Reading Aloud Multisyllabic Words: A Single-Route Connectionist Model for Greek

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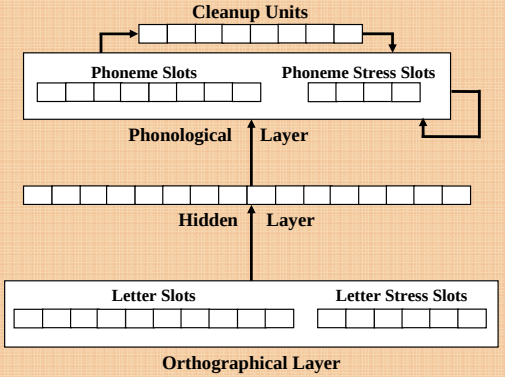
1. Goal

We aim to create a connectionist model of Greek multisyllabic word reading. Most existing models used mono-syllabic English words aligned on the nucleus.

Greek orthography is relatively transparent but there are exceptions affecting syllabification. A stress diacritic marks the stressed vowel in the orthography, therefore stress assignment must be considered.

2. The Model

Based on Harm's (1999) implementation modified by Zevin (2006). Extended for words with 2–5 syllables, 4-10 letters long. The input was not syllabically aligned because CiV letter groups are ambiguous (Protopapas & Nomikou, 2009). The output layer was simply extended by adding more syllable groups to the original English implementation.



Training lasted 9 million word presentations using a corpus of 120,745 frequency-weighted word types, not reaching asymptote; resulted in 96% correct word reading and less than 0.1% stress assignment errors.

Example: Representations for word άδεια
(homograph of /'a.ði.a/ "permission" and /'a.ðʝa/ "empty")

Orthographical Input Representation *(grouped by letter type)*

Letters: _ _ _ α _ _ _ _ δ _ _ _ _ ε ι α _

CCCVVVVVCCCCCVVVVVCCCCVVVVVCCCVVVVCCVVC

Stress: α _

Phonological Output Representation *(in syllable groups)*

Phon: _ _ _ a _ _ | _ _ ð i _ _ | _ _ _ a _ _ | _ _ _ _ _ _ _ | _ _ _ _ _ _ _ — ***/'a.ði.a/*** (permission)

