



Testing the viability of web DMDX for masked priming experiments



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Introduction

- Purpose:
 - Evaluate the viability of a web-based version of the DMDX software package (web DMDX).
 - It was unclear whether web DMDX allowed for the consistent and accurate display of experimental stimuli.
- Research Question:
 - Is web DMDX a reliable tool for psycholinguistic experiments? Are display times in web DMDX comparable to those in the original lab-based version of this software (lab DMDX)?

What is DMDX?

- “DMDX is a Win 32-based display system used in psychological laboratories around the world to measure reaction times to visual and auditory stimuli.” (Forster 2002; see Forster & Forster, 2003 for details)
- In lab DMDX, screen refresh intervals are determined by TimeDX.
- In web DMDX, the OS reports the refresh rate.
- In lab DMDX, display times are coded as numbers of screen refresh cycles.
- In web DMDX, display durations are coded in milliseconds that are translated into refresh cycles.

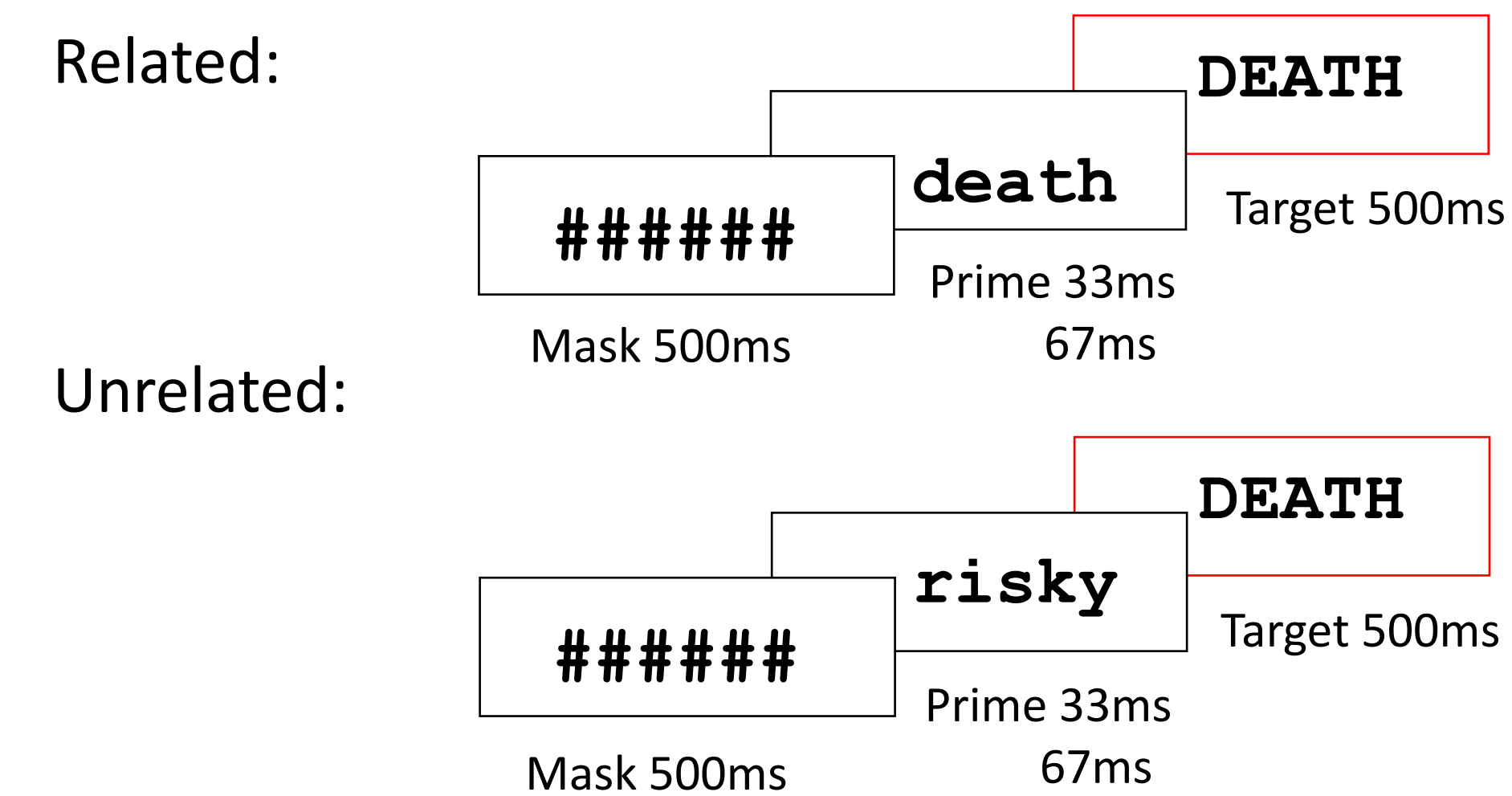
Methodology

- 2 experiments:
 - Experiment 1: lab DMDX
 - Experiment 2: web DMDX
- 2 Tasks:
 - lexical decision task (LDT), with high/low frequency words and repetition priming
 - e-/a-detection task (EAD)
- Participants: 64 University of Texas at Arlington students
 - 32 for Experiment 1, 32 for Experiment 2
- Reaction times (RTs) for errors were excluded in the LDT
- RTs less than 300 ms, and more than 1500 ms were discarded; outliers trimmed to 2SD above/below the mean for each subject
 - Affected 5.77% of the data in Experiment 1
 - 4.77% in Experiment 2

Experimental Tasks

Lexical Decision Task (LDT)

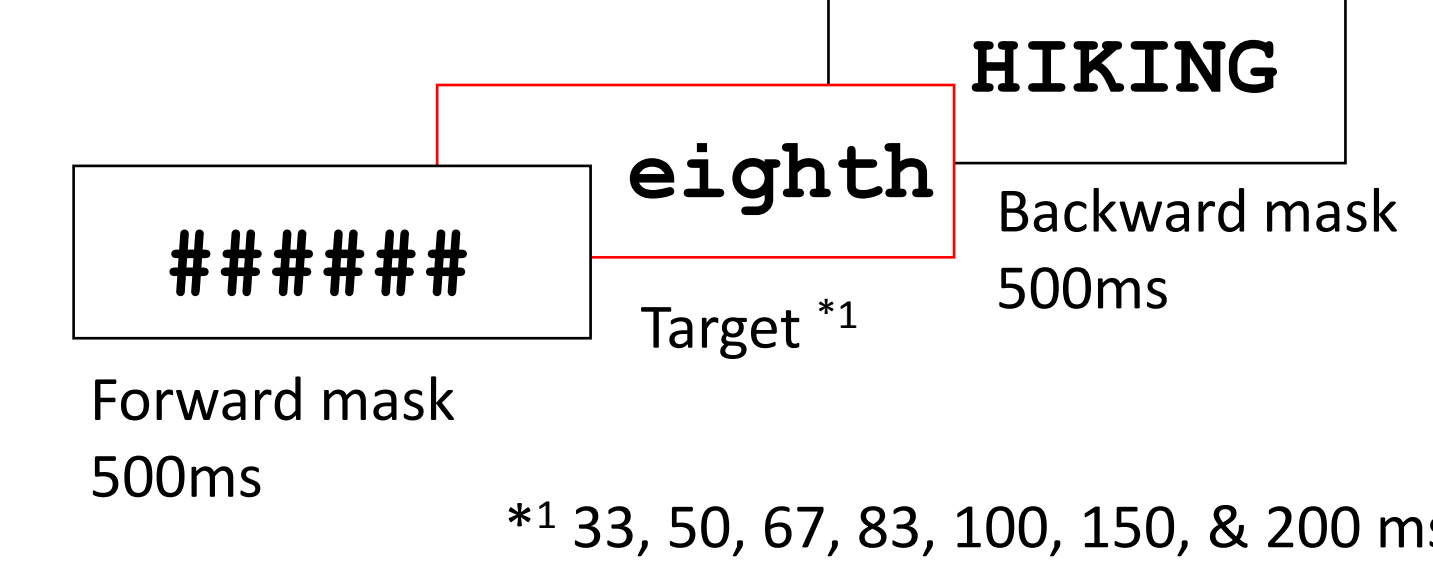
- Lexical Decision Task: the participant decides whether letter strings are words as quickly and accurately as possible.



