



# The effect of attribute representation methods on noise valuation: A choice experiment study

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## ABSTRACT

Traffic noise has been known to severely affect human population. The valuation of traffic noise pose a significant challenge in choice experiments as respondents have little understanding of the physical measure of noise and its associated perception. As a result, several techniques have been developed that represent noise using different methods, either based on the level of noise exposure or the respondent's level of noise annoyance. This study examines the effect of different methods of attribute representation on respondents' attribute understanding and valuation. The study is focussed on residential choice and residential view and sunlight are important attributes that are examined along with traffic noise. The study demonstrates that the methods of attribute representation have an important effect on respondents' understanding of the attributes as well as in the subsequent valuation. It was found that attribute such as view is better represented using the location representation while noise is better represented using the linguistic method. Moreover, the method of attribute modelling also plays a significant role in the analysis as certain data input techniques are more suitable for some representation methods.

## 1. Introduction

Traffic related noise is an important externality significantly affecting human population. Though several techniques exist to value noise, choice experiment (CE) has been increasingly applied as it offers some advantages over contingent valuation (CV) and revealed preference techniques such as hedonic pricing (Arsenio et al., 2000; OECD, 2007). However, an important problem associated with CE as well as CV in context of noise valuation lies in the adequate representation of the attribute. As the physical noise measure is generally more difficult for respondents to understand, following from Navrud (2002), two general types of noise representation can be observed in CE and CV studies – the exposure based and the annoyance based methods.

Studies applying the annoyance based method, which employ change in noise annoyance level as a representation method such as Bjorner, 2004; Fosgerau and Bjorner, 2006 and Li et al., 2009, have shown that the presentation of the annoyance levels in the survey poses a significant challenge in its application. As the exposure based method allows the noise levels to be represented in several different ways, the examination of different noise representation techniques is easier under this method. Several methods of noise representation have been adopted within this technique, ranging from percentage or proportionate change (Saelensminde, 1999; Wardman and Bristow, 2004), auditory noise measure (Garrod et al., 2002), residential location reference (Arsenio et al., 2006) and proxy method (Carlsson et al., 2004; Bristow and Wardman, 2006).

While some comparisons of different noise representation methods using priority ranking can be observed in Wardman and

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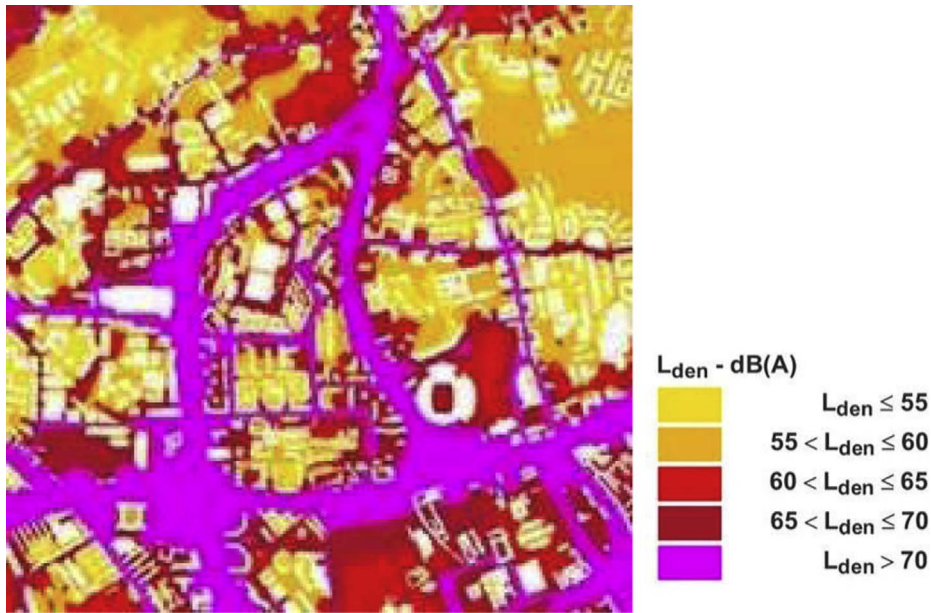


Fig. 1. Lisbon Noise Map for Telheiras Area.

Source: <http://www.cm-lisboa.pt/en/living-in/environment/noise/mapas-de-ruído>.

Bristow (2008), few examples can be found within the CV and CE literatures which examine the effect of different noise representation methods on attribute understanding and valuation. This paper addresses this issue using a residential CE survey by representing the attributes using the residential location reference as well as the linguistic representation method, to examine the effect of varying representation methods on respondents' understanding of the attributes. Thus, the effect of different attribute representation methods on attribute valuation will be examined in this paper.

The paper is structured as follows: Section 2 outlines the case-study area and the survey design, Section 3 provides the structure of the analytical models, Section 4 details the results and discussion while Section 5 gives the conclusions.

## 2. Background area and survey design

A noise residential survey was conducted in Telheiras area of Lisbon, Portugal to analyse the effect of different attribute representation methods on attribute valuation. The valuation CE was conducted during February–April 2008, with view, noise, sunlight and housing service charge as attributes in the SP exercise. Portugal has about 30% of the population exposed to more than 65 dB (A) of road traffic noise (Nijland and van Wee, 2005). The Telheiras residential area in Lisbon is surrounded by three main traffic roads (Avenue Norton de Matos, Eixo Norte Sul and Avenue Padre Cruz). Based on the noise map of the city given by the city council of Lisbon ([www.cm-lisboa.pt](http://www.cm-lisboa.pt)), some sections of the main traffic road surrounding the Telheiras area were observed to have noise levels greater than 70 dB (A). The daytime noise levels are given in the following map of the Telheiras area (see Fig. 1):

The general questionnaire format and the survey site choice followed from a previous CE exercise conducted in the same area by Arsenio (2002). However, in comparison to the survey conducted by Arsenio (2002), which adapted a binary choice computer aided personal interview (CAPI) with the respondents' current apartment as the base alternative, the current study adapted an in-person paper based interview. As the focus of the current study was to examine the effects of different attribute representation methods on valuation, the pivotal design was not adapted.

The current survey was conducted in different phases and experiments based on the method of attribute representation and choice elicitation. The levels of the attributes view, noise and sunlight in the first phase of the survey were based on the relative locations of the apartments in the block (the location method) while for the second phase of the survey, the attribute levels were represented using linguistic categories (the linguistic method).

The questionnaires for both the phases of the survey comprised of questions on the perception ratings for the attribute levels for view, noise and sunlight, reasons for choosing the particular apartment and the residential location, number of hours spent in the apartment during weekdays and weekends, the presence and age of children in the household, the levels and causes of noise annoyance perceived in the apartment during day and night and socio-economic questions such as education, household income, occupation and gender. The choice experiment section of the questionnaire varied based on the phase and the experiment employed.

For both the phases of the survey which varied based on the attribute representation method employed, a fractional factorial orthogonal main effects design was developed based on the attribute level differences across the two alternatives. To eliminate the dominant choice problem in the second phase of the survey (which employed the linguistic representation method), variations were made in the sign of the housing charge difference for some of the scenarios, thus compromising on the orthogonality of the design.

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