

Improving the Use of Prepositions in Expressive Aphasia: The Effects of Syntactic Computer Training

Elitsa D. Slavkova, Kate E. Watkins, & Glyn W. Humphreys

Cognitive Neuropsychology Centre, Department of Experimental Psychology, University of Oxford

Introduction

Prepositions are heterogeneous in their functions and have structural characteristics, such as government and lexical characteristics, such as meaningfulness, syntactic and lexical properties, and could be stressed or unstressed. Previous research has indicated that a number of characteristics affect preposition production and comprehension post-stroke:

- Phonologically stressed prepositions > unstressed prepositions (Kean, 1977; 1979)
- High frequency prepositions > low frequency (Kreindler & Mihailescu, 1970)
- Meaningful prepositions > meaningless prepositions (Frederici, 1982)
- Lexical prepositions > syntactic prepositions (Bennis et al., 1983)
- Governed prepositions > ungoverned prepositions (Godzinsky, 1988)

Matzig (2009) did not confirm any of the above findings and suggested that syntactic knowledge is preserved and the deficit occurs at spell-out, post-syntax.

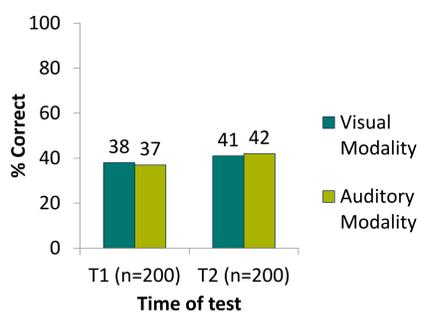
Disadvantages of previous research on prepositions:

- Paucity of research on prepositions
- Small number of prepositions used and poor classification of prepositions, often not based on linguistic theory
- Lack of assessment of all subcategories of prepositions in a single study
- Small number of aphasia patients
- Unclear classifications of types of aphasia

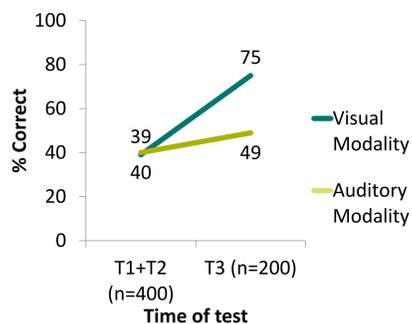
Matzig (2009) presents a very comprehensive study including multiple types of prepositions. However, only 5 patients (4 Broca's and 1 anomia patient) were included in the study.

Results

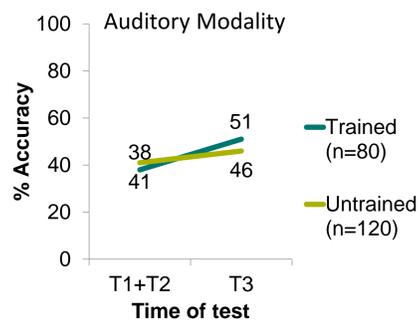
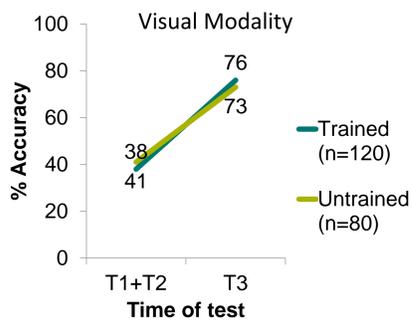
Spontaneous Recovery



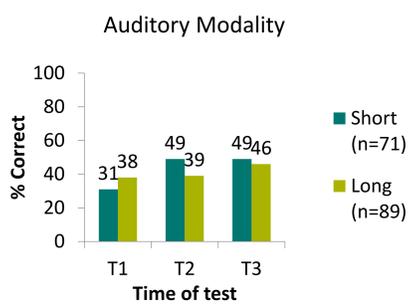
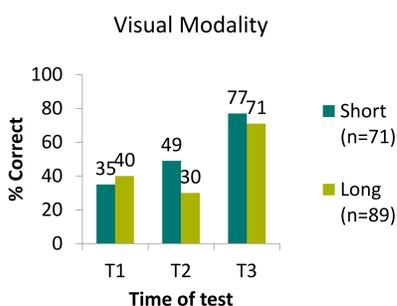
Effects of training



Effects generalised to untrained prepositions

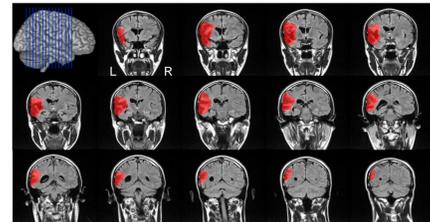


Sentence length effects (combining trained and untrained prepositions)



Patient Profile

The patient (RR) is a right-handed male, 31. He was previously an accountant. RR sustained an ischemic stroke in March 2012, which resulted in a left temporal and parietal lesion and expressive aphasia



Visualization of RR's lesion, drawn manually on a clinical FLAIR scan in native space

Results on the Oxford Cognitive Screen in the acute stage and the Birmingham Cognitive Screen in the chronic stage indicated impairments in picture naming, sentence construction and reading, word and nonword reading, number, price and time reading, number writing, multiplication and division

Training Program

The training targeted 5 prepositions: *IN*, *ON*, *TO*, *AT* and *INTO*. Only 3 of these were included in the training which allowed us to explore generalization effects

The training consisted of:

- Multimodal presentation of 6 phrases (2-4 words; M=2.7; SD=.8)

<u>IN</u> the future	<u>ON</u> Wednesday	return <u>TO</u>
<u>IN</u> the middle ages	<u>ON</u> the bus	listen <u>TO</u>
<u>IN</u> 1724	<u>ON</u> television	appeal <u>TO</u>
<u>IN</u> the field of	<u>ON</u> the right	next <u>TO</u>
<u>IN</u> place	<u>ON</u> the surface	pay tribute <u>TO</u>
<u>IN</u> September	<u>ON</u> a quest	<u>TO</u> a good use

RR's task was to:

- *Locate the preposition* which aimed to facilitate encoding of the location of the preposition within a phrase and improve syntactic processing
- *Type in the preposition* in order to facilitate orthographic processing
- *Repeat the phrase* in order to improve phonological processing

Baseline measures were obtained:

- Before the training on time 1 (T1) and time 2 (T2) 5 weeks apart
- After the training at time 3 (T3) 12 weeks later
- Visual modality(reading) and auditory modality(listening)

Stimuli:

- 200 sentences (5-14 words long; M=8.5; SD=1.9)
- 1 omitted preposition in each sentence

Conclusions

The syntactic computer training described above resulted in improved use of prepositions during reading and listening. We did not observe spontaneous recovery and there was a larger improvement in the visual, compared to the auditory modality. The increased working memory demand in the auditory modality may have been the factor which led to the smaller improvement.

Further aims of the present study:

- Contrasting the recovery rate after a long training program (200 repetitions over 3 months) with the recovery rate after a short training program (34 repetitions over 1 month)

I am planning to address the challenges presented by previous studies by:

- Including multiple types of prepositions (based on Matzig, 2009)
- Including a bigger sample of aphasia patients
- Use standardised language assessments to present clear aphasia patient profiles

Objectives of the future study:

- Establishing which prepositions are most affected in different types of aphasia
- Designing effective rehabilitation strategies using TMS and tDCS