

Is gradient phonotactic knowledge lexical or grammatical?



Evidence from a serial recall recognition experiment

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This study addresses the question whether gradient phonotactic effects on lexical processing solely arise from the lexicon, or whether phonotactic grammar also plays a role. Studies which support the view that gradient phonotactic effects depend on the lexical neighborhood size have so far only used simple CVC nonword stimuli. However, CC-clusters in syllable-onset or coda position are more strongly restricted than CV or VC strings. Using a recognition task, the current study tested the hypothesis that phonotactic grammar might become more strongly involved in the processing of complex syllable words. As predicted, the difference in recall performance between nonwords of high versus low phonotactic probability increased with syllable complexity. This finding supports the hypothesis that gradient phonotactic effects are partly attributed to grammatical processing.

Introduction

- **Frequency of co-occurrences of phonemes** (transitional probability, O/E etc.) influence wordlikeness-judgements (Bailey & Hahn 2001), speech processing (Vitevitch & Luce 1999) and lexical acquisition (Gathercole et al. 1999).

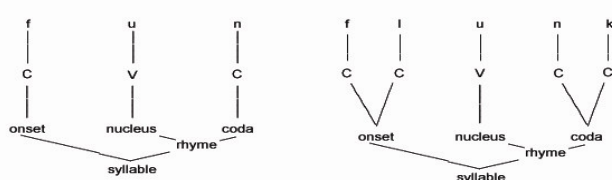
Question: Where is this gradient phonotactic knowledge represented? Within or outside the lexicon?

Prior research

- Although earlier results (e.g., Gathercole et al. 1999) suggested that bi-phone frequency affects repetition accuracy in a short-term memory task, Roodenrys & Hinton (2002) showed that this effect disappears when lexical neighborhood size is controlled. Conversely, lexical neighbourhood size affects recall, also when bi-phone frequency is controlled.

Caveat: The findings of Roodenrys & Hinton could be attributed to the fact that in their experiment only CVC syllables were tested.

→ Co-occurrence restrictions are stronger in syllable constituents (e.g. CC onsets or codas) than in non-constituents (e.g. CV or VC strings).



Hypothesis: Gradient phonotactic knowledge is grammatical, hence its impact on processing may depend on other grammatical factors, such as syllable complexity.

→ Effects of bi-phone frequency on recall performance will appear with complex syllables, when co-occurrence restriction are stronger, even when lexical neighbourhood is controlled.

Experiment: Serial recall recognition task (Sternberg, 1966)

Testing the short-term memory performance on manipulated nonwords:

- Auditory sequence of 4 nonwords containing 1 target stimulus followed by probe
- Task: Did the 5th item occur in the sequence before? Yes or No?
- Stimulus presentation at random.

Measures: Error rates and reaction times (RTs).

Filler 1	Test item	Filler 2	Filler 3	Probe	appeared before?
/brɪnt/	/pra:n/	/me:f/	/ro:mt/	/pra:n/	yes
/brɪnt/	/pra:n/	/me:f/	/ro:mt/	/blas/	no

Participants: 25 native speakers of Dutch.

Material:

Monosyllabic Dutch sounding nonwords of

- simple (CVC) versus complex (CCVC, CVCC, CCVCC) syllables
- high versus low frequent bi-phones
- controlled for lexical neighborhood density (frequency data from CELEX).

Prediction:

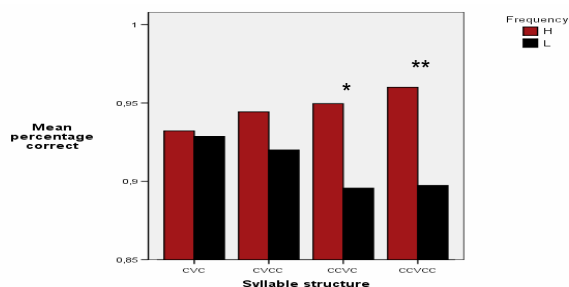
- Differences for error rates and reaction times between high versus low bi-phone frequency will increase with increasing syllable complexity.

Results

- Differences in recall performance between high and low bi-phone frequency nonwords increased with increasing syllable complexity.

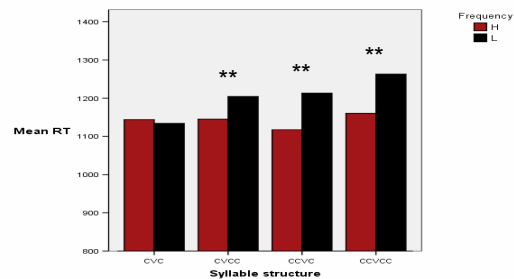
Error rates:

- For CVC, high versus low bi-phone frequency did not have an effect on recall.
- For complex syllable structures however bi-phone frequency had an impact on recall: Listeners made more errors on nonwords with low-frequency bi-phones compared to high-frequency bi-phones.
- The difference in recall between simple and complex syllables was significant.



Reaction Times:

- For CVC, high versus low bi-phone frequency did not have an effect on recall.
- For complex syllable structures bi-phone frequency had an impact on recall: Recall of words with high-frequency bi-phones was faster.
- The difference between recall of simple versus complex syllables was significant.



But: possible confound by stimulus duration.

→ Work on excluding this confound is in progress.

Conclusion

Gradient phonotactic effects are modulated by syllable complexity.

→ Evidence for the hypothesis that gradient phonotactic effects reflect also the grammar, not only the lexicon.

→ Indirect evidence for a role of gradient phonotactic grammar on lexical acquisition, particularly of phonotactically complex words, because short-term memory performance and long-term memory storage are correlated.

→ This study underscores the need to integrate gradient in future models of grammar (Pierrehumbert 2003, Pater & Coetzee 2005).

References

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