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# Measuring the visual pedestrian qualities of urban streets through crowdsourcing

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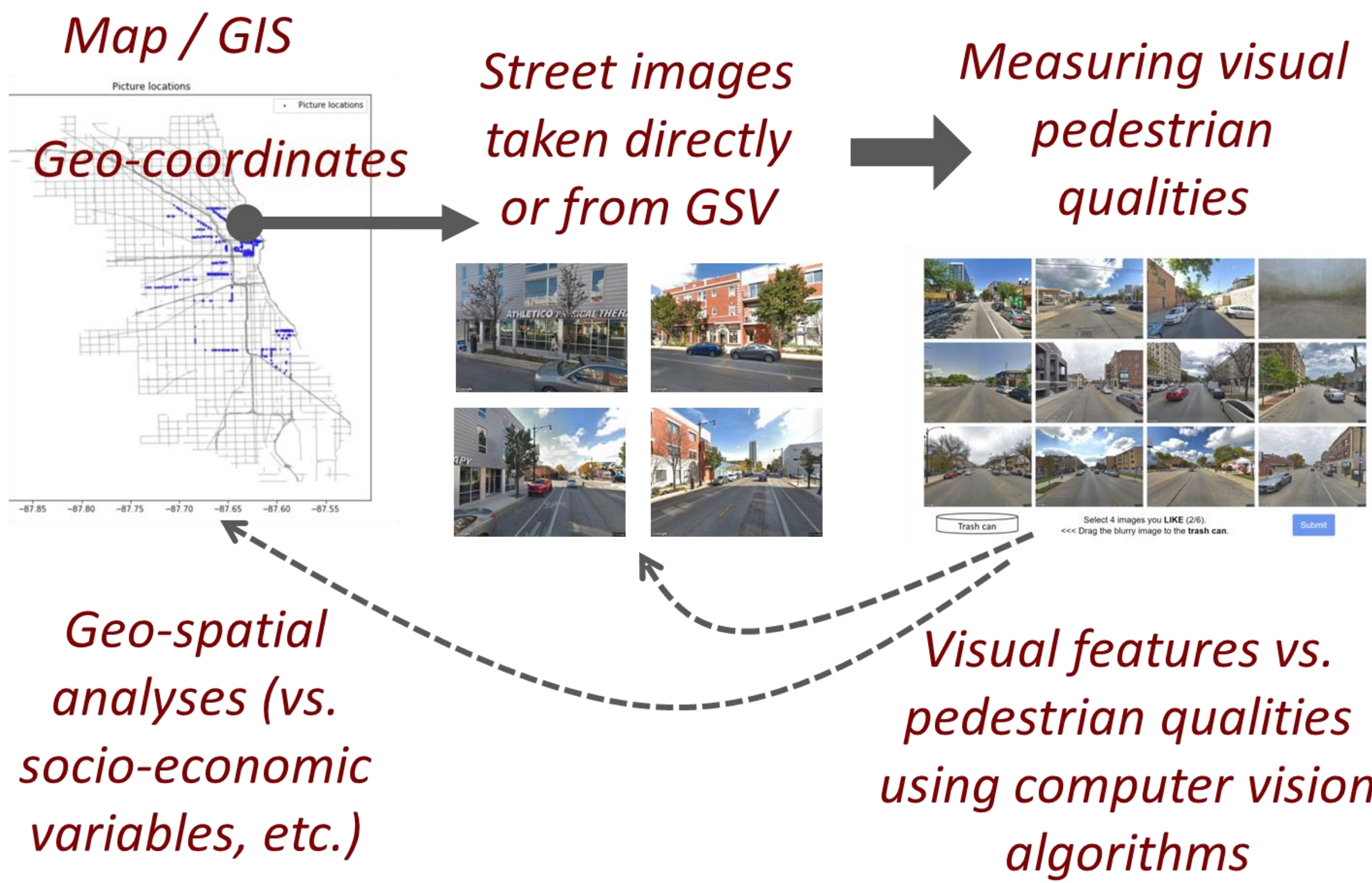
## Promise of Street Psychology

- Psychologists and neuroscientists have produced robust scholarship documenting the effect of the physical environment on psychological well-being. While much of this work has focused on the neuroscience of architectural objects, public space, or natural settings, **we propose to take these insights to the street level.**
- If psychological benefits are driven by predictable perceptual patterns, it may be possible to optimize the perceptual properties of the built environment to create more restorative spaces for human inhabitation.

