LIMITATIONS OF QUESTIONNAIRES

- Who is your internet provider? ...?
- What is your grip strength? ...?! 
- Workouts per week? 3. At least.
- Do you take drugs? Nope.
- ...

Image: Concrete wall (sic, modified) under CC BY-SA 3.0
WHAT IF WE DON'T NEED TO ASK?

Measure automatically.

Image: Automatic Gear Shift, Hyundai Elantra (modified) under CC BY 2.0
# SENSORS IN MOBILE PHONES

<table>
<thead>
<tr>
<th>3D touch</th>
<th>accelerometer</th>
<th>ambient light</th>
</tr>
</thead>
<tbody>
<tr>
<td>battery</td>
<td>bluetooth</td>
<td>camera</td>
</tr>
<tr>
<td>cellular</td>
<td>fingerprint</td>
<td></td>
</tr>
<tr>
<td>gyroscope</td>
<td>heart rate</td>
<td>humidity</td>
</tr>
<tr>
<td>magnetic field</td>
<td>microphone</td>
<td></td>
</tr>
<tr>
<td>pressure</td>
<td>proximity</td>
<td>wifi</td>
</tr>
<tr>
<td>wireless charging</td>
<td>thermometer</td>
<td></td>
</tr>
</tbody>
</table>

...?
MEASUREMENTS IN BLAISE

blaise.cbs.nl/measure

(how it works)
JAVASCRIPT API EXAMPLES

Support is browser-specific.
Everything in color is specific to your device.

Try it yourself: isbjornlabs.com/js
USER AGENT

Gives information about the browser type and version, the rendering engine and the operation system type and version.

Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:49.0) Gecko/20100101 Firefox/49.0
Ambient luminous flux is not supported.

Code: Modified from Ambient Light API by Aurelio De Rosa under CC BY-NC 4.0
The connection type is not supported.

Code: Modified from Network Information API by Aurelio De Rosa under CC BY-NC 4.0
Latitude 489793.7147214999
Longitude 6811941.715958532
Accuracy 55 m

Code: Modified from OpenLayers Examples by OpenLayers under the Simplified BSD License
Code: Modified from webaudio-scope by fadams under ASL 2.0
VIDEO / PHOTO

Code: Modified from webaudio-scope by fadams under ASL 2.0
DEVICE ORIENTATION

compassneedscalibration event not supported

Coordinates: (null, null, null)
Position absolute? unavailable

Acceleration: (null, null, null) m/s^2

Acceleration including gravity: (null, null, null) m/s^2

Rotation rate: (null, null, null)

Interval: 0 milliseconds

Code: Modified from Device Orientation API by Aurelio De Rosa under CC BY-NC 4.0
What statistics could you **complement** with sensor data?
What new statistics could you make with sensor data?
SENSOR DATA FOR CBS

These are the six topics in consideration for CBS.

Sorted by ascending complexity.

Image: CBS Heerlen (modified) under CC0
1. RELOCATION AND TIME-SPENDING

- Use mobile phones to deduce travel times and locations
- Deduce modes of transportation
- Ask *context specific* questions
- Derive purposes and behaviour for work, shopping, leisure?
2. INTERNET USE AND BEHAVIOUR

- Determine internet service provider
- Measure internet speed: upload / download / ping
- Determine browser type, operation system type
- Monitor internet usage for a short time (~ 1week)
3. EXPENSES AND BUYING BEHAVIOUR

- Use cell phone camera to scan receipts
- Geotag photos to determine shops or malls
- Monitor internet usage for online shopping
### 4. Health and Fitness

<table>
<thead>
<tr>
<th>Category</th>
<th>Measurement</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Obesity, calorie intake</td>
<td>Photos</td>
</tr>
<tr>
<td></td>
<td>Blood pressure</td>
<td>Connected devices</td>
</tr>
<tr>
<td></td>
<td>Heart rate</td>
<td>Wearables, phones</td>
</tr>
<tr>
<td>Sensory</td>
<td>Hearing and vision</td>
<td>Games</td>
</tr>
<tr>
<td></td>
<td>Reaction time</td>
<td>Games</td>
</tr>
<tr>
<td></td>
<td>Reading</td>
<td>Phone</td>
</tr>
<tr>
<td>Motoric</td>
<td>Movement</td>
<td>Phone, wearables</td>
</tr>
<tr>
<td></td>
<td>Sedentary behaviour</td>
<td>Phone, wearables</td>
</tr>
<tr>
<td></td>
<td>Grip strength</td>
<td>Phone, 3D touch</td>
</tr>
</tbody>
</table>

*Image: runner race competition female (modified) under CC0*
5. PERSONAL AND PROF. LIVING CONDITIONS

- Measure
  - Noise levels
  - Amount of light
  - Temperature
  - Vibrations
- Determine room size / dimensions with echo
- Ask context specific about perceived safety
- Use cheap attachments to determine air quality
6. MENTAL AND EMOTIONAL STATES

Infer sociableness, state of mind and emotions through
- Contacts and address book
- Incoming and outgoing calls
- Relocation measurements
- Pattern and behaviour recognition

Image: audience concert music (modified) under CC0
<table>
<thead>
<tr>
<th>Category</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td><a href="mailto:bo.mussmann@cbs.nl">bo.mussmann@cbs.nl</a></td>
</tr>
<tr>
<td>This Talk</td>
<td><a href="https://isbjornlabs.com/ibuc2016">https://isbjornlabs.com/ibuc2016</a></td>
</tr>
<tr>
<td></td>
<td><a href="https://isbjornlabs.com/js">https://isbjornlabs.com/js</a></td>
</tr>
<tr>
<td>Blaise Questionnaire</td>
<td><a href="http://blaise.cbs.nl/measure">http://blaise.cbs.nl/measure</a></td>
</tr>
<tr>
<td>JavaScript API Compatibility</td>
<td><a href="http://caniuse.com/#cats=JS%20API">http://caniuse.com/#cats=JS%20API</a></td>
</tr>
<tr>
<td>Code</td>
<td><a href="https://github.com/AurelioDeRosa/HTML5-API-demos">https://github.com/AurelioDeRosa/HTML5-API-demos</a></td>
</tr>
<tr>
<td></td>
<td><a href="http://openlayers.org/en/latest/examples/">http://openlayers.org/en/latest/examples/</a></td>
</tr>
<tr>
<td></td>
<td><a href="https://github.com/fadams/webaudio-scope">https://github.com/fadams/webaudio-scope</a></td>
</tr>
<tr>
<td>Slide Framework</td>
<td><a href="https://github.com/hakimel/reveal.js">https://github.com/hakimel/reveal.js</a></td>
</tr>
</tbody>
</table>

Image: chain metal chain link (modified) under CCO