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August 26, 2021

# Imagine a word sinking your yacht: sequential effects on reading accuracy in older adults and people with aphasia

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## Introduction

During oral reading tasks, the order of item types affects response times (Kinoshita & Lupker, 2007; Taylor & Lupker, 2001). Some researchers attribute these sequential effects to “response homogenization,” observing that “fast” words are read more slowly and “slow” words more quickly in blocks of mixed word types compared to blocks containing only one word type (Lupker et al., 1997). Thus, readers subconsciously control speed, not process. Other studies suggest that readers dynamically adjust the knowledge they need to read a particular word, and the cost of switching between different reading processes slows response times (Reynolds & Besner, 2005). These studies have been designed within Dual Route frameworks that do not emphasize the role of semantics in reading aloud (Coltheart et al., 1993, 2001) and therefore have not examined sequential effects of semantic content. Prior studies have also never investigated sequential effects on accuracy, which could not be explained by response homogenization. To address these gaps, we examine sequential effects on reading accuracy in people with aphasia and matched older controls using a mixed-block word reading task, allowing simultaneous examination of sequential effects of multiple word features.

## Methods

Participants were 36 people with a history of aphasia post left-hemisphere stroke and 39 controls matched on age and education. Both groups read aloud 200 monosyllabic words crossed factorially on frequency (high/low), regularity (regular/irregular), and imageability (high/low). Items were presented in an order such that each item type was preceded by each other item type the same number of times. Generalized linear mixed effects models, using the maximal random effects structure justified by the data and experiment, tested how preceding factors of frequency, regularity, and imageability relate to accuracy on high frequency regular, low frequency regular, high frequency irregular, and low frequency irregular words.

## Results

Low frequency irregular words were read more accurately by both controls and patients if preceded by a low imageability word rather than a high imageability word (Controls:  $Z = -2.33$ ,  $P = .02$ ,  $OR = 0.27$ ,  $95\% CI = .09$  to  $0.81$ ; Patients:  $Z = -2.62$ ,  $P = .009$ ,  $OR =$

0.45, 95% CI = 0.25 to 0.82). There was no significant interaction of preceding imageability with current imageability. Patients also more accurately read high frequency regular words when preceded by an irregular word rather than a regular word ( $Z = -2.13$ ,  $P = .033$ ,  $OR = 0.60$ , 95% CI = 0.37 to 0.96).

## Conclusions

Our findings suggest that preceding stimulus type affects word reading accuracy. Specifically, residual semantic activation from a highly imageable prior trial interferes with correct reading of low frequency irregular words, consistent with models suggesting semantic reliance in reading these words (Plaut et al., 1996). Results are not likely due to attentional effects or prior item difficulty, as no effect of preceding frequency was observed. The preceding regularity effect on high frequency regular words requires further investigation. Overall, these findings support dynamic process-related causes of sequential reading effects, and suggest that sequential effects are not solely attributable to response time homogenization.

## References

- Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993). Models of reading aloud: Dual-route and parallel-distributed-processing approaches. *Psychological Review*, *100*(4), 589–608. <https://doi.org/10.1037/0033-295X.100.4.589>
- Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review*, *108*(1), 204–256. <https://doi.org/10.1037/0033-295x.108.1.204>
- Kinoshita, S., & Lupker, S. J. (2007). Switch costs when reading aloud words and nonwords: Evidence for shifting route emphasis? *Psychonomic Bulletin & Review*, *14*(3), 449–454. <https://doi.org/10.3758/BF03194087>
- Lupker, S. J., Brown, P., & Colombo, L. (1997). Strategic control in a naming task: Changing routes or changing deadlines? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *23*(3), 570-590. <https://doi.org/10.1037/0278-7393.23.3.570>

- Plaut, D., McClelland, J., Seidenberg, M., & Patterson, K. (1996). Understanding normal and impaired word reading: Computational principles in quasi-regular domains. *Psychological Review*, *103*, 56–115. <https://doi.org/10.1037//0033-295X.103.1.56>
- Reynolds, M., & Besner, D. (2005). Contextual control over lexical and sublexical routines when reading English aloud. *Psychonomic Bulletin & Review*, *12*(1), 113–118. <https://doi.org/10.3758/BF03196355>
- Schwartz, M. F., Saffran, E. M., & Marin, O. S. M. (1980). The word order problem in agrammatism: I. Comprehension. *Brain and Language*, *10*(2), 249–262. [https://doi.org/10.1016/0093-934X\(80\)90055-3](https://doi.org/10.1016/0093-934X(80)90055-3)
- Taylor, T. E., & Lupker, S. J. (2001). Sequential effects in naming: A time-criterion account. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *27*(1), 117–138. <https://doi.org/10.1037/0278-7393.27.1.117>

## Acknowledgments

Thank you to our participants for their time and commitment to our work. This work was funded by NIH grant R01DC014960 (P.E.T) and F30DC018215 (J.V.D).

## Figure 1

**Table 1. Linear mixed effect model predicting accuracy reading low frequency irregular words based on preceding trials**

<i>Predictors</i>	Accuracy (controls)			Accuracy (patients)		
	<i>Odds Ratios</i>	<i>CI</i>	<i>P</i>	<i>Odds Ratios</i>	<i>CI</i>	<i>P</i>
(Intercept)	29.46	14.87 – 58.36	<b>&lt;0.001</b>	1.05	0.49 – 2.24	0.899
Imageability	4.57	1.53 – 13.65	<b>0.007</b>	2.71	1.49 – 4.91	<b>0.001</b>
Preceding Regularity	0.91	0.31 – 2.68	0.868	0.85	0.47 – 1.54	0.598
Preceding Frequency	0.45	0.15 – 1.35	0.155	0.7	0.39 – 1.26	0.233
Preceding Imageability	0.27	0.09 – 0.81	<b>0.02</b>	0.45	0.25 – 0.82	<b>0.009</b>
<b>Random Effects (<math>\sigma^2</math>)</b>						
Residual	3.29			3.29		
Item: Intercept	2.7			0.89		
Subject: Intercept	0.96			4.46		
Subject:Preceding Frequency	0.34			n/a		
N <sub>Subject</sub>	39			36		
N <sub>Item</sub>	48			48		
Observations	1869			1726		
Marginal R <sup>2</sup> / Conditional R <sup>2</sup>	0.160 / 0.545			0.049 / 0.638		