## Key research questions

- What (visual) street features contribute to a superior pedestrian experience?
- Big data approach:** We aim to make a large urban street perception database.
- We propose a crowdsourcing method for measuring the pedestrian qualities of streets – walkability, preference, imageability, complexity, enclosure, human scale, transparency, and disorder, all of which are important design dimensions for pedestrian experience.

## Street Psychology framework



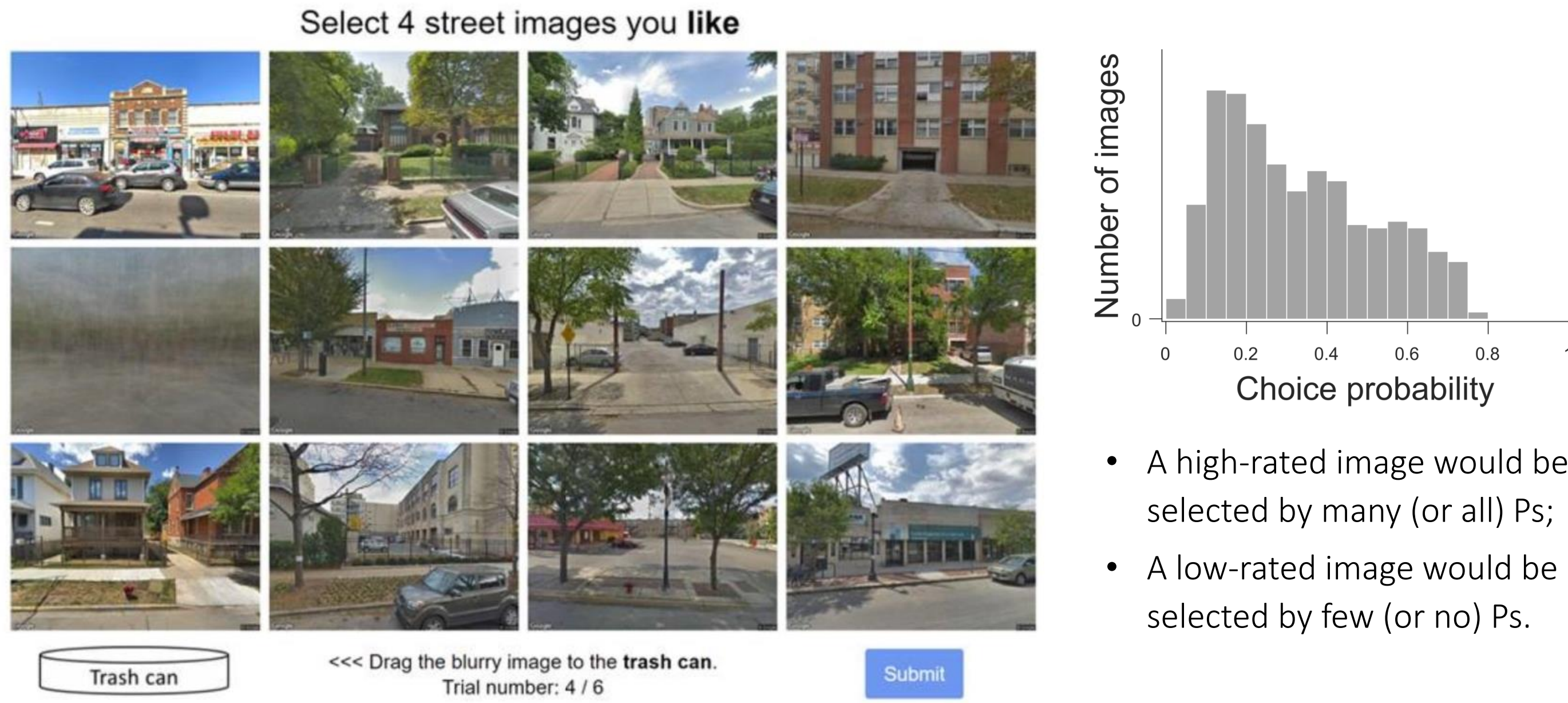
## Data collection through crowdsourcing

