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Research paper

Comparing text-only and virtual reality discrete choice experiments of neighbourhood choice

Zachary Patterson[a,*], Javad Mostofi Darbani[a], Ali Rezaei[a], John Zacharias[b], Ali Yazdizadeh[a]

[a] Transportation Research for Integrated Planning (TRIP) Laboratory, Department of Geography, Planning and Environment, Concordia University, 1455 de Maisonneuve W., H 1255-15 (Hall Building), Montreal, QC H3G 1M8, Canada
[b] College of Architecture and Landscape, Peking University, Beijing 200080, China

HIGHLIGHTS

- Virtual reality model had more significant coefficients.
- Virtual reality platform appears to have better focused respondent attention.
- Visually attributes did not gain importance relative to text-only attributes.
- LPS visuals best employed when they are accurate descriptions of possible outcomes.
- Visual LPSs well suited to use in public consultations on planning interventions.

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ABSTRACT

Stated Preference (SP) surveys are used in many disciplines including: marketing; transportation-, environmental- and health-economics; and landscape and urban planning. The Landscape Preference Study (LPS) is a common SP technique in landscape and urban planning, defined by the presentation of landscapes through images, something uncontroversial in this literature. The use of visual attributes in SP surveys in the marketing and economics literatures has, however, aroused controversy. Potential benefits are evoked (greater realism in tasks), but drawbacks (e.g. unintended information affecting respondent choices) are also discussed. At the same time, the use of visualization and simulation is said to be "outstripping" understanding of how best to use them in planning contexts. We adopt "the economic approach" to LPSs (the Discrete Choice Experiment) to better understand how presentational methods affect results in the context of neighborhood choice. We compare two experiments; one administered as a virtual reality simulation, and the other as a text-only survey. We conclude that in essence, respondent preferences in the text-only survey were based on respondent mental images of building types, whereas in the visual survey, preferences were based on the displayed images. As such, we propose that LPS visuals are best employed when the visual representations provided to respondents are accurate descriptions of possible outcomes, as they could be in public consultations related to landscape and urban planning. In so doing we make one step toward Lovett et al.'s (2015) call to help evaluate the increasing number of options available in landscape visualization.

1. Introduction

The Stated Preference (SP) survey encompasses a large number of research tools designed to help understand people's preferences, and is used in many disciplines, including: marketing; transportation-, environmental- and health-economics; and landscape and urban planning. One particularly common SP tool in landscape and urban planning is the Landscape Preference Study (LPS). LPSs take various forms, but a defining feature is the representation of landscapes as images, and increasingly, computer simulations. Images play a fundamental role in LPSs and their use in landscape and urban planning is uncontroversial. The visual presentation of attributes in SP surveys in the marketing and economics literatures, however, has aroused controversy. While

* Corresponding author.
E-mail addresses: zachary.patterson@concordia.ca, zak.patterson@gmail.com (Z. Patterson), jj.mostofi@gmail.com (J.M. Darbani), a.rezaaei@gmail.com (A. Rezaei), zachariasjohn478@gmail.com (J. Zacharias), ali.yazdizadeh.pres@gmail.com (A. Yazdizadeh).

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potential benefits are evoked (greater realism in tasks), disadvantages (e.g. unintended information affecting respondent choices) are also discussed. At the same time, in the landscape and urban planning literature, there is recognition that the use of increasingly sophisticated visualization techniques is outstripping understanding of how they work. This recognition is associated with calls that "more systematic empirical treatments, particularly comparing two or more visualization techniques that differ in content or delivery, would offer the most robust way to evaluate available options" (Lovett, Appleton, Warren-Kretzschmar, & Von Haaren, 2015).

The research presented here adopts the "economic approach" to LPSs (the Discrete Choice Experiment (DCE)) to better understand how different modes of content delivery can affect results from a DCE survey on neighborhood choice. We compare results of two Discrete Choice Experiments, one administered in a virtual reality simulation environment and the other as a text-only survey. Both survey versions are designed with the Gaming Engine, Unity®. In the virtual reality survey, respondents were able to navigate simulated neighborhoods in which they received supplementary textual information as they viewed alternative virtual neighborhoods. By contrast, the text-only survey provided written attribute descriptions.

Previous attempts to evaluate the impact of presentational mode in housing/neighborhood choice have had trouble ensuring systematic control of visual attributes and had small respondent samples. Through the use of the virtual reality simulation environment, it was possible to systematically control the visual elements. Moreover, a relatively large number of attributes were included, and a relatively large number of respondents (368 in total and 184 for each survey) participated in this study. The goal of the study was to test whether superior models would result from the data collected in the simulation environment, after addressing shortcomings of previous comparisons of presentational modes in housing/neighborhood choice. In so doing we seek to contribute to DCE and LPS literature, as well as help evaluate the increasing number of presentational methods available for these surveys.