- Nonword targets included as distractors

E-/A Detection (EAD) Task

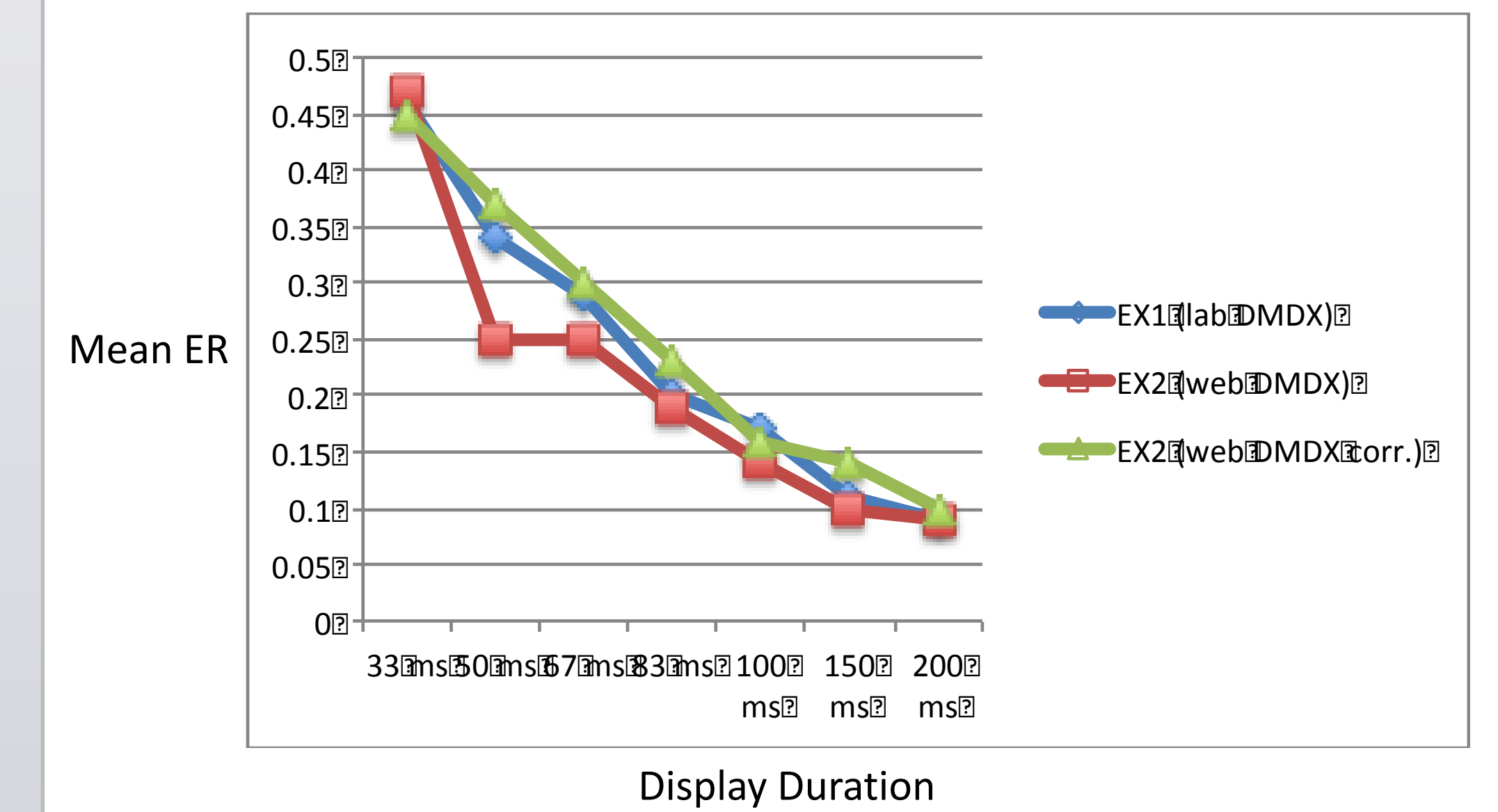
- Based on e-detection task (Finkbeiner et al., 2004)
 - Tests the accuracy of display times
 - The participant decides whether s/he saw the letter 'e' in a briefly presented word
- E-/A Detection: the participant decides whether briefly presented words contained the letter 'e' or 'a'.



