

Background and Introduction

Influential models in cognitive psychology, neuroscience, and economics hold that effort is costly and therefore avoided where possible, unless offset by an appropriate reward.¹ Thus, understanding how individuals decide what is effortful deserves our attention.

Mental effort is sometimes associated with tasks that we judge as time consuming or prone to error.^{2,3} However, Dunn et al., made a curious finding: individuals anticipated reading a single rotated word as more effortful than reading two upright words. A strange finding given the latter takes longer and may be more prone to errors.⁴ We explore this finding further here.

In Dunn et al., participants judged effort prospectively, without doing the task.⁴ Here, participants were asked to make a judgment of preference (Experiment 1) or a judgment of effort (Experiments 2 and 3-choice) across 60 trials for which they were also asked to complete the word-reading task. In addition, we present results from a forced-choice experiment in which subjects experienced reading an equal number of upright and rotated word trials in order to examine the performance associated with reading these displays.

Method

Participants in Experiment 1 (N = 48) were asked to choose a display consisting of either 1-word rotated 110° or 2-words rotated 0°, then read the words on the following screen for 60 trials.

Stimuli consisted of high frequency words balanced across screen position and condition.

Experiment 2 (N = 48) was similar in all respects except the instruction presented at the choice screen:

- Experiment 1: “Please choose the type of display you would prefer to read.”
- Experiments 2 and 3-choice: “Please choose the type of display you feel would be less effortful to read”.

Experiment 3 (N = 48) began with a forced-choice task (Exp. 3-no choice) using analogous stimuli balanced across 32 trials. Subsequently, the same participants completed 60 trials (Exp. 3-choice) using the same procedure and stimuli as Experiment 2.

Presentation of stimuli and collection of responses was handled by DMDX software.

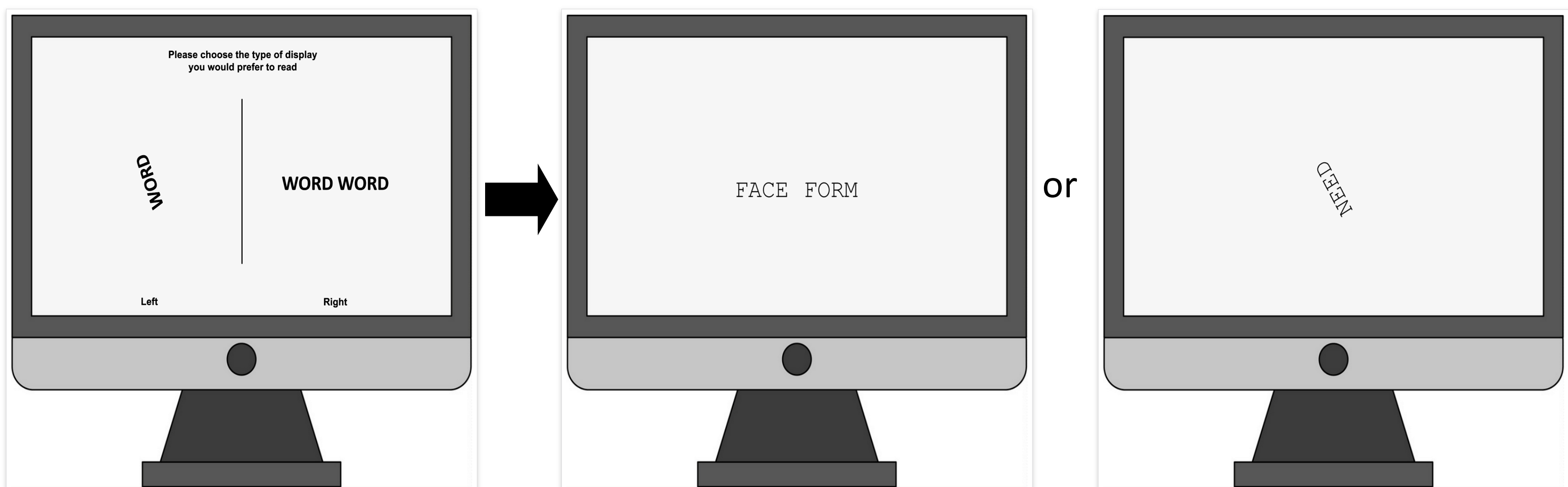


Figure 1. Example stimuli.