CCCVCC|CCCVCC|CCCVCC|CCCVCC|CCCVCC

Stress: a _ _ _ _

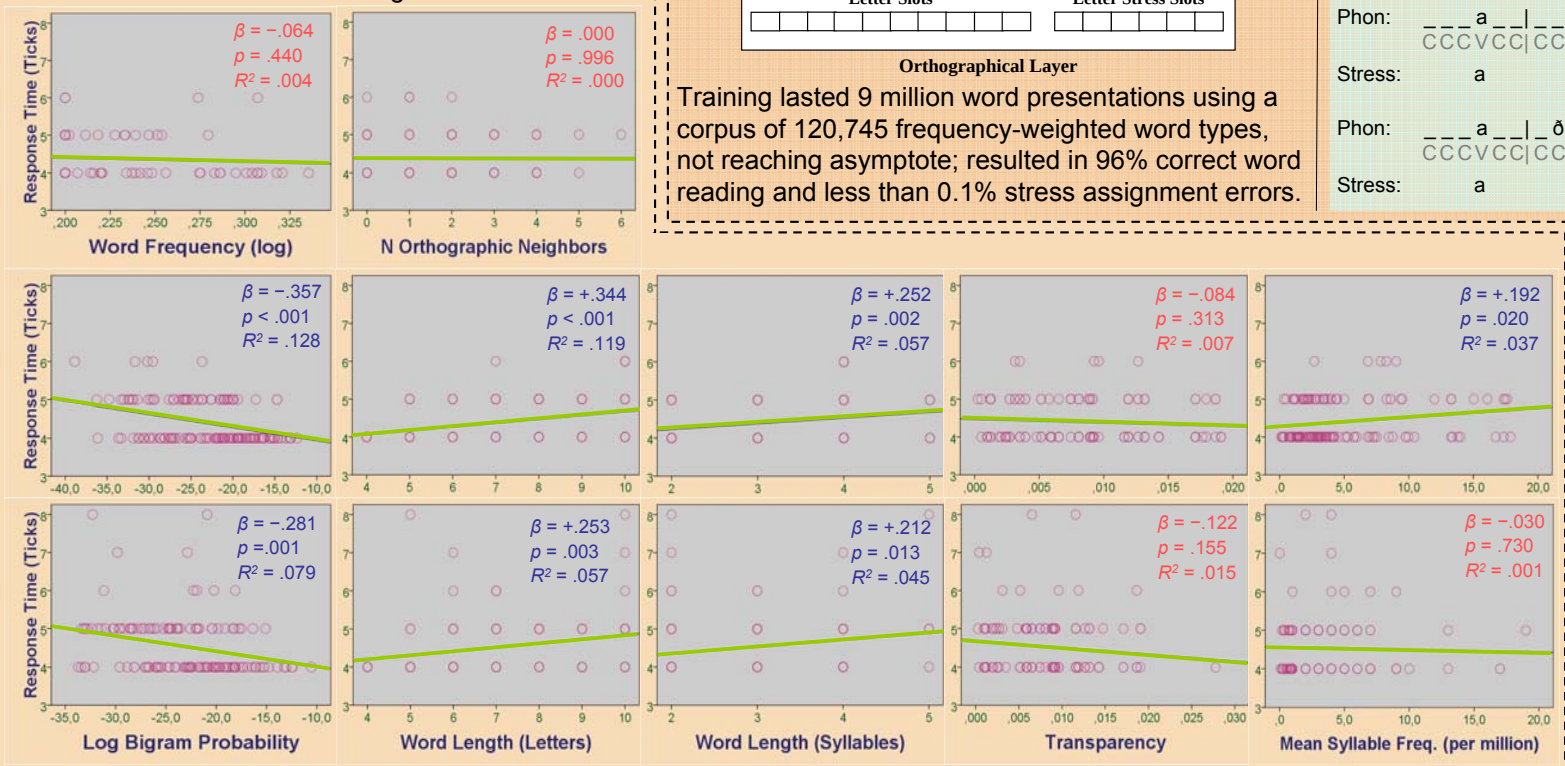
Phon: _ _ _ a _ _ | _ ð ʝ a _ _ | _ _ _ _ _ _ _ | _ _ _ _ _ _ _ | _ _ _ _ _ _ _ — ***/'a.ðʝa/*** (empty)

CCCVCC|CCCVCC|CCCVCC|CCCVCC|CCCVCC

Stress: a _ _ _ _

3. Testing & Results

Measured reading and stressing accuracy and response time (in ticks) for 150 words and 150 matched nonwords with minimal intercorrelations among basic variables.



Performance was 97.3% correct for words and 91.3% for nonwords. The response time difference between words and nonwords was not significant: $t(247)=1.870$, $p=.063$; Mann-Whitney U=9159.5, $p=.154$.

(All analyses include correct responses only, excluding one word and one nonword outlier RT; "Transparency" is Spencer's (2009) minimum sonograph probability, a bidirectional index).

When the same items were presented without stress mark information, only 53.3% of the words and 42.7% of the nonwords were stressed correctly. However, stress assignment was not random but matched stress distribution in the corpus.

4. Discussion

Novel representation successfully mapped arbitrary (non-aligned) orthography to syllabified phonology.

The model learned to use stress mark information for stress assignment even though stress mark positions did not map to fixed vowels or phonological syllables.

Significant word length effects emerged despite parallel computation. Perhaps lack of orthographic alignment posed additional computational demands for longer words, leading to a short-word advantage.

No word frequency effect was found. However, words were relatively low frequency, and did not appear often due to the huge corpus. Lack of a lexical effect also suggests insufficient distinction of words from nonwords, consistent with bigram frequency effects.

Acknowledgments

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References

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