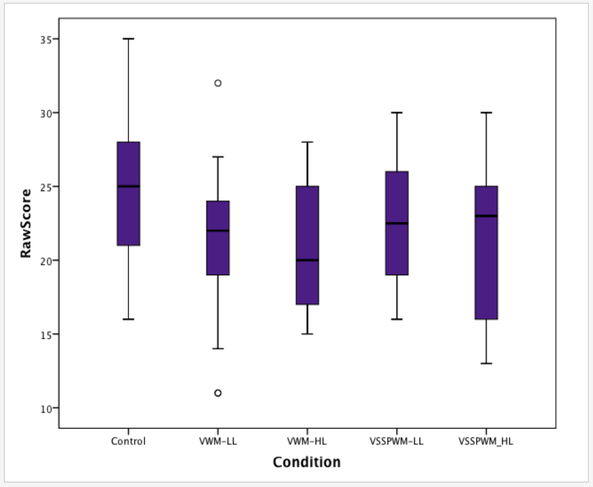
Means and effect sizes of word identification scores (out of 36) for experimental groups and controls

	Task Domain		
Task Load	**No Domain**	**Verbal**	**Visuospatial**
No Load			
M (SD)	24.36 (4.30)		
Low Load			
M (SD)		21.05 (5.26)*	22.55 (4.15)
d		0.77	0.43
High Load			
M (SD)		21.09 (4.31)*	21.64 (5.29)
d		0.76	0.56

Table 1: * = $p < .05$; Planned simple contrasts compared experimental groups to controls. Those in either verbal working memory task domain identified significantly fewer words than controls.

FIGURE 1:

Word identification scores for experimental groups and controls



Conclusions

- Participants successfully segmented words from artificial speech using transitional probabilities
- Participants engaged in a concurrent verbal working memory task, regardless of task load, had significantly lower word identification scores than controls
- Participants engaged in a concurrent visuospatial working memory task, regardless of task load, did not differ from controls
- Dual-task interference with an explicit verbal task impairs verbal statistical learning
- Limited verbal working memory resources may impair learning of new phonological forms

References

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