

Dynamic Landmarks: Exploring Cognitive Maps and Entitativity in Crowds

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Field Study in Kirchentag 2025 (Preliminary Study)

- ❖ A protestant church gathering held in every 2 years
- ❖ Approximately 100.000 people
- ❖ 9 participants → Selected & approach during the gathering
- ❖ Two sections:
 - Walking through a selected route
 - Waiting inside of a crowd

Questionnaires

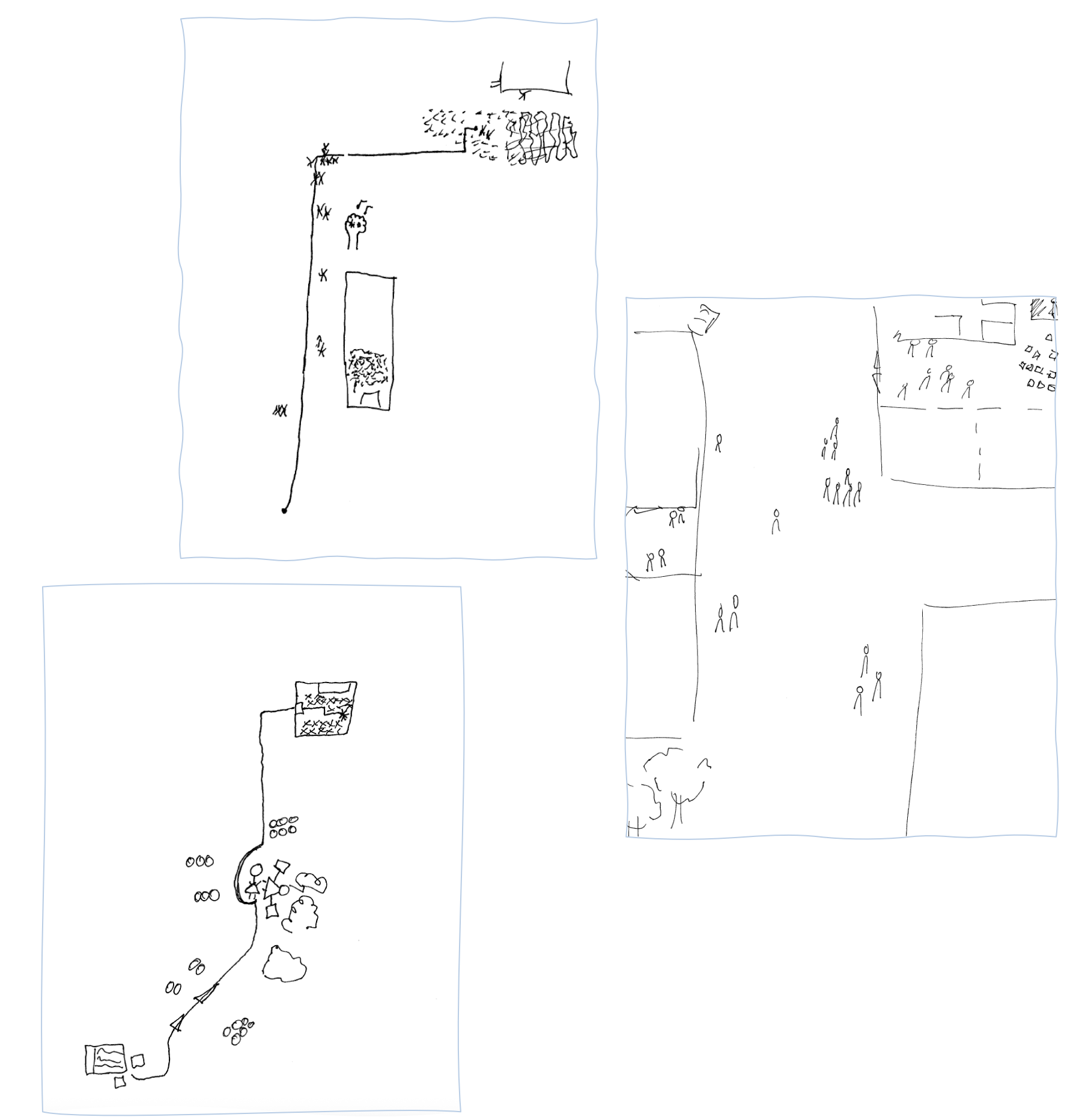
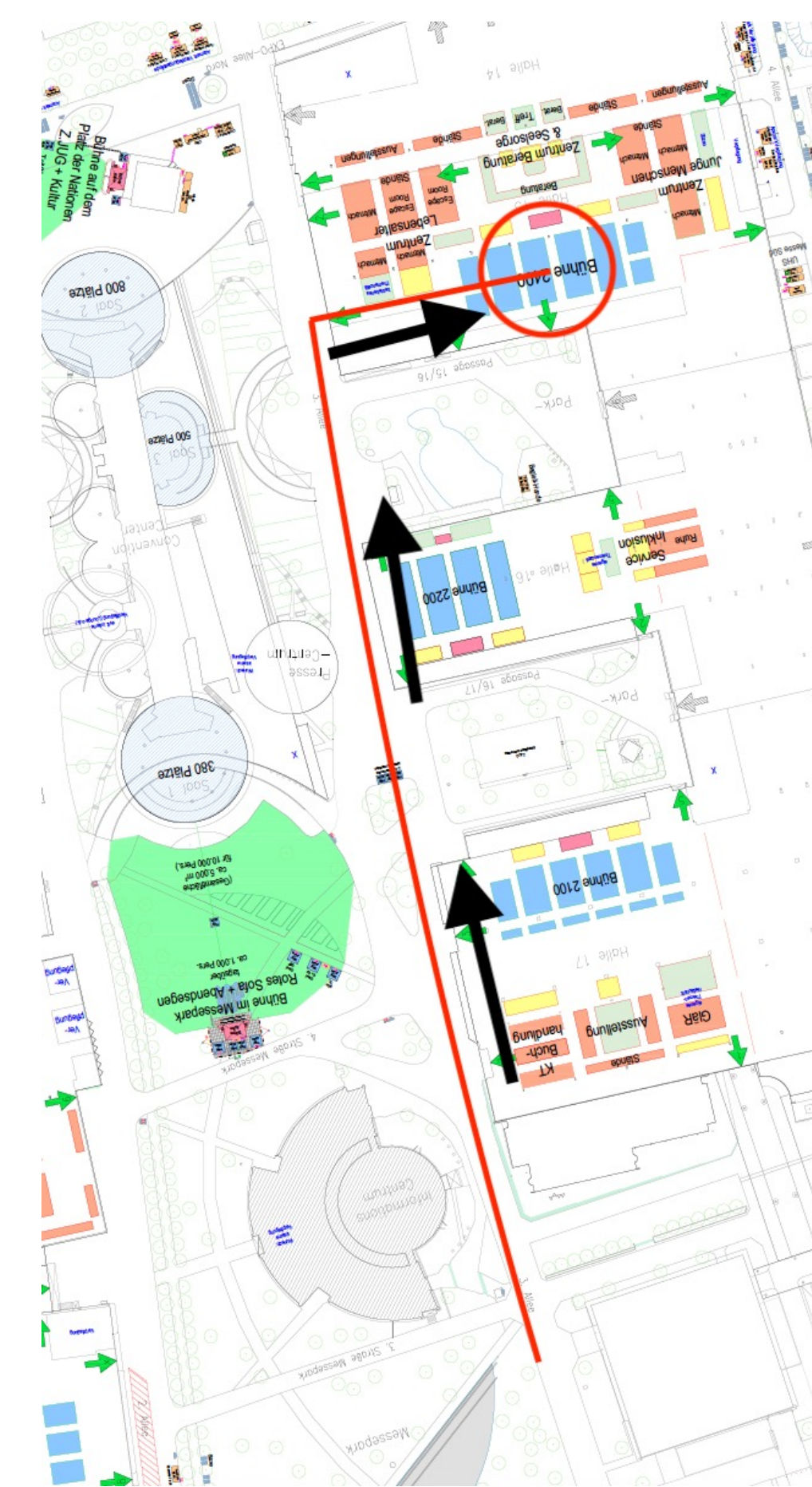
- ❖ Cognitive mapping
 - Mental representations of the physical environments
 - Collected through questionnaires: “mapping ability”
- ❖ Entitativity
 - The degree of a group or crowd is perceived as a cohesive unit
 - Collected through questionnaires: “observed entitativity” and “within entitativity”

