Readers show trade-offs between print-speech correspondences and semantic imageability in visual word naming

Deanne Tak On Wah[1] (dwah@uwo.ca), Marc Joanisse[1,2]
[1]Department of Psychology, University of Western Ontario, [2]Haskins Laboratories, New Haven CT, USA

meet me

Introduction

- English spelling is quasi-regular: mappings between orthography (O; print) and phonology (P; speech) can be ambiguous
- Vowel pronunciations tend to contain the most ambiguity, though many can be learned via statistical patterns in rime units (context dependent mappings)[1]
- Contemporary reading models propose that words are recognized through joint contribution of analytic (decoding print-to-speech) and holistic (whole-word) processes

Research Questions:

1. What grain size of print-speech information is a reliable reading cue for skilled readers (**vowel surprisal** vs. **context dependent vowel surprisal**)?
2. How does an analytic approach interact with whole-word mechanisms (as indexed by imageability effects)?

OP correspondence is measured using surprisal[2]

Low Vowel Surprisal *(easier to read)* — **High Vowel Surprisal** *(more difficult to read)*

COIN FOIL VOICE ⟷ MOTHER DOG TOLD

Low Context Dependent Vowel Surprisal *(easier to read)* — **High Context Dependent Vowel Surprisal** *(more difficult to read)*

COIN JOIN GROIN ⟷ PINT MINT LINT

Semantics is measured using imageability[3]

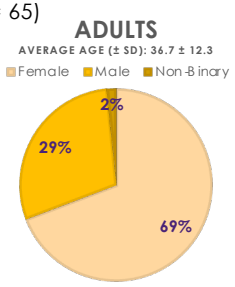
Low Imageability *(more difficult to read)* — **High Imageability** *(easier to read)*

WERE 1 2 3 4 5 6 7 CAT

Methods

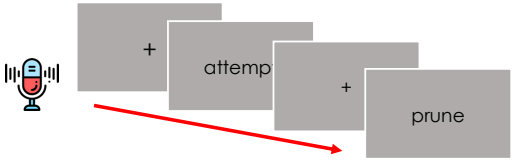
Participants:

- Monolingual English Adults (N = 65)
- Neurologically healthy



Word naming task:

- 300 monosyllabic & disyllabic words that vary along lexical and sub-lexical variables (2 words removed in analyses)
- Measure: log transformed word naming latency



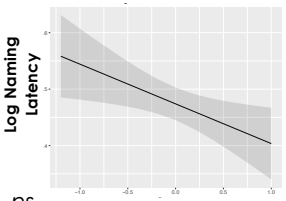
Results

Individual Models:

- Linear mixed effects models of **vowel surprisal**, **context dependent vowel surprisal, imageability** on naming latency & random intercepts (word & participant)
- For each participant, standardized coefficients indicated degree of reliance on competing mechanisms

Reliance on Reading Routes and Naming Latency:

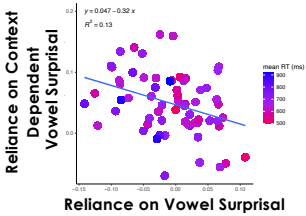
- Greater reliance on vowel surprisal & faster naming latency, $p = .017$
- Imageability & naming latency, *ns*
- Context dependent vowel surprisal & naming latency, *ns*



Results

Comparing Degree of Reliance on Reading Routes:

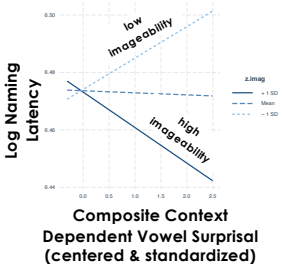
- Tradeoff between vowel surprisal & context dependent vowel surprisal, $p = .004$
- Vowel surprisal & imageability, *ns*
- Context dependent vowel surprisal & imageability, *ns*



Item Analysis – Predictors of Reading in Adults:

Stepwise backwards elimination of linear mixed effects regression predictors:

1. age, $p = .016$
2. word frequency, $p = .025$
3. number of syllables, $p < .001$
4. individual's reliance on vowel surprisal, $p = .031$
5. interaction between word's context dependent vowel surprisal & imageability, $p = .025$



Discussion

- Greater reliance on one-to-one vowel correspondences best accounted for variance in naming time, compared to context-dependent correspondences
- Context-dependent correspondences trade-off with semantic imageability, particularly for low imageability words, suggesting that adults relied more on decoding for these words

References

1. Steacy, L. M., Compton, D. L., Petscher, Y., Elliott, J. D., Smith, K., Rueckl, J. G., Sawi, O., Frost, S. J., & Pugh, K. R. (2019). Development and Prediction of Context-Dependent Vowel Pronunciation in Elementary Readers. *Scientific Studies of Reading, 23*(1), 49–63. https://doi.org/10.1080/10888438.2018.1466303
2. Siegelman, N., Rueckl, J. G., van den Bunt, M., Frijters, J. C., Zevin, J. D., Lovett, M. W., Seidenberg, M. S., Pugh, K. R., & Morris, R. D. (2021). How you read affects what you gain: Individual differences in the functional organization of the reading system predict intervention gains in children with reading disabilities. *Journal of Educational Psychology*. https://doi.org/10.1037/edu0000672
3. Cortese, M. J., & Fugett, A. (2004). Imageability ratings for 3,000 monosyllabic words. *Behavior Research Methods, Instruments, & Computers, 36*(3), 384–387. https://doi.org/10.3758/BF03195585