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.

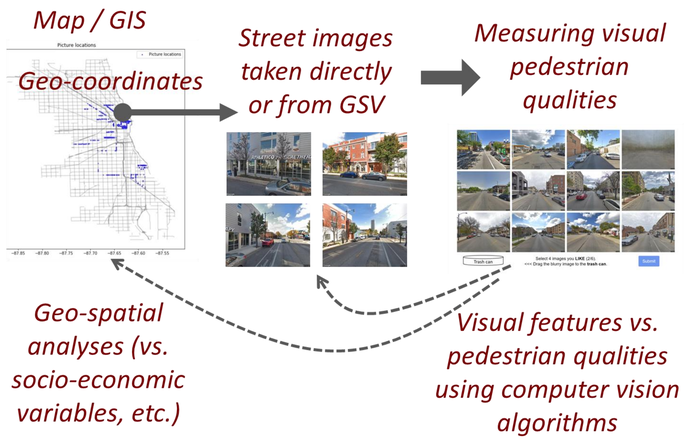
Key research questions

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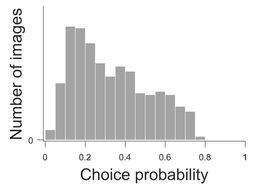
Multi-image rating task: Using one-line questions to evaluate complex visual qualities

• 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.



- A high-rated image would be selected by many (or all) Ps;
- A low-rated image would be selected by few (or no) Ps.

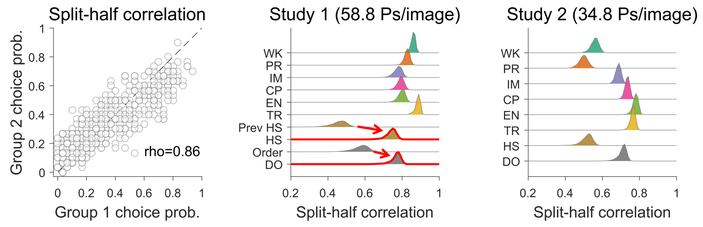
• Task demo: https://kywch.github.io/StreetPsych/rating_preference.html

• 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.

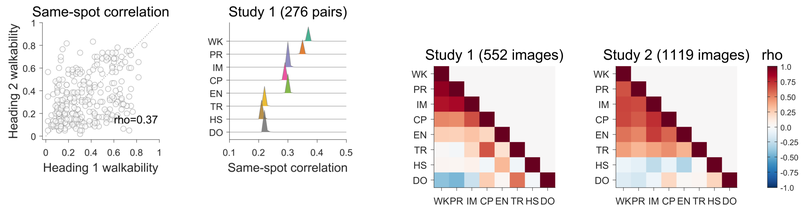
• Overall, we observed high levels of split-half correlations. But, we also found that ***question wordings have a huge effect on the rating reliability***. Previous human scale and order questions yielded low reliability. Previous questions: "Select the 4 streets that most match the size and proportion 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.