Drawings

- ❖ Instructed to draw the route
- ❖ Instructed to draw the people they notice

Eye-tracking

- ❖ Anonymized eye-tracking data of the participants collected during the runs



Ideas & Results

- ❖ Triangulating observation (eye-tracking), representation (drawing), and belief/structure (entitativity).

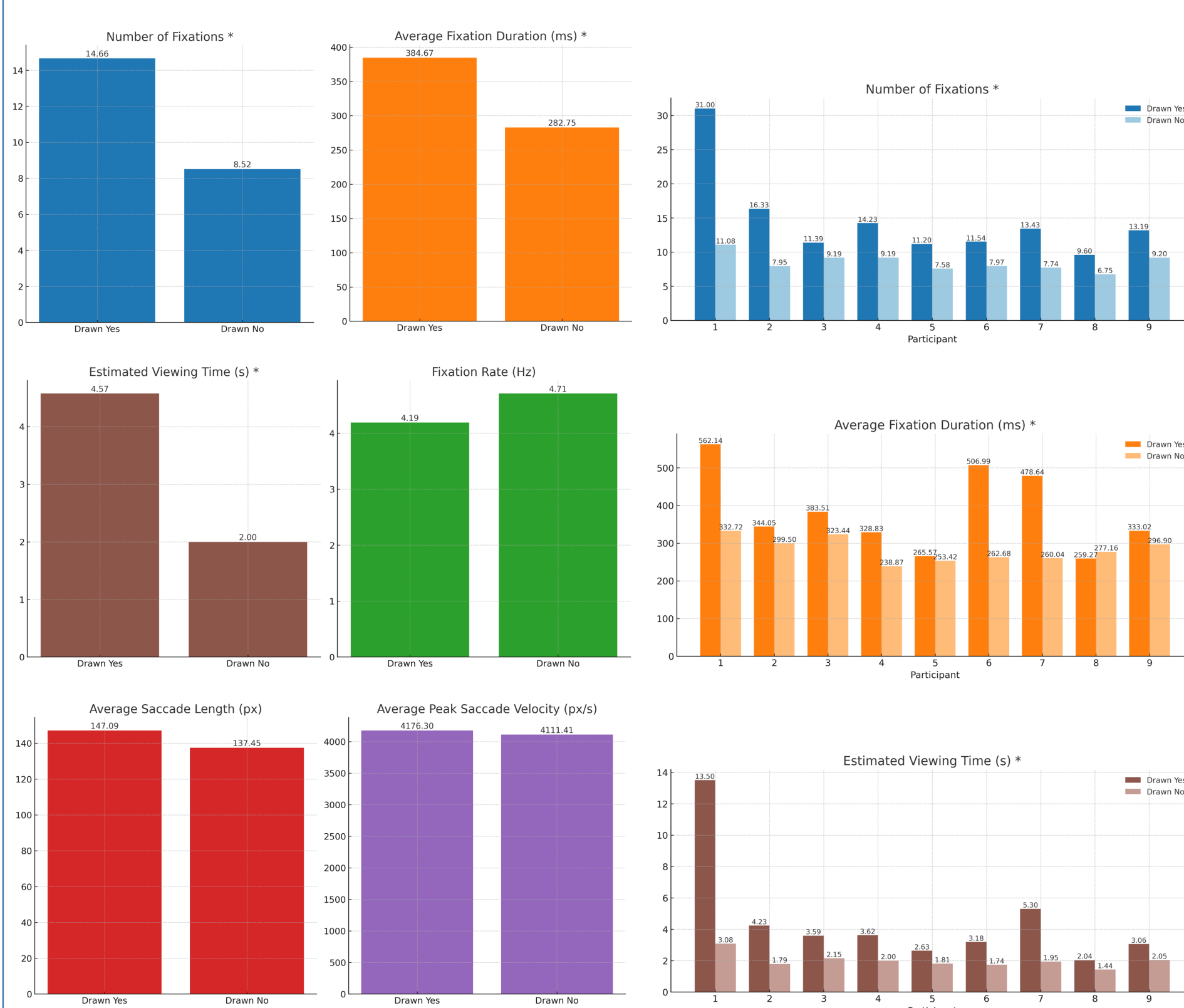
- Gaze % on people
- Drawn units detail
- Entitativity (both observed and within)

