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Participants know best – the effect of calibration method on data quality

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BACKGROUND
1. Automatic calibration
   Software decides when eye feature samples are recorded.

2. Operator-controlled
   The operator clicks a button to record eye feature samples.

3. Participant-controlled: The participant clicks a button to record samples.

Challenges
- The participant must look straight at the calibration target, and keep the eye still. Also, optical conditions may confuse gaze the estimation algorithm.
- The participant may move his eye during calibration for a variety of reasons:
  - Anticipation (looking ahead too soon)
  - Square-wave jerks, glissades, blinks
  - Distraction
  - Poor task instructions
  - Etc.

Gaze estimation may be faltering due to
- Reflection in glasses
- Split corneal reflection in lenses
- The corneal reflection is in the sclera
- The pupil or corneal reflection are covered by eyelids or lashes
- Etc.

METHOD

Data recording
Four stations with identical SMI HiSpeed 500 Hz binocular
Six operators (five experienced, one novice)
149 non-prescreened students of economics
Two recordings: Just after calibration, and after 15 minutes of reading.
Automatic (44), Operator-controlled (62), Participant-controlled (43)

Challenges:
- Accuracy: the lme4 package of R.
- Participant-controlled calibration best
- Higher position on monitor better
- Glasses make accuracy worse
- Open eye physiology better
- Accuracy decreases on dominant eye

RESULTS

Data analysis using a linear mixed-effects model: the lme4 package of R.

Accuracy (offset) is predicted by:

Precision (RMS) is predicted by:

Amount of data loss is predicted by:

Data loss: Higher position on monitor better
Glass make data loss worse
Lenses make data loss worse
Data loss increases over time

RESULTS

Accuracy is better with experienced operators

Dominate eye (Miles test) gives better accuracy

No difference between L and R eye.
Left dominant (LD) and right dominant (RD) eye give better accuracy than non-dominant eyes (LN and RN).