Results and Discussion

Choice

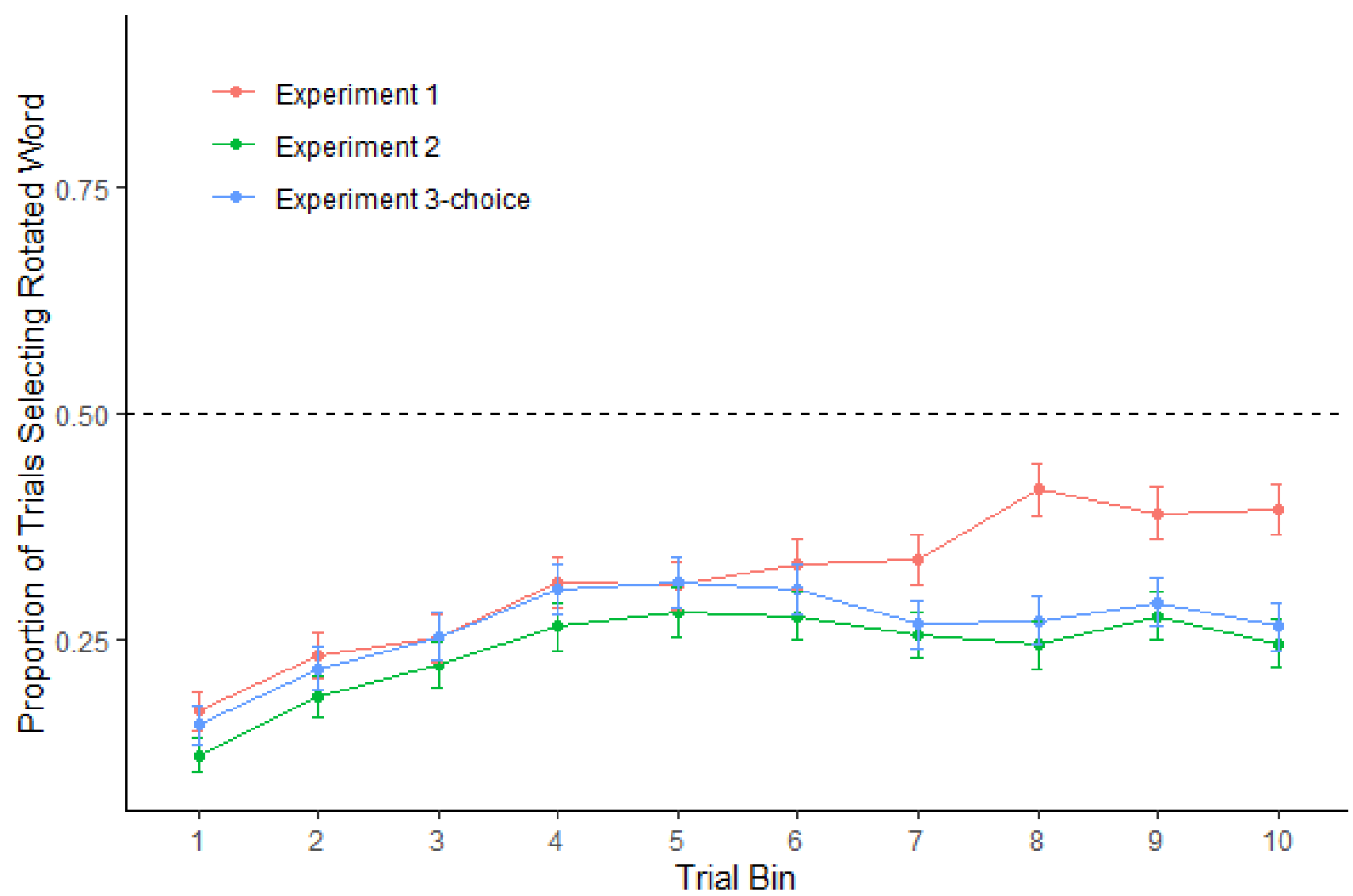


Figure 2. Choice aggregated at the level of trial bin (6 trials per bin). Error bars indicate +/- 1 SEM.

Accuracy

	Overall	1 Word	2 Word
Exp. 1	.97 (.17)	.98 (.13)	.97 (.18)
Exp. 2	.97 (.17)	.97 (.18)	.97 (.17)
Exp. 3-no choice	.98 (.14)	.98 (.13)	.97 (.16)
Exp. 3-choice	.97 (.18)	.97 (.18)	.97 (.18)

Table 1. Mean accuracy (and standard deviations).