- No meaningful correlations...

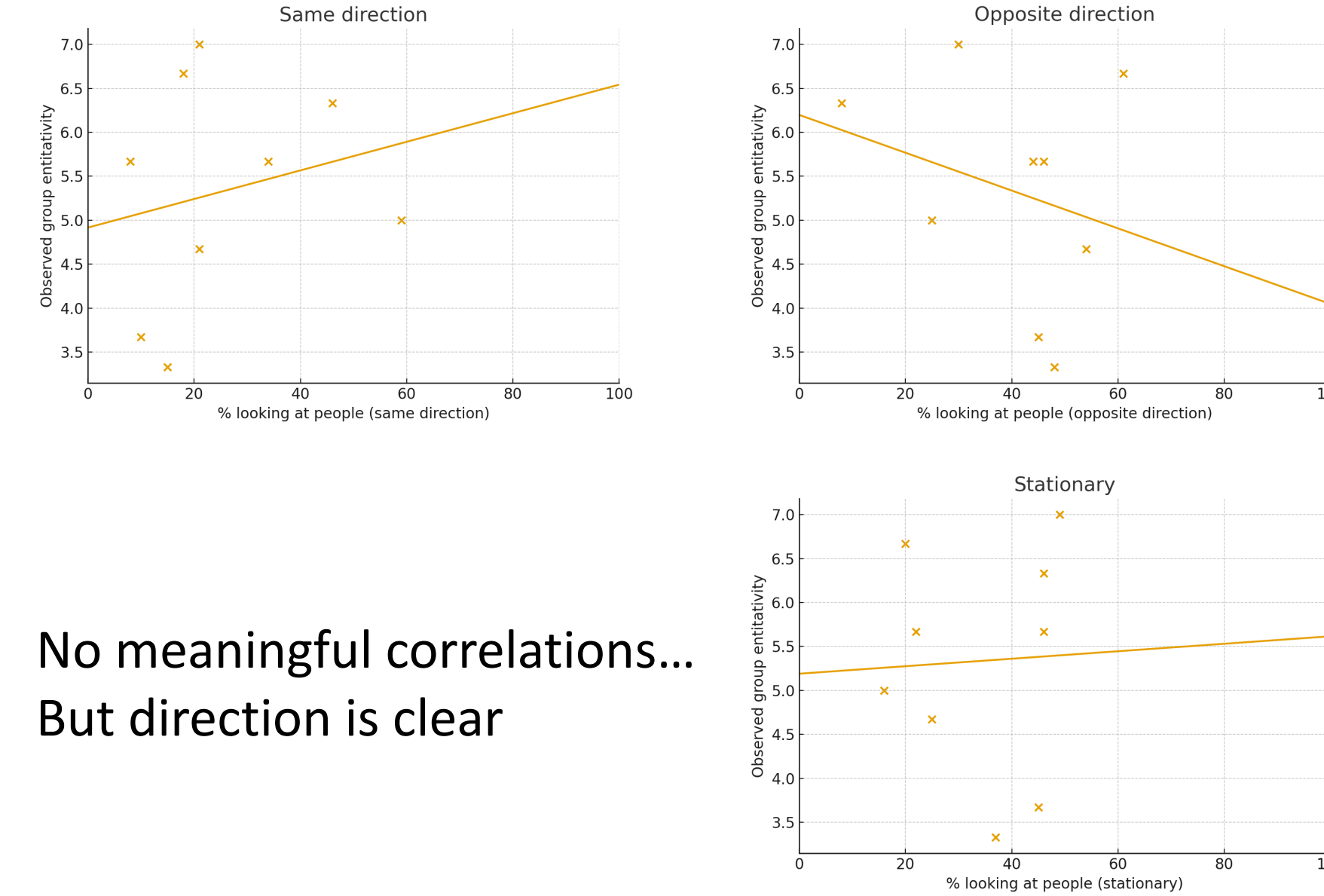
- ❖ Who gets recalled more (Part I)?

