

Reading reflections

USP 570

Shen Qu

Week 7

- The ‘Diamond of Design’

Levinson and Krizek (2018 Chapter.11) introduced a new ‘Diamond’, a structure of four key design tenants-hierarchy, morphology, layers, and architectural content. Here author define the term ‘design’ as “how elements of place and plexus arrange their parts into a whole on a variety of scales, from the neighborhood to the metropolis.” This framework even covers the cities system as a high-level hierarchy place. This perspective is more from engineering or computer science. The author compare the layers of place and plexus with the OSI (Open Systems Interconnection) Model, a computer networking framework. This view point is different with the planner who have design background but it provide a powerful tools to explain the complexity of urban land use and transportation.

- Objectively measure subjective qualities

The study by Ewing et al. (2006) attempts to quantitatively measure five urban design qualities in terms of physical characteristics of street for walkability. The research team selected nine from 51 perceptual qualities, 48 from more than 200 video clips, and 10 urban design and planning experts. The expert panel are invloved in defining the ‘operational’ and give the walkability ratings for each clips and assign a score for each quality on a scale from 1 (low) to 5 (high). This study used the fractional factorial design, the crossed multilevel Design, random effects models, and linear regression models to built up the relationship among physical teatures, urban design qulities ad overall walkability.

At the end the team dropped four qualities and choose imageability, enclosure, human scale, and transparency as the measurement of walkability based on five criteria including significant level, ICC,¹ and variance components. This study found that 37 of more than 130 physical features have significant effects on one or more perceptual qualities. In a later paper, Ewing and Handy (2009) gave all the consensus qualitaitive definiations and operational definitions for each qualities and identify detailed physical features associated with each quality.

- Discussion: predetermined or prior information.

In name of fractional factorial design (FFD). The team selected 48 from more than 200 clips that “best matched the combinations of high/low values in a 2^{8-4} FFD.” “The 2^{8-4} sample allowed us to capture the main effects² of each urban design quality on overall walkability, . . . to

¹Intraclass Correlation Coefficient reflects the proportion of the variance of an observation that is the result of differences between treatments.

²In FFD, “significant interaction will often mask the significance of main effects. In the presence of significant interaction, the experimenter must usually examine the levels of one factor, say A, with levels of

maximize geographic diversity.” (Ewing et al. 2006)

FFD is to simplify and improve experiment by factors selection. “The major use of FFD is in screening experiments—experiments in which many factors are considered and the objective is to identify those factors that have large effects.”³ (Montgomery 2017) The input is potential factors and observations. Through examining all the combination of factors, the output is which factors and interactions are important or non-negligible.

Firstly, the paper misused the concept of sample selection. The sample is the 48×10 observations on walkability and $48 \times 10 \times 9$ observations on qualities, rated by viewers in the next step. Selecting 48 from 200 scenes is a treatment selection.

Secondly, a 2^{8-4} FFD means $k=8$ factors, $p=4$ independent generators and 48 observations can assign each of 16 runs with 3 replication. Properly choosing the generators make the effects of potential interest are not aliased with each other. However, the paper don’t provide any information of generators and alias and don’t clarify which factors are confounded.

Finally, the results is not based on FFD, is to make the selected scenes more ‘diverse’ for the 9 qualities. The combination table of quality and clips (Clemente and Ewing 2005) just make the manual selection more clear. The correct use of FFD should be: Rating a random selection from 200 clips by 9 qualities, the results of FFD tell us which qualities or quality combination are more important; Or rating a random selection from 51 qualities by 48 clips, the results will tell us which clips or clips set have significant effects on urban design qualities. That might not be the purpose of this research, but it is what FFD can do.

A nonrandomized ‘random effects models’. The concept of random effect means “the factor levels are chosen at random from a larger population of possible levels, and the experimenter wishes to draw conclusions about the entire population of levels, not just those that were used in the experimental design.” (Montgomery 2017) In this research, the factor of qualities is assigned 9 levels according literature and the factor of scenes has 48 levels selected by qualities. The factor of raters is also manipulated. The research team define their purpose are “trying to operationalize design concepts, not assess public preferences”. They believe “average person” cannot rate streetscapes as to their “legibility,” “transparency,” and so on. The 10 expert define the criteria and rate the clips being selected to match some designated qualities. Therefore, the fixed-effect factors are not applicable for random effects models. It is not strange that “8 of the 9 qualities were collinear. Tolerance values were unacceptably low when all variables were included in a regression at once.” In this situation, we cannot extend the conclusions to all scenes and experts in the population. Technically, the relationship about qualities and walkability are predetermined in this experiment. The conclusion should be: For the 10 experts and the 48 scenes, the 5 urban design qualities and 37 physical features are more amenable and would be defined operationally in the field survey instrument.

the other factors fixed to draw conclusions about the main effect of A.”

³“A major use of fractional factorials is in screening experiments—experiments in which many factors are considered and the objective is to identify those factors that have large effects. Screening experiments are usually performed in the early stages of a project when many of the factors initially considered likely have little or no effect on the response. The factors identified as important are then investigated more thoroughly in subsequent experiments.”

It is also not enough to examine the relationship between walkability and physical features by significant level in linear regression. We can look this study as an iteration of the Bayesian paradigm. The prior information $\pi(\theta)$ (qualities) combined with the sample information $f(\vec{x}|\theta)$ (viewers and scenes) to obtain the posterior distribution $\pi(\theta|\vec{x})$. (Casella and Berger 2002) Collecting more and more scenes and viewers to train the models and draw the inference.

References

- Casella, George, and Roger L Berger. 2002. *Statistical Inference*. Vol. 2. Duxbury Pacific Grove, CA.
- Clemente, Otto, and Reid Ewing. 2005. “Final Report-Identifying and Measuring Urban Design Qualities Related to Walkability.”
- Ewing, Reid, and Susan Handy. 2009. “Measuring the Unmeasurable: Urban Design Qualities Related to Walkability.” *Journal of Urban Design* 14 (1). Taylor & Francis: 65–84.
- Ewing, Reid, Susan Handy, Ross C Brownson, Otto Clemente, and Emily Winston. 2006. “Identifying and Measuring Urban Design Qualities Related to Walkability.” *Journal of Physical Activity and Health* 3 (s1): S223–S240.
- Levinson, David M, and Kevin J Krizek. 2018. *Metropolitan Land Use and Transport: Planning for Place and Plexus*. Routledge. <https://doi.org/10.4324/9781315684482>.
- Montgomery, Douglas C. 2017. *Design and Analysis of Experiments*. John Wiley & Sons.