

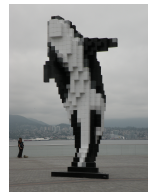
# Eye-Tracking in Practice: Results from a Study on Human Postures

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## Outline

- 1 **The Posture Study**
- 2 **Methods**
- 3 **Visual Analysis**
- 4 **Quantitative Assessment**
- 5 **Conclusions and Outlook**

## Primary Research Question

- Does judging the action capabilities of another person depend on one's own experiences?
- Background: Action anticipation must be present when interacting with others (e.g., to avoid collisions, pass something on to someone, etc.).
- Motivated by research in the Kinesiology and Health Science Department at Utah State University (USU).

## Participants

- Group 1: 20 students with minimal experience with actions that require stability (e.g., yoga, gymnastics, . . .) from the undergraduate psychology student pool at USU.
- Group 2: 20 students with extensive yoga experience from advanced yoga classes at USU.
- Data collection still ongoing. Preliminary results presented here.

## Anticipated Outcomes

- Those with extensive yoga experience will judge an actor to be more stable than those without stability-specific experience.
- **The visual information (i.e., viewing patterns) used to judge stability will differ between different groups of individuals with unique action experiences.**

## Apparatus and Tasks

- 22 pictures of a single actor holding a posture.
- All postures shown to each participant in random order.
- Participants have to judge the stability of each posture, i.e., how long the person could hold the posture.
- Participants wear an ASL portable eye-tracking device that records the viewing patterns.
- Extract information from the eye-tracking videos via the *EyeTrackR* R package (Li, 2017).

## Postures 1 to 6 (out of 22)



## Statistical Analysis

- What are **within groups** similarities /differences (if any) of the viewing patterns for each posture / for all postures?
- What are **between groups** similarities / differences (if any) of the viewing patterns for each posture / for all postures?

## The Syrjala (1996) Test

- Tests for a difference between the spatial distributions of two populations.
- Sensitive to differences in the way the populations are distributed across the study area.
- Insensitive to differences in abundance between the two populations.
- Frequently used for wildlife sample surveys and epidemiology; rarely used for eye-tracking so far (e.g., Chetverikov et al., 2018).
- Here: Applied to the viewing patterns from pairs of participants using  $5 \times 5$ ,  $10 \times 10$ , and  $20 \times 20$  **grids** and 25, 100, and 400 **random point locations** obtained from a sequential spatial inhibition (SSI) process.

## Posture A: Scatterplots of Viewing Patterns



## Posture B: Scatterplots of Viewing Patterns



## Posture C: Scatterplots of Viewing Patterns



## Posture D: Scatterplots of Viewing Patterns



## Syrjala's Test Results for Postures A through D

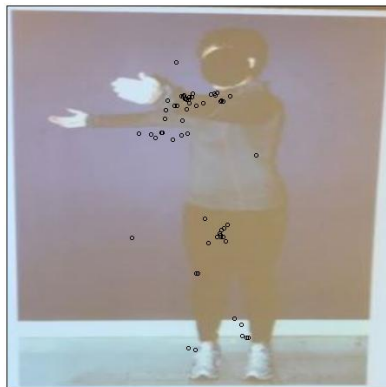
Posture	Type of Data Conversion					
	Grid			Random Points		
	5 × 5	10 × 10	20 × 20	25	100	400
A	0.279	0.057	<b>0.008</b>	0.164	0.066	<b>0.013</b>
B	0.618	0.554	0.310	0.758	0.418	0.334
C	<b>0.015</b>	<b>0.001</b>	<b>0.001</b>	<b>0.009</b>	<b>0.002</b>	<b>0.001</b>
D	0.238	0.109	<b>0.018</b>	0.170	0.095	<b>0.042</b>

- Statistically significant differences in viewing patterns ( $p \leq 0.05$ ) shown **in bold**.
- P-values tend to get smaller as the number of grid cells / random points increases, but this is not monotonic.

## Revisiting Posture C: Scatterplots of Viewing Patterns



## Revisiting Posture B: Scatterplots of Viewing Patterns



## Interpretation of Syrjala's Test Results

- Results of Syrjala's test highly depend on type of data conversion (grid vs. random points) and number of grid cells or number of random cells, respectively.
- A total of 144 tests [= (22 postures + 2 test images) × 6 data conversions] for each pair of participants conducted:
  - Minimum number of significant test outcomes: 8 ( $\approx 6\%$ ) — This could be by chance.
  - Maximum number of significant test outcomes: 43 ( $\approx 30\%$ ) — This is no longer by chance.

## Remedies and Future Steps

- Aggregate the six p-values, e.g., as  $\sum \log p_i$  (Fisher, 1934),  $-\sum \log(1 - p_i)$  (Pearson, 1933),  $\sum p_i$  (Edgington, 1972),  $\min\{p_i\}$  (Tippett, 1931), etc.
- Define cutoffs for these aggregated p-values to classify viewing patterns as *similar*, *somewhat different*, and *considerably different*.
- Use the aggregated p-values for multidimensional scaling.
- Investigate alternative options to compare viewing patterns, e.g., Jaccard index, applied to areas of interest in each posture.
- **Keep in mind: We want to determine similarity for participants from two groups and do not have to make a yes / no decision here.**

## References

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- **Questions !? —**

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