We begin with a review of existing relevant literature and continue with methodology. In the methodology section, we explain survey development and interface design, survey administration, as well as the statistical approach to the analysis of the data. In the fourth section we present the modeling results. After discussing the results, we conclude with a section the contribution of the findings to the larger literature on methods in LPS and DCE.

2. Literature review

Several subthemes within the abundant literature on Stated Preference (SP) techniques are relevant to this research. SP techniques involve the use of surveys where the intention is to understand people's preferences by asking respondents to rank, rate, assign monetary value, or choose between alternatives. Alternatives are characterized by attributes of different levels (e.g. the attribute "residential building type" may have the levels single-family detached, townhouse, apartment, etc.). Different alternatives grouped together in a question are referred to variously as tasks, profiles, scenarios, and choice sets, among other terms. SP methods are used across many different disciplines including, but not restricted to marketing; transportation-, environmental- and health-economics; and landscape and urban planning.

2.1. Landscape preference studies, conjoint analysis and discrete choice experiments

In landscape and urban planning, a common SP technique is the Landscape Preference Study (LPS). The term Landscape Preference Study itself covers many different methods and instruments generally used to evaluate "landscape quality"—so many in fact that reviews (e.g. Daniel & Vining, 1983; Daniel, 2001; Zube, Sell, & Taylor, 1982) are not uncommon and even meta-analyses (e.g. van Zanten, Verburg, Koetse, van Beukering, 2014) are conducted. The present research relates to the subset of LPSs referred to as the "perception-based approach" (Arthur, Daniel, & Boster, 1977; Daniel, 2001) or "the psychophysical paradigm" (Zube et al., 1982), among others. As described by Daniel (2001), with such surveys "Indices of perceived landscape quality are based on overt choices, rankings or ratings of landscapes (usually represented by photographs) provided by samples of (actual or potential) human viewers" (p. 273). Such methods have been used since the 1960s (e.g. Peterson & Neumann, 1969; Shafer, Hamilton, & Schmidt, 1969) and continually since (e.g. Arthur et al., 1977; Dramstad, Sundli Tveit, Fjellstad, & Fry, 2006; Mudrak, 1983; Visscher, Nassauer, & Marshall, 2016; Zacharias, 1999). As suggested in Daniel (2001) definition of the "perception-based approach," various methods have been adopted. For reasons that will be clear below, we further subdivide the literature into two categories: choice-based approaches, and rating and ranking approaches. In the choice-based approach, respondents may be asked to choose among alternative landscapes, or they may be asked to rank or rate alternatives. Choice-based approaches typically draw on methods developed in the marketing and economics literatures (e.g. Arnberger & Eder, 2011; Laing, Davies, & Scott, 2005; Chapter 9; Rambonilaza & Dachary-Bernard, 2007). They can be used to estimate the "willingness to pay" for particular landscape elements (e.g. Rambonilaza & Dachary-Bernard, 2007). As a result, they are sometimes referred to as the "economic approach" for evaluating landscape preferences (Rambonilaza & Dachary-Bernard, 2007).

As it turns out, the SP techniques used in other disciplines are not very different from the LPSs used in landscape and urban planning. The differences relate primarily to the context of application, the use of images in LPSs, and the terminology used to describe them. The first two differences are closely linked since the evaluation of landscape preferences is practically synonymous with the use of images. The use of images in other disciplines adopting SP techniques is not as commonplace and has been controversial. With respect to terminology, the techniques used in LPSs are used differently across disciplines and are given different names. Ranking and rating techniques are more likely used in the marketing literature and are referred to as Conjoint Analysis (Green & Srinivasan, 1978). Applied economics disciplines are much more likely to adopt choice-based approaches (e.g. Bateman, Day, Jones, & Jude, 2009; Louviere, Louviere, & Swait, 2000; Louviere, Flynn, & Carson, 2010; de Bekker-Grob, Ryan, & Gerard, 2012). Within this literature, choice-based approaches are referred to variously as Stated Preference surveys, Stated Choice surveys, or Discrete Choice Experiments. In the rest of this paper we use the term Discrete Choice Experiment (DCE) as recommended by Louviere et al. (2010). As a result, although the research described in this paper could be seen as an LPS application, the motivation for the research is drawn from the literatures on conjoint analysis and discrete choice experiments. It is also directly relevant to questions being raised in landscape and urban planning.

2.2. The use of images in conjoint analysis and discrete choice experiments

As described above, the use of images in landscape preference studies is commonplace, *de rigueur* and uncontroversial. In the conjoint analysis and DCE literature, however, this is not the case. In the conjoint analysis and DCE literature it is recognized that flexibility is needed in how alternatives are presented to respondents. Above all, it is recognized they should be presented in a