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# Using images to measure qualitative attributes of public spaces through SP surveys

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## Abstract

Stated preference choice experiments can benefit from the use of images to describe complex scenarios such as public spaces or urban infrastructure. However, images will be perceived subjectively by users who will probably understand them in a more qualitative than quantitative way. A method to quantify the relevance of qualitative attributes of public spaces such as beauty, safety or security is proposed. The method is based on the sequential estimation of discrete choice and latent variable models. Two case studies are described and the complexity of the construction of images is discussed. Results show that the proposed method allows the inclusion of qualitative features in choice models, but the use of images introduces a bias in the perception of the magnitude of design attributes that should be analysed carefully.

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## 1. Introduction

Design of urban infrastructure and public spaces is a topic of major relevance for cities as these are the main elements that connect places, people and activities, providing common areas for social interaction and facilitating integration of communities. Successful design should encourage intensive use of public infrastructure and space in a

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way that is beneficial for society, thus justifying the investment of resources. For this, the design process must identify which attributes and characteristics are relevant for potential users, in order to generate attractive projects. This analysis (if performed) is usually done in a qualitative way, characterising the preferences of users through interviews or focus groups where specific cases studies are discussed and explored. However, this approach may not be enough when the relevant attributes are subjective or abstract, when the relative marginal value of attributes needs to be known or when a generalised and quantifiable understanding of individual preferences is required in order to economically evaluate hypothetical scenarios.

There is abundant evidence showing that qualitative attributes of urban space and infrastructure have an important effect on user behaviour (Handy et al., 2002; Ewing et al., 2003). For example, perceived safety, comfort and ease of access may encourage the use of public spaces (Khisty, 1994; Shriver, 1997), encourage the performance of particular activities like sports (Davison and Lawson, 2006; Heath et al., 2006) or influence the choice of transport mode, especially where exposure of the user to the environment is higher, as in walking or cycling (Antonakos, 1994; Zacharias, 2001; Hunt and Abraham, 2007).

While individuals usually perceive public spaces qualitatively, it is clear that qualitative attributes are a subjective interpretation of quantitative features of space. A typical example of this is perceived safety of public spaces, modelled through structural equations relating safety to physical features of space (Barker et al., 2003; Blöbaum and Hunecke, 2005). For a review of quantitative methods to analyse urban form and how it is perceived see Clifton et al. (2005).

Identifying which (and how) quantitative attributes contribute to each qualitative or subjective feature is not straightforward. For example, it has been noted that the presence of trees may increase the sense of safety in a public area (Kuo et al., 1998). While the presence of trees is an attractive feature by itself (Smardon, 1988), the positive effect on perceived safety is not obvious and, if not modelled explicitly, may be confounded. Moreover, other quantitative attributes may be contributing to the qualitative feature and should also be considered in the modelling effort. For example, Fanariotu and Skuras (2004) proved that omission of beauty indicators in landscape evaluation produces bias in the estimation of environmental welfare, even when all the variables used in the indicator are included. In general, there is a difference between the objective environmental quality of space (measured by quantitative attributes) and perception of users (Adamowicz et al., 1997), suggesting that (perceived) qualitative attributes should be explicitly modelled as a function of measurable attributes of both the object or space in question and the decision maker.

Measuring the preferences of users generally requires using stated preference surveys, especially when the subjects are designs, scenarios or projects that do not exist yet. In particular, stated preference choice experiments are good tools to evaluate, for example, environmental quality of physical spaces because they allow calculation of the relative value of attributes (Boxall et al., 1996) and can be used to estimate discrete choice models (Lancaster, 1966; McFadden, 1974). The main difficulty with this kind of tool is representing the scenarios in a way that properly conveys the nature of all the features (both quantitative and qualitative) the space or object would have in reality. For example, use of text for the description of a scenario requires respondents to read, interpret and visualise (or imagine) the situation by themselves, which is clearly limited and a possible source of bias if the scenario is complex, such as a public space.

Images are representations that can be more accurate than text because they explicitly show the physical features of the scenario to the respondent. For example, Strazzera et al. (2010) studied the use of images in stated preference surveys in order to identify preferred design attributes for urban refurbishing processes. Sillano et al. (2006) and Iglesias et al. (2013) used images to measure the perception of safety in neighbourhoods as a function of urban design variables. Torres et al. (2013) used images to describe the level of maintenance of a street to measure its effect on location decisions. However, despite the clear advantages over text-only based description, images are still far from describing choice scenarios in a completely realistic way, since they lack volume, texture, temperature and sound. Moreover, when the scenario involves a public space, there are dynamic features that cannot be described with static pictures, such as the movement of objects or people. All these elements are hard to illustrate in traditional surveys, especially when the alternatives are complex scenarios like public spaces, where the description of alternatives can be ambiguous or incomplete and will be perceived in a subjective way by the respondent.

In discrete choice models, the subjective attributes that describe alternatives beyond quantitative attributes are usually considered part of the choice context (Oppewal and Timmermans, 1991) rather than intrinsic attributes of the

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