Task Duration and Vocal Onset Times

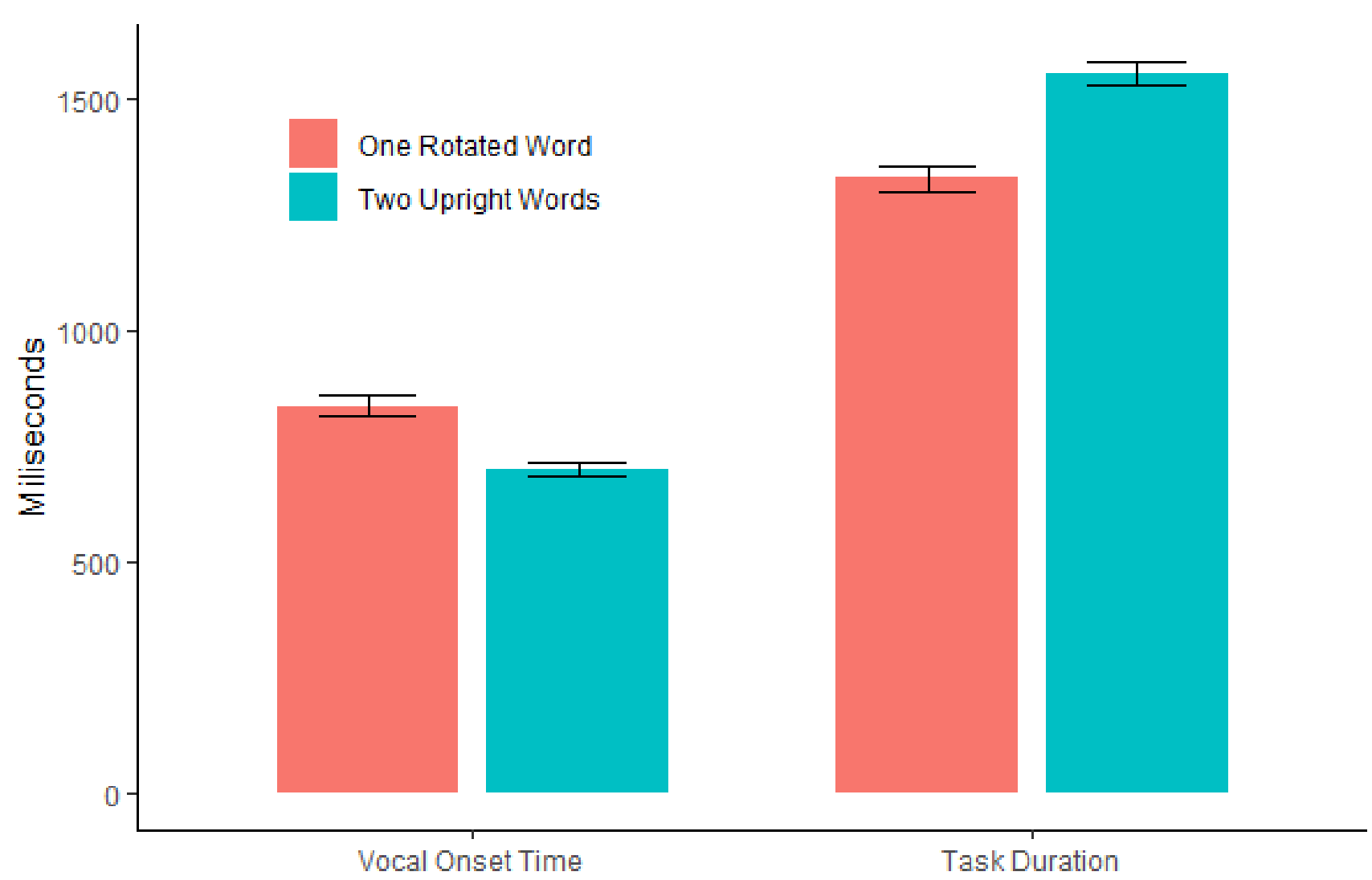


Figure 3. Vocal onset and task duration times, Experiment 3-no choice. Error bars indicate 95% confidence intervals.

In Experiment 1 participants made choices based on *preference* while in Experiments 2 and 3-choice, choices were based on a judgment of *least effortful*.

Two words were more frequently selected in all three experiments: the proportion of 1-word selections is less than 50% at all levels. However, 1–Way ANOVAs reveal a significant effect of time on word-choice across all demand-selection experiments:

Exp. 1: $F(9,423) = 5.21, p < .001, \eta^2 G = .04$

Exp. 2: $F(9, 405) = 4.03, p < .001, \eta^2 G = .02$

Exp. 3-choice: $F(9, 414) = 3.81, p < .001, \eta^2 G = .02$

Mean accuracy scores were consistently higher for 1-word than 2-word trials, however, the differences were small and not statistically significant.

Provided participants consistently favoured 2-word trials, it is unlikely their judgments were based on error-commission.

Data from the Experiment 3-no choice block indicates it takes significantly longer to read 2 words rotated 0° than 1 word rotated 110° (paired-samples $t(45) = 8.82, p < .001$). However, there is a longer time between stimulus presentation and vocal onset for 1 rotated word than 2 upright words (paired-samples $t(45) = 8.25, p < .001$).

Conclusion. We replicated the preference/least effort pattern from Dunn et al.⁴ Individuals both prefer reading two upright words to one rotated word and believe it is less effortful. The strength of this effect decreased with experience but never reversed overall. According to the performance data, when individuals had to perform either task it took longer to complete the reading of two words but was shorter to start. This suggests that mental processes prior to onset in a reading task might be aligned with preference/effort judgements and more broadly demonstrates that there is likely to be a complex relationship between time and effort.

Selected References

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Acknowledgments

This work was supported by a Discovery Grant (#04091) from the Natural Sciences and Engineering Research Council of Canada (NSERC), an Early Researcher Award from the Province of Ontario (#ER14-10-258), funding from the Canada Foundation for Innovation and Ontario Research Fund (#37872) and from the Canada Research Chairs (#950-232147) program to E.F.R. *The University of Waterloo acknowledges that much of our work takes place on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. Our main campus is situated on the Haldimand Tract, the land granted to the Six Nations that includes six miles on each side of the Grand River. Our active work toward reconciliation takes place across our campuses through research, learning, teaching, and community building, and is centralized within our [Indigenous Initiatives Office](#).* Neither the Department of the Navy nor any other component of the Department of Defense has approved, endorsed, or authorized this product.