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Integrating attribute non-attendance and value learning with risk attitudes and perceptual conditioning

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ABSTRACT

This study integrates multiple decision process strategies (Attribute Non-Attendance and Value Learning) with risk attitudes, perceptual conditioning and overt experience, which, to the best of our knowledge, has not been done before. We propose a way to include multiple heuristics as an alternative to current dominant paradigms, which supports a behavioural view that more than one heuristic simultaneously is at play in attribute and alternative processing. Our results show that including multiple decision process strategies, and integrating of all these components, significantly improves the model's performance and enhances our understanding of how preferences are made.

1. Introduction

Discrete choice modelling has become the preferred empirical context to study individuals' preferences and willingness to pay. Although the *outcome* is important in decision making, so is the *process* that individuals adopt to assist them in reaching a decision. Both should be considered when analysing individual behaviour as they represent jointly the endogeneity of choice. Traditional choice studies assume, in the main, a fully compensatory (FC) approach, where individuals are rational and take into account all the attributes and alternatives presented to them when reaching a decision. Moreover, they also assume that individuals value the attribute levels exactly as were presented in the experiment. This has not always been shown to be a behaviourally valid representation of behavioural response (see for example evidence in Hensher et al. 2015, Chapter 21), and there is a growing literature on the role of a number of alternative decision process strategies that individuals use when facing a decision, which are often referred to as heuristics or simply as process rules. An objective of this paper is to integrate multiple decision process strategies, Attribute Non-Attendance (ANA) and Value Learning (VL) in particular, alongside the traditional fully compensatory 'process rule', to take into account process endogeneity in choice responses. ANA will take into account the set of attributes that a person attends to, and VL will focus on how the attribute levels are considered when evaluating the prospect. The appeal of jointly investigating the selected heuristics is that we have two behavioural processes that appear in large part to represent different ways in which attributes influence choices: ANA focuses on how an individual evaluates the current choice set while VL focuses on how repetitive choice sets might be interacting with each other.

The majority of choice studies also assume that respondents have a risk attitude that is risk neutral (i.e., a risky alternative is indifferent to a sure alternative of equal expected value) and that they perceive the levels of attributes in choice

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experiments in a way that suggests the absence of perceptual conditioning. Considering each in turn, there are people who are risk adverse, risk taking or risk neutral, and this heterogeneity in risk attitude does influence individuals' decisions when faced with different choice scenarios. Heterogeneity is also present for perceptual conditioning in cases where there is variability in the outcomes of an attribute(s), which allows for differences between the stated probability of occurrence (in a choice experiment) and the perceived probability used when evaluating the prospect. Finally, the (accumulated) experience that individuals' have with each alternative might also influence their decisions.

All of these components, i.e., multiple heuristics, risk attitudes, perceptual conditioning, and overt experience, have been studied separately in the existing literature, and each one has been shown to potentially have a behaviourally important influence on the performance of discrete choice models. This paper focusses on integrating, for the first time, all of these behavioural components jointly, contributing to our understanding of decision making processes and outcomes under risk. Including more than one heuristic together with risk attitudes, perceptual conditioning and experience, is very challenging due to the model complexity. Specifically, this research proposes an extension of an existing methodology known as a *Probabilistic Decision Process* (*PDP*) (McNair et al., 2012), referred to as *Probabilistic Decision Processes Combined* (*PDPC*), as a way to integrate all components in a single model (more details in Section 4), and compares this rich behavioural formulation to the single process approach (*PDP*).

The remaining sections are organised as follows: Section 2 presents the background and broader literature associated with the different components explained above. Section 3 describes the dataset that will be used for this study. Section 4 describes the methodology used, followed by the results of the choice models. Section 5 presents willingness to pay (WTP) estimates and Section 6 summaries the main findings and concludes.

2. Background

Different decision process strategies have been considered in transport studies to represent the way in which individuals reach a decision. A heuristic that has been the subject of many studies (also in other disciplines such as health and environmental economics) is Attribute Non-Attendance. This heuristic proposes that when making a decision, an individual may only take into consideration a subset of the attributes, i.e., they choose, for whatever reason, to not attend to certain attributes. A growing number of studies (e.g., Hensher et al., 2005; Hensher, 2006; Hess and Rose, 2007; Puckett and Hensher, 2009; Campbell et al., 2014) have investigated this heuristic and their results have shown that there are individuals who do not consider all the attributes presented to them (for many reasons). Only a subset of attributes are deemed relevant in choice making, within the context being considered. This heuristic can be identified through stated responses (i.e., the individual states which attributes he attended to or did not attend to), or inferred analytically where it has to be considered by the model specification. Given the documented influence that ANA has on preferences (including willingness to pay estimates) and that it does not impose an excessive burden on estimation of the model, it has been one of the commonly used heuristics and hence should be included in this research. In its simplest form, ANA excludes some of the attributes from the utility function representing the non-attendance (essentially setting the marginal utility or disutility to zero in the likelihood expression). Hence, it only takes into consideration the characteristics and attributes of the current choice being evaluated by the respondent.

Another behaviourally appealing heuristic which has not been as widely studied is Value Learning (VL). This heuristic considers that over the course of a choice experiment, individuals discover their preferences, i.e., preferences are not stable and depend on the starting point and attribute levels presented. Discrete choice model studies (Day and Pinto, 2010; Hensher and Collins, 2011; McNair et al., 2012) have shown that this Value Learning heuristic improves the statistical fit of the models, and offers an appealing behavioural explanation of decision-making, not only in stated choice studies, but more generally. This heuristic creates a relationship between the current choice being evaluated by the respondent with a previous choice as represented by the best attribute levels shown in previous choice sets, as a way of assessing whether the previous circumstance might have influenced current preferences. VL can be included in any experiment with multiple choice sets. It is important to take into consideration the correlation between multiple choice sets as we have done in this study. There can also be endogeneity issues when the relation between choice sets is included through a lagged dependent variable (Adamowicz and Swait, 2013; Hensher and Collins, 2011; Honoré and Kyriazidou, 2000), but this was not the formulation used in this paper.

In this study we look at ANA and VL because they have been promoted in the decision science literature as having a significant influence on preferences, as well as having behaviourally intuitive appeal. Whereas ANA focuses on the process used in the current choice set, VL focuses on the process used during multiple choice sets. The presence of ANA and VL need not be mutually exclusive, and presenting empirical evidence of their joint role is an important contribution of this paper.

In this paper we include overt experience as a behavioural refinement on how preferences are represented. Experience has been included in transportation studies in different forms. One example is as a measure of inertia, which says that an individual will be more likely to choose the same alternative that he has experience with (e.g., Cantillo et al., 2007)[1]. Another example is anchoring, which conditions the hypothetical alternatives on a reference experienced alternative (e.g., Hess, 2008).

[1] We could consider another word than experience to avoid any implication of lagged effects, since all we are doing is to recognise the mode **currently** used; however we like the word 'experience' but it could also be referred to as the reference alternative, which is common in studies that incorporate gains and losses relative to a reference alternative (for example Hess et al., 2008).