Reading reflections

USP 570

Shen Qu

Week 2 (Due April 11)

### Mainpoint

* The theories and models explaining how land use/built environment was measured and incorporated into the analysis

Levinson and Krizek (2018 ch. 1) explains different ways of understanding that decision-making and give a brief overview of some of the relevant theories, which largely have three sources: economics, psychology, and biology [pp. 4-5]. In travel behavior research, the theory of utility maximization efforts to forecast choice of travel mode. Mode choice models rooted from *utility theory*[[1]](#footnote-21) and *consumer behavior theory*[[2]](#footnote-22) in economics and psychology. For transport choices tending to be discrete, scholars applied the utility theory to *discrete-choice model* and *multinomial logit model*[[3]](#footnote-23). Above models are associated with decisions to maximize utility while minimize cost.

Another category is the cognitively oriented theories. *social learning theory*[[4]](#footnote-24), the *theory of planned behavior*[[5]](#footnote-25), the *social ecological models*[[6]](#footnote-26), and the *prospect theory*[[7]](#footnote-27). The cognitively oriented models are more explicit about the specific variables that explain behavior while models on utility theory are more explicit about the mechanism by which these variables act on behavior. Based on Planned Behavior Theory and Social Cognitive Theory, Bopp, Gayah, and Campbell (2015) explore the link between public transit use and active commuting, using a typical reseach using statistical method.

There are also some other explanation around transport models. Jones (2009) summarizes that the evolving paradigm in transport research and policy agendas includes vehicle-based (P1), trip-based (P2), activity-based (P3), attitude-based (P4), and dynamics-based. OECD (2017) introduces a simple framework with individual dimension (person-based, location based) and transport dimension (travel-time-based, generalised-costs-based). Meanwhile, Zhang and Van Acker (2017) proposes a paradigm shift from traditional approaches to the life-oriented approach for a better understanding of travel behavior and for better supporting cross-sectoral transport policymaking.

In short, these theories of travel behavior are useful but no single theory can explain all behavior. Scholars acknowledge its limitations and try to find human-centered solutions instead of vehicle-centered.

* Accessibility

Accessibility is the keyword this week. In addition to Levinson and Krizek (2018 ch. 2), OECD (2017) provide some latest research findings, methodologies and data sources on urban accessibility. Handy (2018) further argues that Accessibility is more worth focusing on.

“Access is the fundamental force for understanding cities,”…“is a concept that helps understand and conceptualize the complex relation between transport and land use in a city and their impacts on city organization, development, and planning to achieve more sustainable outcomes.”(Levinson and Krizek 2018, 22) Lyons and Davidson (2016) argue for a focus upon the *Triple Access System* of spatial proximity in land use system, physical mobility in transport system and digital connectivity in telecommunications system as a framework for policy and investment decisions that can harness flexibility and resilience.

Levinson and Krizek (2018) introduce four measure methods for network size[[8]](#footnote-28), accessibility to employment[[9]](#footnote-29), overall accessibility[[10]](#footnote-30), and gravity model[[11]](#footnote-31). Network size indicates an attribute of built environment. Accessibility can descibe the “interaction by a function of the travel cost, such that distant interactions have less weight than nearby interactions.” gravity models also consider distance or travel time and disclose that the interaction between places is inversely proportional to travel cost.

In this part, authors says that “in cumulative opportunities measures, if cost is less than threshold T and 0 otherwise, so only employment within the threshold is considered.” Here seems like an indicator function denoted by (Casella and Berger 2002, Definition 3.4.5) where represents a set. I cannot understand this case well.

Levinson and Krizek (2018) also introduce some important concepts: the four-Cs Diamond of Action (constraints[[12]](#footnote-32), complementors and competitors, chances) affect choices, absolute and relative accessibility[[13]](#footnote-33), regional accessibility[[14]](#footnote-34) etc. I put them in Endnotes for future use.

### Discussion

* The discussion around A" and “Ds”

Handy (2018) aruges that current academic literature pay too much attention to Ds and suggests replacing Ds with A, accessibility. It is true that there is a large amount of aricles disscusing the effects of the built environment on travel behavior. Scholars also don’t forget accessiblity in the past decades. In the year of the original “three Ds,” coined by Cervero and Kockelman (1997), Cervero (1997) also published a papaer to advocate focusing on accessibility rather than mobility. “Not only do our objective change, but so do our analytical methods, styles of planning, and strategies” change from automobility to accessibility, from for movement to for people and places, from working on the supply side to emphasizing demand management. One of the followed D, destination accessibility (Ewing and Cervero 2001) involved A to measures ease of access to trip attractions.