- Study 1:** We obtained 552 Chicago street images from Google Street View images by sampling two sidewalk images from 278 geo-coordinates in Chicago. A total of 588 Amazon Mechanical Turk (MTurk) workers completed the multi-image rating task across ten different dimensions/questions. Each participant rated all 552 images, and each image was rated by 58.8 (SD=2.8) participants.
- Study 2:** We photographed 1119 Chicago street images with varying design qualities. A total of 440 MTurk workers completed the image rating task images across eight dimensions. Each participant rated randomly-selected 708 (out of 1119) images, and each image was rated by 34.8 (SD=1.5) participants.

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## Multi-image rating task: Using one-line questions to evaluate complex visual qualities

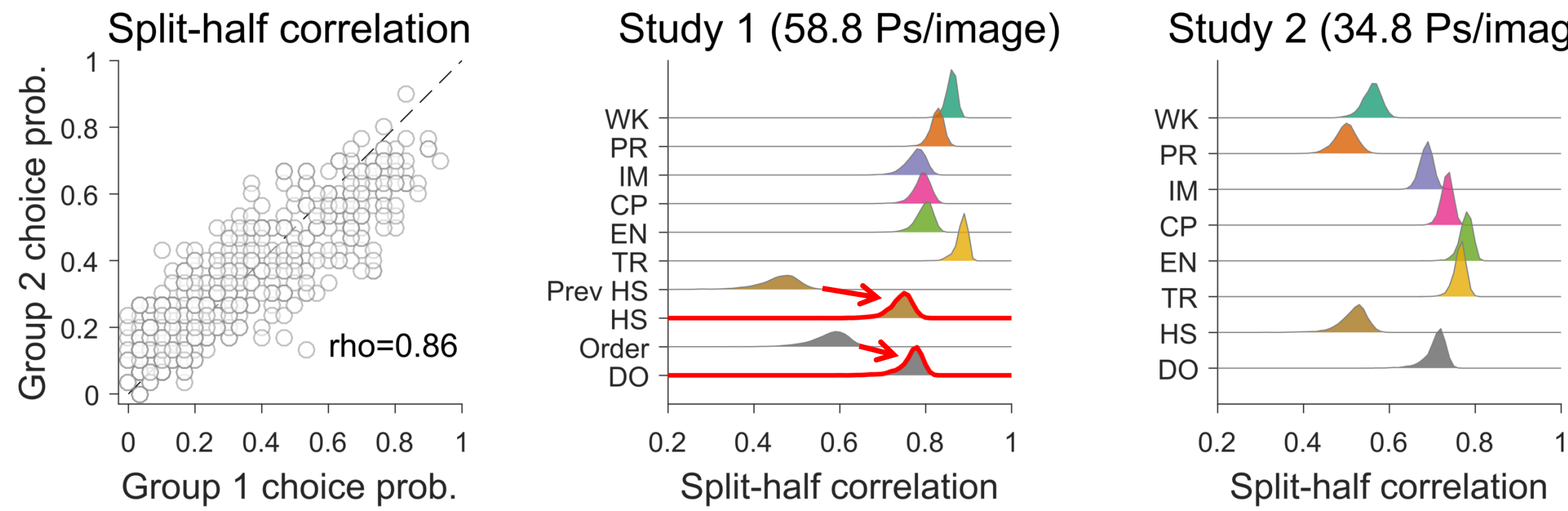
- In each trial, participants were shown 12 images in a 4x3 grid and asked to choose four images that they evaluate highly on that dimension/question. The probability of selecting each image across participants, i.e., **choice probability**, was used to quantify how much that image represented that dimension.



