Participants know best: The effect of calibration method on data quality

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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 too ahead too)
  - 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.

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)
- Eye-lashes directed down (8), forward (32), up (109)
- Eye cleft: medium (13), narrow (3), open (133)
- Eye colour: blue (112), brown (35), quite other (2)

**Method**

**Results**

**Accuracy (offset) is predicted by:**
- Participant-controlled: -0.1102
- Operator-controlled: -0.072722
- Target placed low: -0.0001
- Target placed high: 0.0000
- Participant-controlled: -0.0001
- Participant-controlled: -0.0001
- Participant-controlled: -0.0001
- Calibration method
- Etc.

**Precision (RMS) is predicted by:**
- Participant-controlled: -0.003247
- Operator-controlled: -0.001872
- Calibration method
- Etc.

**Amount of data loss is predicted by:**
- Participant-controlled: -0.002340
- Operator-controlled: -0.000187
- Calibration method
- Etc.

**Accuracy:**
- Participant-controlled calibration best
- Higher position on monitor better
- Glasses make accuracy worse
- Open eye physiology better

**Precision decreases over time**
- Participant-controlled calibration.
- Open eye physiology.
- Glasses make precision worse

**RESULTS**

**Accuracy is better with experienced operators**

**Dominant eye (Miles test) gives better accuracy**

<table>
<thead>
<tr>
<th>Operator</th>
<th>No difference between L and R eye.</th>
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<tbody>
<tr>
<td>1</td>
<td>Left dominant (LD) and right dominant (RD) eye give better accuracy than non-dominant eyes.</td>
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**Data loss is recorded:**
- Participant-controlled calibration.
- Open eye physiology.
- Glasses make data loss worse
- Lenses make data loss worse

**Data loss increases over time**

**Histograms over all data**

<table>
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<tr>
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