The difference between Ds and A is, Ds focus on some elements in built environmnet, which are more visible and more measurable. Thus Ds are easy to applied in urban planning, policy, regulation and easy to implement. A is a abstract concept, a estimated value. A could be a comprehensive evaluation, a overall objective. Sometimes, the verbal A is subjective while the A in some models is too complicated for many people. Some online tools for evaluating A are helpful. Ds and A will not replace each other in futrue.

* How to improve the study design.

Using t-test and regression analysis, Bopp, Gayah, and Campbell (2015) explore the relatioship between public transit use and active commuting. What is special about this reaserch is that examine the connection between two travel modes, not between travel modes with other soci-economic or built environment factors. In other words, this study treat two levels in a variable as two variables. As the author mentioned, “the two travel modes are more intrinsically connected than previously thought.” This result may be predeterminate because two levels in a factor are not independent. Some multi-modal trips composed of transit commuting and active commuting make thing more complex. Other variables such as gender, race, and income level often have interaction effects. This study checks the colinearity but doesn’t report the details. A factorial design might help to identify the interaction effects among the choosen factors. The nonparametric test could work for depnedent factors.

The authors say “our sampling strategy and use of a volunteer, convenience sample limit the generalizability as well as our ability to objectively assess land use factors.” This sampling way hurts the randomization more, which is a basic requirment for t-test. The final 748 participants are recruited by 5251 emails. If there are 9766 potential participants as authors said, the 748 participants largely represent the group who can access and are willing to complete the electronic survey, and who live in a transit-available commounity. The sample size are large enough but the numbers of observations are imbalanced (596 non public transit riders v.s. 152 public transit riders). These may be common in social studies and are also highly likely having selection bias. Using the proportions tests to compare the observed proportion with national levels may help. For example, one fifth people’s income are higer than 50k $ per year in the U.S. (cencus, 2018), does this sample have same proportions? If not, the conclusion can describe some specific gorups. Some checks of normality, residual, and variances could help to improve the stduy design too.

# Notes

# References

Bopp, Melissa, Vikash Gayah, and Matthew Campbell. 2015. “Examining the Link Between Public Transit Use and Active Commuting.” *International Journal of Environmental Research and Public Health* 12 (4). Multidisciplinary Digital Publishing Institute: 4256–74. <https://doi.org/10.3390/ijerph120404256>.

Casella, George, and Roger L Berger. 2002. *Statistical Inference*. Vol. 2. Duxbury Pacific Grove, CA.

Cervero, Robert. 1997. “Paradigm Shift: From Automobility to Accessibility Planning.” *Urban Futures (Canberra)*, no. 22. Housing; Urban Policy Section of the Dept. of Industry, Technology and …: 9.

Cervero, Robert, and Kara Kockelman. 1997. “Travel Demand and the 3Ds: Density, Diversity, and Design.” *Transportation Research Part D: Transport and Environment* 2 (3). Elsevier: 199–219.

Ewing, Reid, and Robert Cervero. 2001. “Travel and the Built Environment: A Synthesis.” *Transportation Research Record* 1780 (1). SAGE Publications Sage CA: Los Angeles, CA: 87–114.

Handy, Susan. 2018. “Enough with the ‘Ds’ Already—Let’s Get Back to ‘a’.” Transfers Magazine. <https://transfersmagazine.org/enough-with-the-ds-already-lets-get-back-to-a/>.

Jones, Peter. 2009. “The Role of an Evolving Paradigm in Shaping International Transport Research and Policy Agendas over the Last 50 Years.” In *Proceedings of the Xii International Association for Travel Behaviour Research Conference (Iatbr2009. Asu. Edu)*, 3:34. Travel behaviour research in an evolving world.

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>.

Litman, Todd. 2017. *Evaluating Accessibility for Transport Planning*. Victoria Transport Policy Institute. <http://www.vtpi.org/access.pdf>.

Lyons, Glenn, and Cody Davidson. 2016. “Guidance for Transport Planning and Policymaking in the Face of an Uncertain Future.” *Transportation Research Part A: Policy and Practice* 88. Elsevier: 104–16.

OECD, International Transport Forum. 2017. “Linking People and Places.” ITF. <https://www.itf-oecd.org/linking-people-and-places>.

Zhang, Junyi, and Veronique Van Acker. 2017. “Life-Oriented Travel Behavior Research: An Overview.” Elsevier.

