Large systematic biases in pointing to real and virtual unseen targets

Jenny Vuong | Lyndsey C Pickup | Andrew W Fitzgibbon | Andrew Glennerster

http://www.reading.ac.uk/3DVision | http://www.jennyvuong.net

Question: Are there systematic biases as we point to unseen targets?

- Large biases that persist in virtual and real world stimuli ($R^2 = 0.88, p < 0.001$), see [3,4,5].
- Large biases that persist in direct and indirect walking ($R^2 = 0.94, p < 0.001$).
- Positive or negative biases depending on the shooting zones.
- Large biases that persist in different facing directions ($R^2 = 0.96, p < 0.001$).

Task: Interval 1:
1. Remember all four target boxes at start zone.
2. Walk to viewing zone a, b, or c.

Interval 2:
1. Face a poster on the wall, indicating the colour of the next target.
2. Use hand-held pointer to shoot each box.

Data:
- $S$ [metre]: Ground Truth: $S$ [metre]
- $\tau_{\text{true}}$ [degree]: Model: $\tau_{\text{true}}$ [degree]
- $\tau_{\text{est}}$ [degree]: Data: $\tau_{\text{est}}$ [degree]

Parameters:
- $S$: green
- $\tau_{\text{true}}$: blue
- $\tau_{\text{est}}$: red

Methods:
- Spatially calibrated head mounted display nVidia SX111, see [1,2].
- Vision real-time optical tracking system, 7 M3 and 7 120fps cameras.
- 60Hz display, end-to-end latency 33 ms.

A simple linear mapping between $S$ and $\tau_{\text{true}}$ provides a reasonable prediction of the data (see above). Note that the mapping is different for the red-yellow boxes than the blue-pink boxes but in each case is the same for all three viewing zones.

Conclusions:
- Participants show large, systematic biases
- Simple gain-based model predicts data better than true geometry