

Telling deliberate from spontaneous blinks on a webcam: few-shot calibration for blink-based Morse text entry

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Abstract

Working draft. The text of this paper is still being written; this PDF shows its planned structure. **Synthetic data.** Every figure, every table and every number marked with a red dagger comes from synthetic test data (analysis/synth.py), not from study participants.

- 1 Introduction
- 2 Related Work
- 3 System
- 4 Study A: Detecting Deliberate Blinks
 - 4.1 Results
- 5 Study B: Text Entry
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Table 1: Participants and devices.

ID	Age	Glasses	Lighting	Camera	fps	Face (%)	Labels
P01	18-24	no	synthetic	synthetic	23.2	99.8	178
P02	18-24	no	synthetic	synthetic	29.3	99.6	165
P03	35-44	no	synthetic	synthetic	24.9	99.8	175
P04	25-34	yes	synthetic	synthetic	24.0	99.8	178
P05	25-34	no	synthetic	synthetic	15.0	99.6	175
P06	35-44	no	synthetic	synthetic	28.7	99.6	167
P07	18-24	yes	synthetic	synthetic	16.5	99.7	141
P08	18-24	no	synthetic	synthetic	27.2	99.7	178
P09	35-44	no	synthetic	synthetic	26.0	99.6	152
P10	35-44	no	synthetic	synthetic	16.3	99.9	156



Figure 1: Processing pipeline.

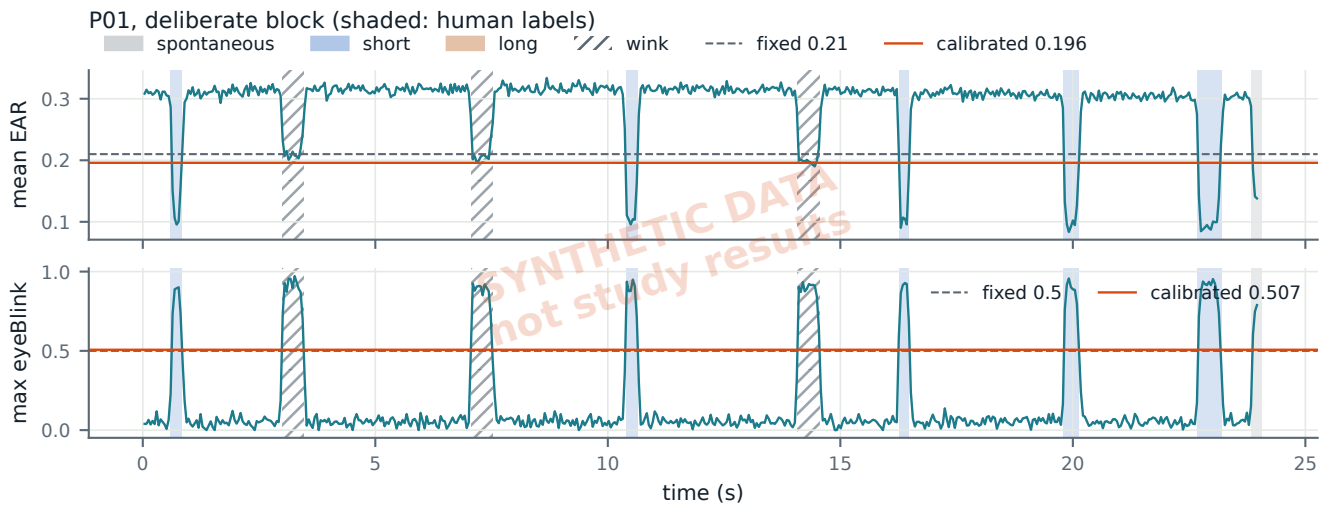


Figure 2: Example signals with human labels and thresholds.

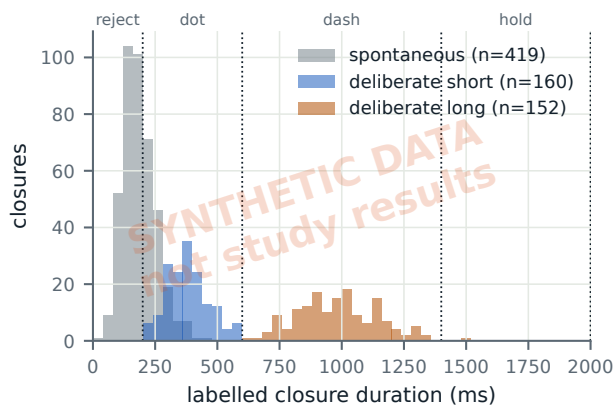


Figure 3: Labelled closure durations by type, with the segmenter bands.

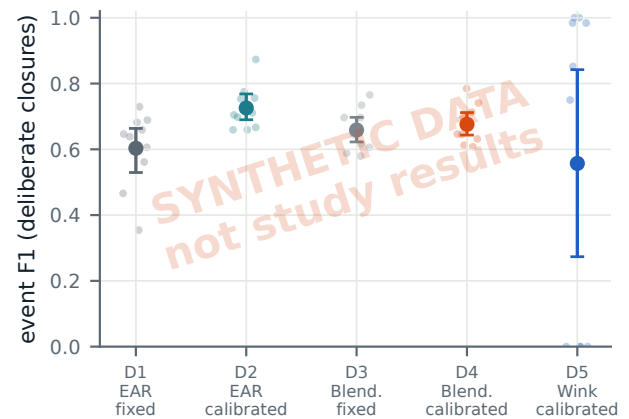


Figure 4: Event F1 by detector; dots are participants, bars are 95% bootstrap CIs.