- ❖ Exploratory idea: Find an eye-tracker metric showing differences between drawn and not drawn people across all participants

- Significant difference in # of fixations, fixation duration, and estimated viewing time



- ❖ Whether perceived “group-ness” increases with shared movement direction.

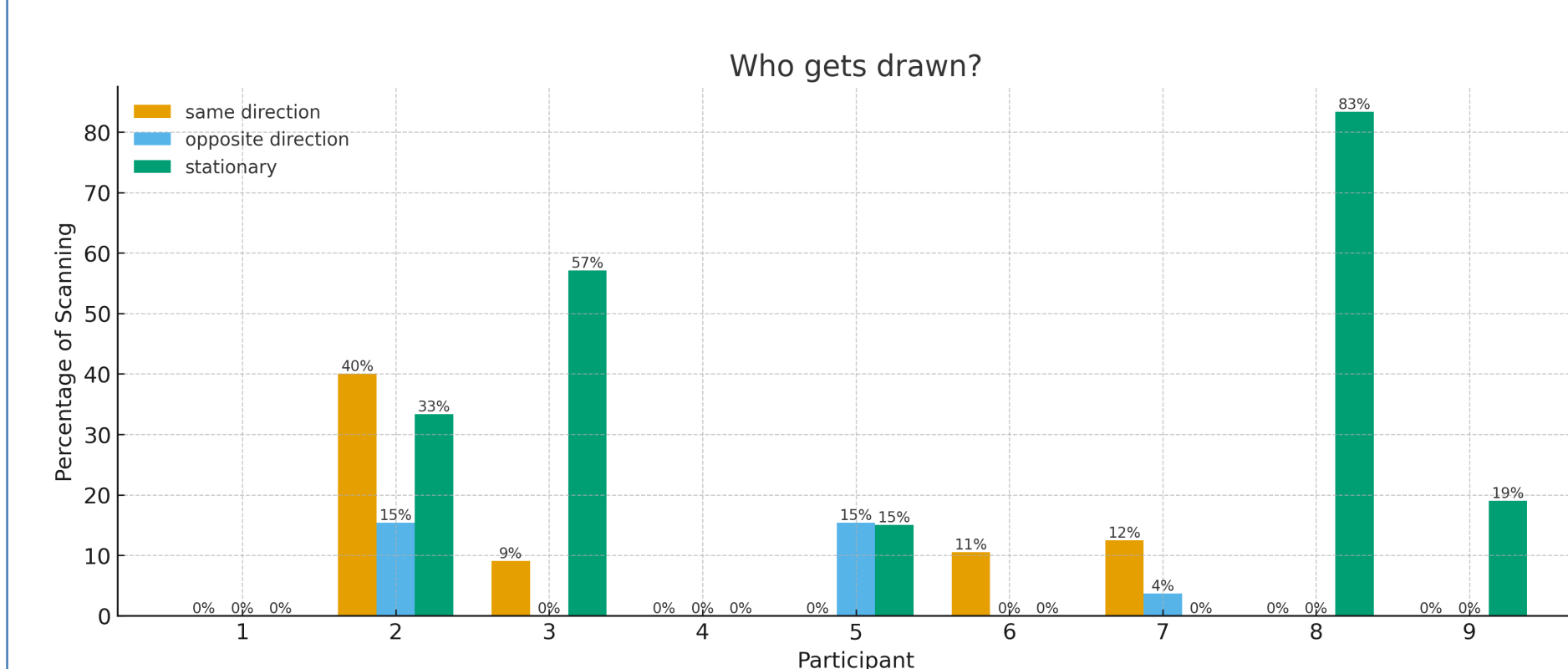


- No meaningful correlations...
- But direction is clear

- ❖ Who gets recalled more (Part II)?