- EAD task created to eliminate criterion effects inherent to Yes/No detection tasks.

Experiment 2b:

- 32 UTA students; took EAD task in web DMDX
- Disparity at 50 ms was due to a coding error in the web DMDX experiment
 - $\langle \%ms 33 \rangle \rightarrow (33 \text{ ms} + (1000 \text{ ms}/60 \text{ Hz})) / (1000 \text{ ms}/60 \text{ Hz}) = 2.98$ refresh intervals (truncated to 2)
 - $\langle \%ms 50 \rangle \rightarrow (50 \text{ ms} + (1000 \text{ ms}/60 \text{ Hz})) / (1000 \text{ ms}/60 \text{ Hz}) = 4.00$ refresh intervals (truncated to 4)
- 50 ms was recoded as $\langle \%ms 48 \rangle$
 - $\langle \%ms 48 \rangle \rightarrow (48 \text{ ms} + (1000 \text{ ms}/60 \text{ Hz})) / (1000 \text{ ms}/60 \text{ Hz}) = 3.88$ refresh intervals (truncated to 3)



- Comparable response accuracy at all display times in the lab DMDX experiment and the follow-up web DMDX experiment

Results

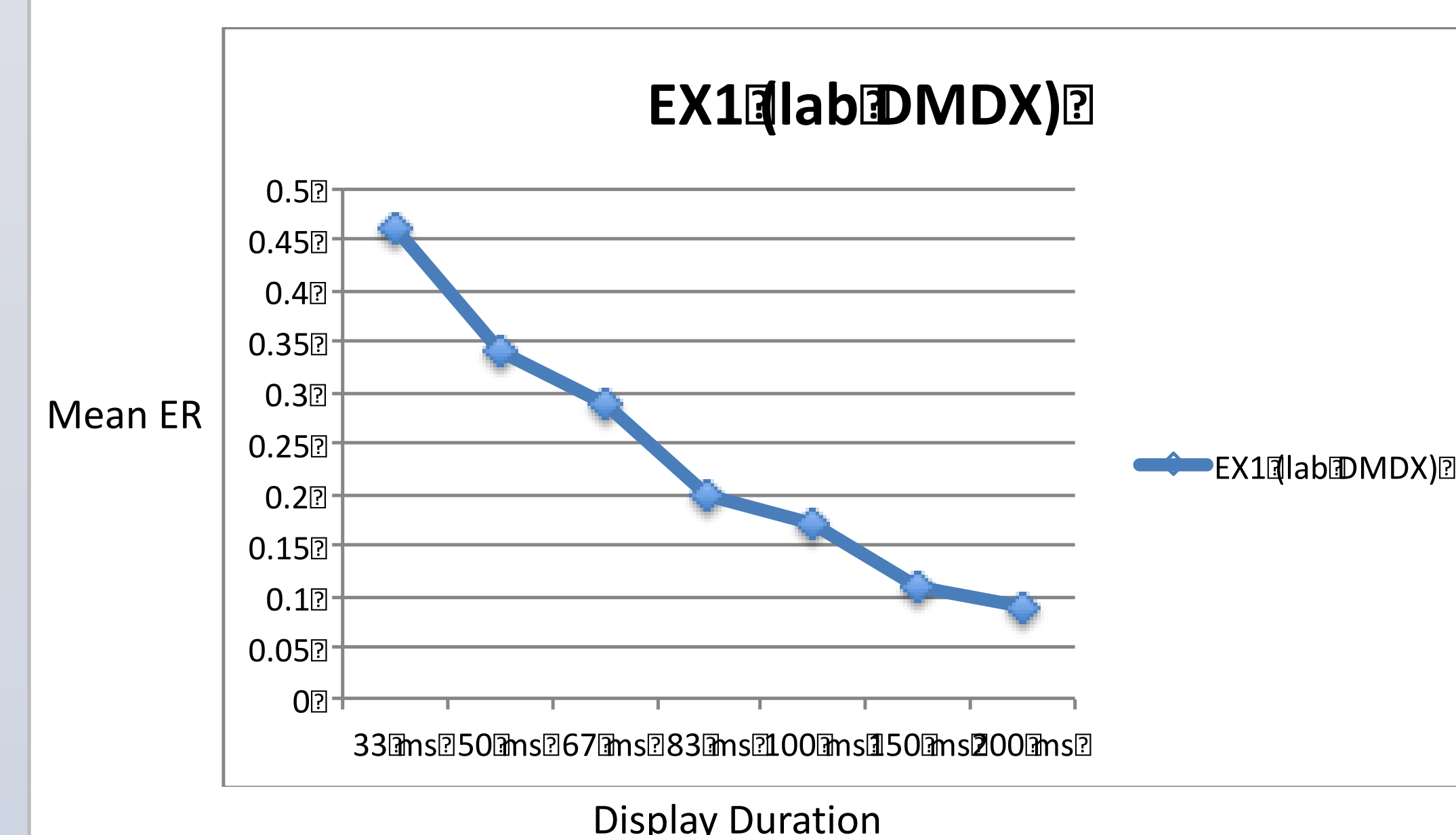
Experiment 1 (lab DMDX)