- Task demo: [https://kywch.github.io/StreetPsych/rating\\_preference.html](https://kywch.github.io/StreetPsych/rating_preference.html)
- Results visualization: <https://kywch.github.io/StreetPsych/visualize.html>

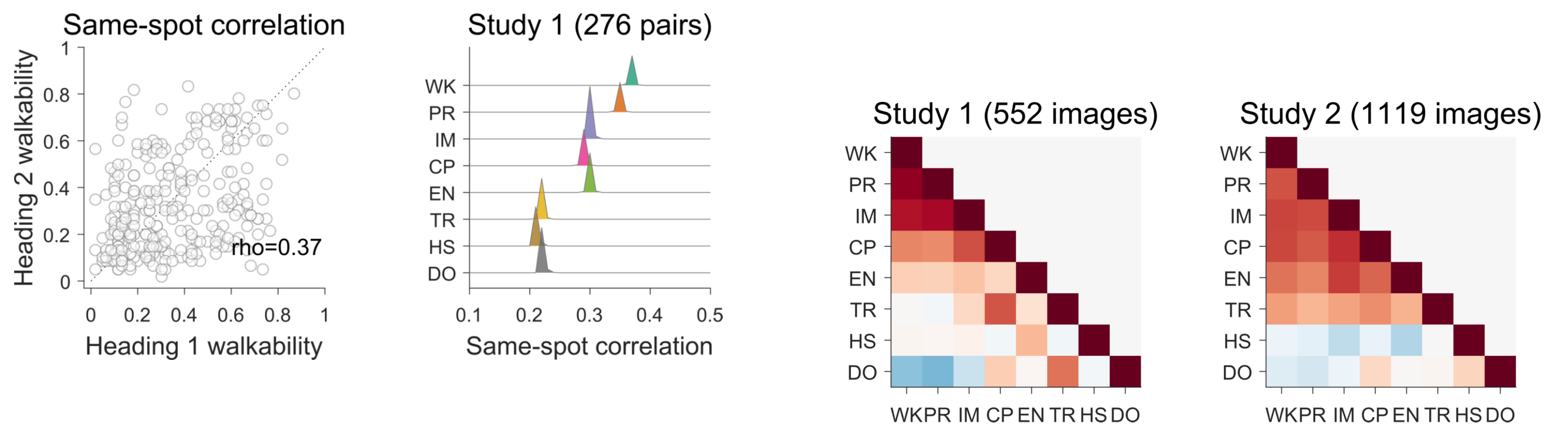
## Examination of rating reliability using split-half correlations

- To test the inter-rater reliability, we randomly split participants into two groups 2000 times and calculated rank-correlations between the measures from each group.
- Overall, we observed high levels of split-half correlations. But, we also found that **question wordings have a huge effect on the rating reliability.** Previous human scale and order questions yielded low reliability. Previous questions: “Select the 4 streets that most match the size and proportion of humans,” and “Select the 4 most orderly streets.”



## Examination of the same-spot rating consistency

- The street images from the same spot can be very different depending on heading.
- We randomly spitted two images (with opposite heading) from the same spot into two bins (of 276 images) 2000 times and found low levels of the same-spot correlations.



## Correlations between the visual pedestrian qualities

**Walkability (WK):** Select 4 streets you would most want to walk down.  
(← Higher) (Lower →) Choice prob.

**Preference (PR):** Select 4 streets that you like.

**Imageability (IM):** Select the 4 streets that have the most character (i.e., that capture your attention).

**Complexity (CP):** Select 4 streets with the most visual richness and diversity of activities.

**Enclosure (EN):** Select 4 streets that feel enclosed and room-like, rather than wide open.

**Transparency (TR):** Select 4 streets where you can see or perceive whats going on inside of the building.

**Human scale (HS):** Select 4 streets with the most human scale (e.g., small buildings and narrow streets).

**Disorder (DO):** Select the 4 streets that seem the most disorderly.

## Discussion

- Our method can efficiently measure pedestrian qualities via crowdsourcing by using the one-line questions that are consistently interpreted by ordinary people. This method can be easily generalized to measure other visual qualities.
- Low levels of the same-spot correlations suggest that we should be careful in associating the measure visual qualities to a specific geo-coordinate.