"BLINK 2021" results

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SUPPLEMENTARY MATERIALS

The design of our study was the subject of a pre-registered protocol (https://github.com/gkaguirrelab/preregistrations/tree/master/blink_2021). Here, we present the results of the pre-registered analysis approach.

Methods

At the first stage of analysis, trials that contained a "valid" blink were identified, using a lid movement criterion defined within the BlinkCNS proprietary analysis software. The valid trials were retained, and a measure of nine blink "features" was derived from the recording made from the eye ipsilateral to the air puff stimulus. These features were:

- Area-under-the-curve (AUC) (msecs * pixels): Mean area-under-the-curve of the trajectory of the eyelid between the onset and completion of the blink as measured relative to the tonic position for that blink.

- Latency (msecs): Mean elapsed time between the application of the stimulus and the detection of the blink onset.

- Time under 20 (msecs): Mean elapsed time between the eyelid reaching a closed position and the eyelid moving more than 20 pixels back towards the tonic position.

- Time to open (msecs): Mean elapsed time between the eyelid reaching a closed position and the eyelid returning within threshold of the tonic position.

- Initial velocity (pixels / msecs): Mean average velocity over the first 7 frames of the blink.

- Time to close (msecs): Mean elapsed time between the detection of the onset of the blink and the eyelid reaching a closed position.

- Max closing velocity (pixels / msecs): Mean maximum velocity of the eyelid between the detected onset of the blink and the eyelid reaching the closed position.

- Max opening velocity (pixels / msecs): Mean maximum velocity of the eyelid between the eyelid reaching the closed position and the eyelid returning within threshold of the tonic position.

- Blink rate (count): Number of blinks performed by the eyelid between stimuli.

An acquisition was retained if it contained at least three valid blinks; the mean value for each feature from all valid trials within an acquisition was obtained. For each blink feature, we fit a linear model that related the log of the realized air pressure to the values of the blink feature, using the data from all acquisitions for the subject. A robust linear regression (the *fitlm* MATLAB function) was used to calculate the fit. The parameters of the fit were expressed as the slope of the relationship between log pressure and the blink feature, and as an offset value, which was the fitted value for the blink feature at 15 PSI.

The fit was performed first using the entire potential set of 50 acquisitions combined across the two testing sessions; for each subject we retained the R^2 of the model fit to the data for each feature. The sign of the slope of the model fit for each subject and blink feature was assigned to the R^2 value, supporting an examination of the mean, across subject, signed R^2 value as a test of the ability of the model to reliably account for experimental variance.

The reproducibility of these parameter values was examined by performing the linear model fit separately for the data from each of the two sessions, standardizing and grouping the resulting parameters across blink features, and then calculating the Pearson's r value between the session 1 data and session 2 data across participants.

Results

	Puff pressure model (R^2)	Test-retest slope (r)	Test-retest slope (IQR)	Test-retest offset (r)	Test-retest offset (IQR)
AUC	**0.81** [0.68, 0.92]	**0.78** [0.28, 0.99]	**33** [6, 116]	**0.64** [0.49, 0.99]	**16** [3, 278]
Latency	**0.98** [0.97, 0.98]	0.81 [-0.13, 0.98]	**24** [8, 51]	**0.92** [0.77, 0.99]	4 [0, 11]
Time under 20	**0.84** [0.76, 0.89]	-0.08 [-0.48, 0.96]	**57** [16, 1973]	0.17 [-0.14, 0.98]	**55** [12, 455]
Time to open	**0.79** [0.66, 0.90]	**0.82** [0.25, 0.99]	**59** [15, 133]	**0.61** [0.46, 0.99]	**38** [2, 231]
Initial velocity	**0.68** [0.53, 0.82]	**0.70** [0.09, 0.98]	**55** [10, 201]	**0.91** [0.77, 0.98]	**10** [4, 15]
Time to close	**0.43** [0.25, 0.61]	**0.79** [0.45, 0.99]	**131** [30, 249]	**0.73** [0.12, 0.97]	**8** [3, 16]
Close velocity	**0.72** [0.56, 0.85]	**0.89** [0.62, 1.0]	**31** [5, 137]	**0.90** [0.66, 0.98]	**11** [4, 20]
Open velocity	**0.58** [0.49, 0.69]	**0.86** [0.39, 0.99]	**35** [11, 107]	**0.75** [0.13, 0.96]	**14** [5, 37]
Blink rate	**0.58** [0.41. 0.74]	**0.56** [0.16, 9.91]	**132** [31, 633]	**0.85** [0.73, 0.96]	**34** [7, 51]

Table 1. Overview
Correlations and test-retest reliability by blink feature as a function of puff pressure. 95% CIs are described in brackets. Values for which the 95% CI excludes zero are bolded. *Column 1*: Pearson's R^2 for the blink feature as a function of log puff pressure combined across sessions. The value shown is the mean R^2 across subjects. *Column 2*: Mean test-retest reliability in the slope of the fit linear regression model for subjects between sessions 1 and 2. *Column 3:* Interquartile range for the slope agreement between sessions 1 and 2. *Column 4:* Mean test-retest reliability in the offset of the fit linear regression model for subjects between sessions 1 and 2. *Column 5:* Interquartile range for the offset agreement between sessions 1 and 2.