- LDT
 - Faster RTs to high frequency words
 - Repetition priming at both 33 ms and 67 ms
 - Larger priming effects at 67 ms

Prime duration		related	unrelated	priming
33 ms	HF	546 ms	569 ms	23 ms**
	LF	591 ms	610 ms	19 ms*
67 ms	HF	520 ms	563 ms	43 ms***
	LF	562 ms	612 ms	50 ms***

* $p < .07$ * $p < .05$ ** $p < .01$ *** $p < .001$

- EAD



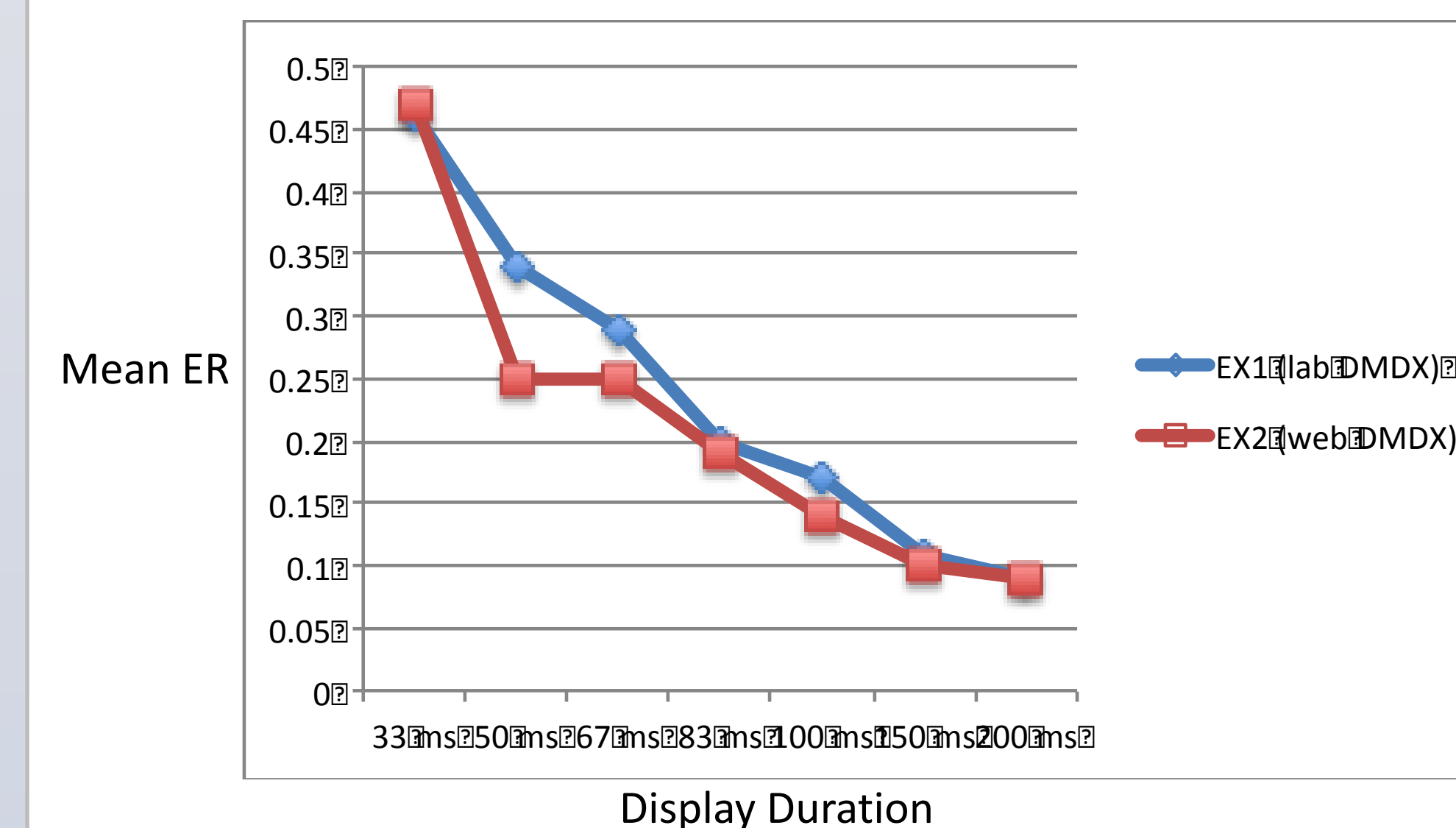
Experiment 2 (web DMDX)

- LDT
 - Faster RTs to high frequency words
 - Repetition priming at both 33 ms and 67 ms
 - Larger priming effects at 67 ms

Prime duration		related	unrelated	priming
33 ms	HF	564 ms	582 ms	18 ms*
	LF	601 ms	628 ms	27 ms*
67 ms	HF	545 ms	587 ms	42 ms***
	LF	584 ms	641 ms	57 ms***

* $p < .07$ * $p < .05$ ** $p < .01$ *** $p < .001$

- EAD



- Comparable response accuracy **except at 50 ms.**

Discussion

- Clear overlap in the findings from the lab DMDX and web DMDX experiments
- Web DMDX appears to be a viable tool for conducting web-based cognitive/perceptual experiments, and even for methods involving tachistoscopic displays.
- A viable web-based software package offers the investigator more flexibility and a convenient way to test otherwise difficult-to-access subject populations.
- Care must be taken when coding $\langle \%ms N \rangle$ display durations.
 - New *emit* option $\langle \%ms N \text{ emit} \rangle$ created that reports refresh cycles in the output files for web DMDX experiments.

References

- FINKBEINER, M., FORSTER, K.I., NICOL, J. & NAKAMURA, K. (2004). The role of polysemy in masked semantic and translation priming. *Journal of Memory and Language*, 51, 1-22.
- FORSTER, K.I. (2002). DMDX Display Software. Online: <http://www.u.arizona.edu/~kforster/dmdx/dmdx.htm>
- FORSTER, K.I., & FORSTER, J.C. (2003). DMDX: A Windows display program with millisecond accuracy. *Behavior Research Methods, Instruments, & Computers*, 35, 116-124.