Table 2: Detector metrics (mean [95% CI] over participants).

ID	Detector	F1	Precision	Recall	FT/min	FT/min, no reject
D1	EAR, fixed 0.21	0.60 [0.53, 0.66]	0.44 [0.37, 0.50]	0.99 [0.98, 1.00]	7.9 [5.4, 11.1]	17.9 [13.8, 23.9]
D2	EAR, calibrated	0.73 [0.69, 0.77]	0.58 [0.53, 0.64]	0.98 [0.97, 1.00]	4.4 [3.1, 5.6]	13.8 [12.0, 15.4]
D3	Blendshape, fixed 0.5	0.66 [0.62, 0.70]	0.50 [0.46, 0.54]	0.98 [0.97, 1.00]	5.8 [4.2, 7.4]	13.9 [12.3, 15.5]
D4	Blendshape, calibrated	0.68 [0.64, 0.71]	0.52 [0.48, 0.56]	0.99 [0.98, 1.00]	5.3 [3.9, 6.7]	13.9 [12.3, 15.5]
D5	Wink (blendshape, calibrated)	0.56 [0.27, 0.84]	1.00 [1.00, 1.00]	0.53 [0.26, 0.80]	0.0 [0.0, 0.0]	0.0 [0.0, 0.0]

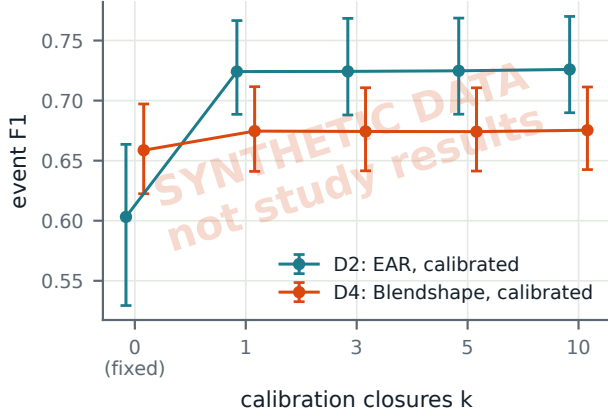


Figure 5: Event F1 against the number of calibration closures k .

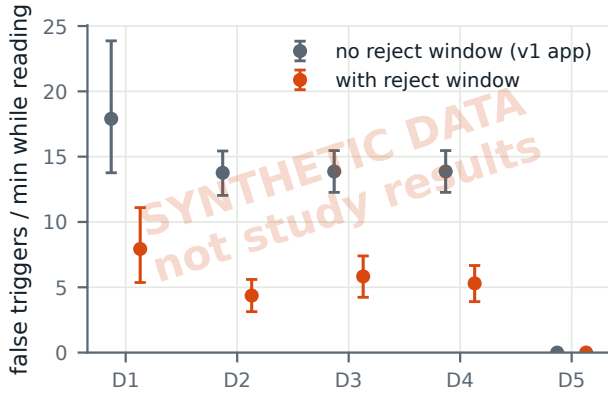


Figure 6: False triggers per minute while reading.

Table 3: Text-entry metrics by block.

Block	CPM	WPM	Uncorr. ER (%)	Corr. ER (%)	Closures/char	Raw TLX
1	5.0 [4.5, 5.6]	1.01 [0.90, 1.12]	1.9 [1.2, 2.7]	4.1 [2.7, 6.0]	2.41 [2.34, 2.47]	46 [43, 49]
2	6.4 [5.5, 7.3]	1.27 [1.09, 1.47]	0.9 [0.5, 1.4]	3.2 [2.6, 3.7]	2.28 [2.24, 2.33]	39 [37, 42]
3	6.8 [6.1, 7.6]	1.37 [1.21, 1.53]	1.0 [0.6, 1.6]	2.5 [2.0, 3.0]	2.31 [2.27, 2.35]	35 [31, 38]

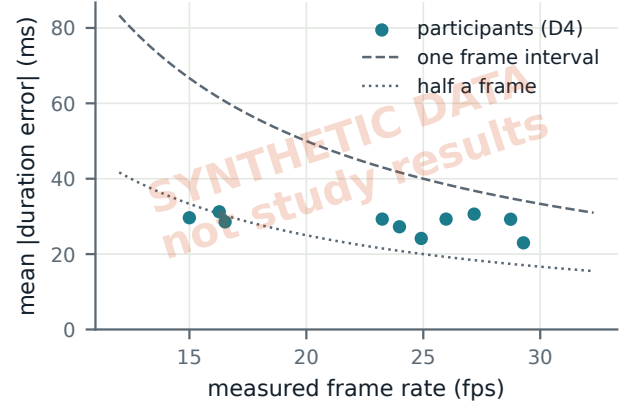


Figure 7: Duration error against measured frame rate.

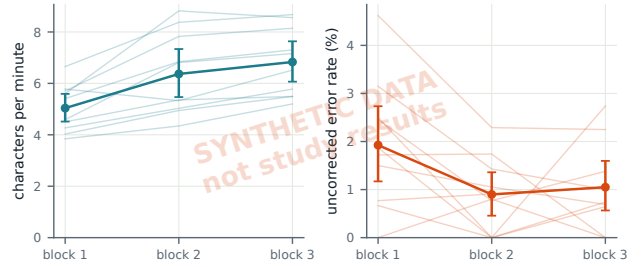


Figure 8: Entry rate and uncorrected error rate by block.

References

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