1. the “Law of Comparative Judgment,” by Louis Leon Thurstone in 1929, which known as () (Levinson and Krizek 2018, 3). [↑](#footnote-ref-21)
2. Kelvin Lancaster’s *consumer behavior theory* (1966) use a function of both the trip’s benefits and its costs to represent the demand for a transit trip. [↑](#footnote-ref-22)
3. Stanley Warner first applied concepts of *utility theory* to disaggregate travel in 1962. In 1975, Daniel McFadden formalized *discrete-choice model* to predict transport mode choice in anticipation of the building of the Bay Area Rapid Transit (BART) system in the San Francisco Bay Area.  
   Moshe Ben-Akiva and other transportation modelers developed the *multinomial logit model* (MNL) in 1985. [↑](#footnote-ref-23)
4. Albert Bandura (1977) posits that by “observing others, one forms an idea of how new behaviors are performed, and on later occasions this coded information serves as a guide for action.” [↑](#footnote-ref-24)
5. The theory of planned behavior focuses on the role of different types of beliefs in explaining behavior. *Behavioral beliefs* (“What will result?”) contribute to people’s perceptions of possible outcomes weighted by an evaluation of those outcomes. *Normative beliefs* (“What would other people think?”) consider the reactions of referent individuals weighted by an individual’s motivation to comply with those referent individuals. *Control beliefs* (“What else would facilitate or constrain this behavior?”) suggest the user considers an array of factors that may advance or inhibit the behavior and these are weighted by the perceived power of each factor. [↑](#footnote-ref-25)
6. *Social ecological models* suggest that there are a variety of contexts—individual, interpersonal, organizational, and community—that operate at multiple levels to influence individual action. “In addition to intra-individual factors, ecological models say that human behavior is shaped by higher-level factors including organizational, policy, social, and physical environments, as well as dynamic interactions across multiple domains.” [↑](#footnote-ref-26)
7. *Prospect theory* explains why people are seemingly irrational when analyzed through the prism of utility theory. Whereas formal utility theory assumes people only care about final outcomes, prospect theory suggests that decisions depend on how the alternatives are presented. The theory suggests that people are risk-averse when seeking potential gains; they are also risk-seeking when addressing potential losses. [↑](#footnote-ref-27)
8. “Law of the Network” (and in a computer networking context, Metcalfe’s Law, named for Robert Metcalfe, developer of the Ethernet networking standard) can be expressed as: , where is the size of the network (number of markets), is the number of nodes. [↑](#footnote-ref-28)
9. where: represents accessibility to employment from zone . is employment at destination . is a function of the travel cost (time and money) between and . The higher the cost, the less the weight given to the employment location. [↑](#footnote-ref-29)
10. an overall accessibility measure is a summation of the measures of all origins: where is overall accessibility for region, represents workers living at origin [↑](#footnote-ref-30)
11. Isaac Newton (1687) first found the relationship between the gravitational force, distance, and mass. Ernest Ravenstein (1876-1889) developed a similar idea in the context of the social sciences. William J. Reilly developed a “Law of Retail Gravitation” (1931) John Q. Stewart developed the notion of demographic force (F) between places, and this demographic force equation forms the basis of the gravity model used in many transport planning models. Alan Voorhees (1956) first applied the gravity model to address problems of urban transport planning.

    where: : trips between origin and destination : trips originating at (for example, workers) : trips destined for (for example, jobs) : distance decay factor, as in the accessibility model : generalized travel cost between and : balancing factors solved iteratively This gravity model suggests several things. First, as city size increases, mean commuting time increases. The structure of gravity models implies diminishing marginal returns to job opportunities at the edge, since each additional job is less and less likely to be taken and thus less likely to increase travel time. Second, these models are largely independent of density—except to the extent that density changes network speed. A uniform increase in density increases the opportunities within each time band proportionately, and thus does not change the distribution of travel times. Third, if preferences shift, mean travel time will change inward or outward. Fourth, if congestion rises, more opportunities will be farther away in terms of travel time, and fewer nearby—implying that average commuting time will rise. [↑](#footnote-ref-31)
12. Constraints are matters that—voluntarily or involuntarily, explicitly or implicitly—set bounds on the daily, weekly, annual, or longer-term decisions that a household makes; they limit the range of opportunities available to any one person and demarcate the frontier that an individual cannot or will not cross. Primary constraints include time, space, finances, and responsibility. [↑](#footnote-ref-32)
13. Absolute accessibility is the total measure of accessibility within a particular area. A transport improvement increases overall accessibility—analogous to increasing the size of the pie. Relative accessibility is the share of total accessibility associated with a particular place. A new transport facility increases the relative accessibility of those points that can directly use the facility—analogous to increasing the percentage of the pie that a particular slice comprises. [↑](#footnote-ref-33)
14. Regional accessibility is determined by the regional structure of a metropolitan area and incorporated variables such as location, type of activities, and size of activities that affect shopping behavior. Local accessibility, is primarily determined by nearby activity (where “nearby” is used to refer to the neighborhood unit, approximately one-half to one mile (800 to 1,600 m) in residential areas). Areas with higher local accessibility would be oriented to convenience goods, such as supermarkets and drug stores, and located in small centers. [↑](#footnote-ref-34)