- ❖ Exploratory idea: Shared movement direction vs counterflow

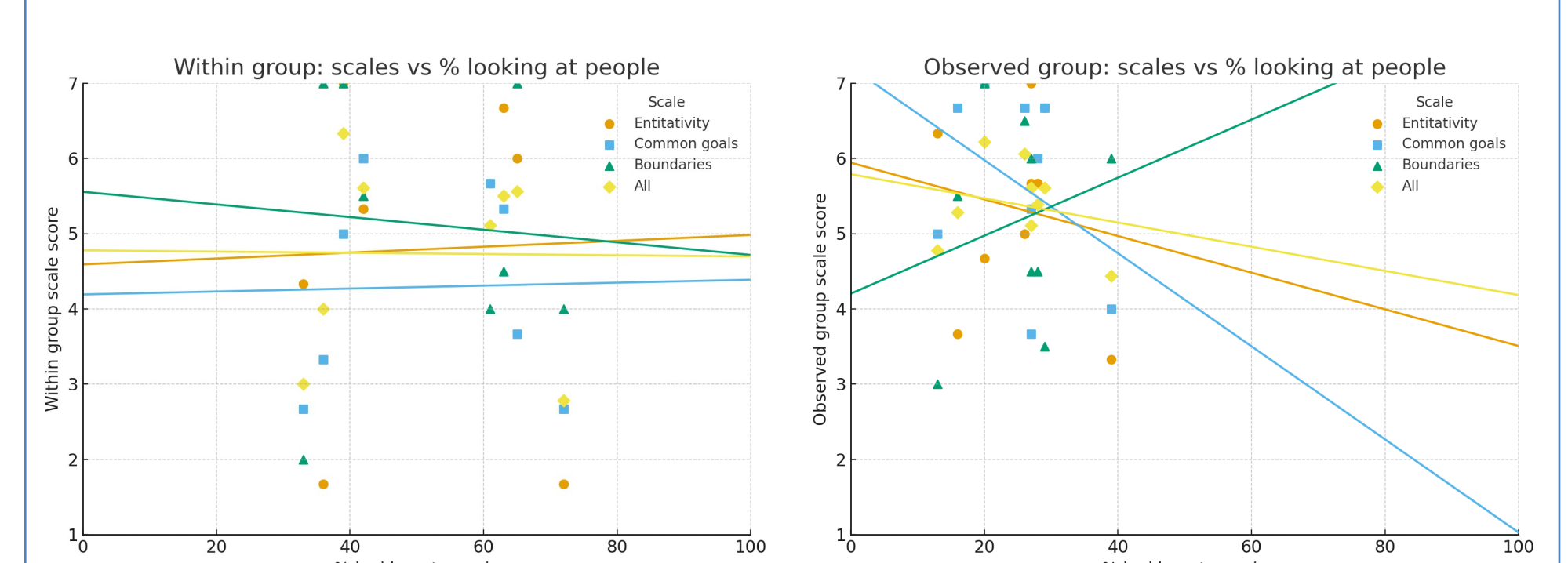
- Non-walking people in most cases
- Static anchors



