Dual-Route Connectionist Model of Greek Spelling

Ioanna Katidioti¹, Ian C. Simpson², Athanassios Protopapas¹

¹Department of Philosophy & History of Science, University of Athens, Greece;
²Department of Developmental Psychology and Education, University of Granada, Spain

Contact email: ioannakatidioti@gmail.com

1. INTRODUCTION

We created a model that maps sequences of phonemes to corresponding sequences of graphemes using a sub-lexical and a lexical route. It is based on the models of Houghton & Zorzi (2003) and Simpson (2011). Its architecture is as follows:

- Phonological Route
  - Input level
  - Lexicon
  - Output level
- Lexical Route

2. INPUT/OUTPUT REPRESENTATION

The representation is syllabic and nucleus centred, with 4 consonant slots before and after the vowel.

**Input (Phonological form):**
- 1st syllable
- 2nd syllable
- 3rd syllable
- 4th syllable
- 5th syllable

**Output (Orthographic form):**
- 1st syllable
- 2nd syllable
- 3rd syllable
- 4th syllable
- 5th syllable

3. TRAINING

To simulate children’s spelling we used:
- 30,391 words from a child database
- 30 epochs of training
- no weight pruning

4. RESULTS (Part 1)

**SPELLING OF THE TRAINING SET BY THE MODEL:**
- Dual-route: 100% correct spelling.
- Phonological route: 65.2% correct spelling. Almost all mistakes were phonologically plausible.

**CHILD SPELLING SESSION 1**

48 words given to 37 students (Grades 3-4):
- 13 of 14 mistakes made by the model were also made by children
- 11 of 14 mistakes made by model were the most common mistakes made by the children

5. THEORETICAL BACKGROUND

- In Greek, possible graphemes of ambiguous phonemes have different frequencies.
  - /o/ is “o” 74% and “u” 26% of the time
- The model spells using only frequencies created during training

6. GOAL

1. To create nonwords that the model would write with a low-frequency grapheme. We used the model’s weights in order to choose consonants that promoted low-frequency graphemes.
2. To test if children are also more likely to choose the less frequent graphemes in the same contexts.

7. METHOD

**CHILD SPELLING SESSION 2:** 177 students (Grades 5-6)

**Item group A:** 39 nonwords spelled by the model with the low-frequency grapheme

**Item group B:** 39 nonwords spelled by the model with the high-frequency grapheme

5 pairs of low and high frequency graphemes were used:
- /o/ (“o” or “u”)
- /e/ (“e” or “e”)
- /i/ (“i” or “y”)
- /g/ (“g” or “y”)

8. RESULTS (Part 2) & DISCUSSION

For each of the 5 grapheme pairs, the relative proportion of low frequency graphemes compared with high frequency graphemes used by children was significantly higher in Item group A compared to Item group B. (all ps < .001)

These results demonstrate that:
- Children’s spelling of ambiguous phonemes is influenced by context
- Spelling is affected by the frequency of phoneme-grapheme co-occurrence
- The model can be used successfully for further research

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