- ❖ The difference between navigation & being part of a group

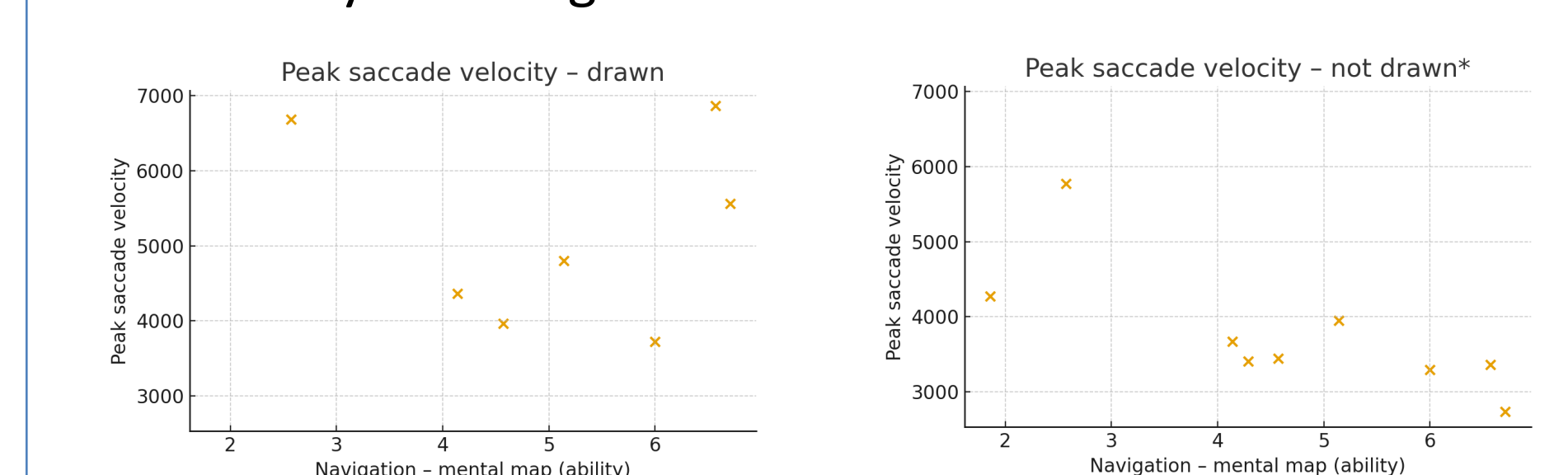
- Gaze % on people
- Entitativity (both observed and within)

- No meaningful correlations...
- Some of the directions are clear (i.e., observed group boundaries)



- ❖ Is there a relationship between cognitive mapping ability and eye-tracking metrics?

- Not many meaningful correlations...



- Better “mappers” seem to scan non-drawn people with less ballistic (slower-peak) saccades

- Probably by chance, the result doesn't mean much by itself

Interpretation

What this preliminary study can (and can't) say:

- ❖ **Small N & field study.** Patterns point in directions but aren't significant. The purpose was to test the proposed metrics in the wild.
- ❖ **Recall needs attention.** People that get more attention are more likely to be recalled.
- ❖ **Anchors matter.** Stationary people functions like map anchors; plausible supports for mental map construction.

Field Study in Tokyo Dome (Main Study)

- ❖ Will be conducted on the day of a high-attendance baseball match: *Japan vs. Korea*
- **Controlled setting:** Predefined walking routes strategically designed to address specific research questions related to crowd perception and movement.
- **Group dynamics:** Two separate participant groups navigate their respective routes simultaneously. Participants observe and interact with both their own group and the “other” group to examine intergroup perception and dynamics.
- **Measurement strategies:** Not only self-reports but also objective data collection using density sensors, trajectory measures, and eye-tracking.

Working ideas & questions

Cognitive maps

- ❖ When the place is new, we construct on the way and recall when asked.
- ❖ Geometric shapes & functions (building shapes, bottlenecks) are likely stored first. Building details & dynamic elements need more cognitive power; they should be constructed only if strongly attended.
- Do we map fuzzy dynamic zones? (e.g., “the car stream,” “the crowd flow”)
- How do crowds sit in the map? As background noise, or as functional zones?

Entitativity

- ❖ Hypothesis: seeing something (i.e., buildings, people) as a unit (not particles) may use the similar cognitive routes with mental mapping processing.
- How do we create our mental maps? As units or as particles? Do we store group-units more easily than scattered items?

Spatial perception

- ❖ We seem to anchor the environment first to get a sense of place.
- Where does direct attention play its part?
- Is mapping driven by quick samples of what “matters” (units/zones), longer attention allocation, or indirect perception without active attention?