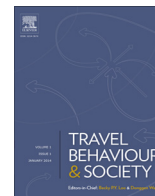




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Application of attitude theory for identifying the effects of non-attendance attributes in stated choice surveys

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ABSTRACT

Owing to the information burden placed on respondents, stated choice studies are unable to clarify the impact of non-attendance attributes on the accuracy of respondents' choices, thus failing to suggest a better option than either overlooking unimportant attributes or excluding important attributes. To deal with the limitation of the conventional approach, this study argues for an important change from the relevance approach to the sufficiency approach represented by a novel construct of perceived information sufficiency. Using attitude theory, this study examines non-attendance attributes through perceived information sufficiency. Theoretical and empirical test results demonstrate that perceived information sufficiency influences the accuracy of respondents' choices. In particular, a higher level of perceived sufficiency of information given to travelers will result in less involvement of bounded rationality, leading to a more accurate attribute-based prediction of conventional stated choice surveys.

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1. Introduction

Consideration of human information processing is important in transportation studies because it reveals how travelers rely on perceived information when making behavioral decisions. Such consideration is especially required in stated choice surveys, a widely used technique in the transportation field as it helps to understand travelers' choices when presented with various sets of information representing different predefined scenarios. Recent stated choice studies have emphasized that not all given attributes are involved in the respondents' decision making process, suggesting that respondents probably ignore unimportant attributes. An awareness of this issue can be found in Hensher's overview work (2010), which indicates that individuals use heuristics-derived strategies including attribute exclusion and/or degrees of attention to arrive at a choice outcome.

As presented in a concise introduction by Hess (2014), early works in this area mainly deal with the issue of an individuals' processing strategy in regard to "ignore attribute or do not ignore attribute," which is commonly referred to as the attribute non-attendance (ANA). Various advanced approaches have been used to treat ANA—direct questions to respondents (e.g., Scarpa et al.,

2010), using latent components (e.g., Campbell et al., 2011; Hensher, 2010), and addressing the confusion that exists when differentiating between non-attendance and low sensitivity (e.g., Hess et al., 2013; Collins et al., 2013). Note that these approaches have been solely designed to understand how respondents treat attributes in any given stated choice set.

Going beyond the conventional issue of attribute processing, a recent ANA research interest regards the presence of attributes in stated choices—i.e., how attribute inclusion/exclusion affects the accuracy of respondents' choice outcomes in stated choice surveys. The literature regarding ANA studies shows that the effect of attribute presence on the accuracy of stated choice surveys is unclear because of two possible reasons (depending on the different views of the researchers involved). Some have argued that the complexity of stated choices creates a burden for respondents, thus leading to a reduction in response quality (e.g., more turbulence, skipping answers). In contrast, others have determined that it is necessary to include all relevant attributes in the choice set (e.g., Hess, 2014) because response quality depends on relevance (Hensher, 2010) rather than respondent burden.

Although the decision of whether attribute presence creates a burden on respondents is obviously judged by a respondent's perception, this issue has been solely investigated in discrete-choice environments, where psychology is not an advantage. In addition, it seems that existing psychology-involved theories dealing with the accuracy of stated choice surveys mostly follow the

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utility-function-based approach: the non-expected utility theory (e.g., [Starmmer, 2000](#)), prospect theory (e.g., [Kahneman and Tversky, 1979](#)), and utility in case-based decision theory (e.g., [Gilboa et al., 2002](#)). The key assumption of the utility-function-based approach is that the utility function is invariant—in other words, stated choices indicate actual choices. However, it is rather that the invariance has been shown commonly violated by many causes, which notably include bounded rationality due to limited information, cognition, and time (e.g., [Payne et al., 1993](#); [Simon, 1990, 1982](#)). Bounded rationality can be understood in a way that a decision maker seems to seek a satisfactory solution rather than an optimal solution due to limitations of information, cognition and time. The issue of attribute presence in stated choices is related to bounded rationality to some extent (e.g., few attributes may lead to limited information; many attributes may lead to limited time). Thus, a better approach to this issue is necessary.

Interestingly, a recent study by [Fujii and Garling \(2003\)](#) is advanced with a focus on contingent preferences (i.e., choices are contingent on context), which are different from core preferences (i.e., choices are determined by an invariant utility function). Arguing the inaccuracy of core preferences without a reflection of actual behavior, the study insists that context is a true determinant of actual behavior. In a notion that behavioral intention is the best predictor of behavior in attitude theory, the study also highlights the necessity of stated choice methods to measure behavioral intention rather than core preferences. By pivoting from core preferences to contingent preferences, the framework presented by [Fujii and Garling \(2003\)](#) is believed to address the effects of bounded rationality on the accuracy of stated choice surveys. As such, their framework suggests a better approach to examine the effects of attribute presence on the accuracy of stated choice surveys.

The objective of this study is therefore to investigate the effects of attribute presence on the accuracy of stated choice surveys under the framework of the applied attitude theory proposed by [Fujii and Garling \(2003\)](#). Toward that goal, first, a conceptual change is presented in Section 2 to argue for a shift from the relevance approach to a newly-introduced sufficiency approach as well as the need of a construct of perceived sufficiency of attributes (PSA), which is considered to be representative of attribute presence in stated choice surveys. Second, to demonstrate the effects of PSA on the accuracy of stated choice surveys, a hypothesis of the relationships between PSA, stated choices, and behavioral intention is developed (Sections 3 and 4); a Japanese-context case study (Section 5) is presented to provide empirical support for that hypothesis.

2. Conceptual change from the relevance approach to the sufficiency approach

It is undeniable that information burdens on respondents in stated choice surveys actually exist. Such burdens have been demonstrated practically by low response rates and arbitrary answers due to problems such as time cost and stress when handling overburdened amounts of information. However, this is not a reason to encourage widespread use of very simple stated choices: such simplicity potentially excludes attributes that are important with regard to respondents, leading to unreliable choice outcomes.

Although arguments made on the basis of information relevance (e.g., [Hensher, 2010](#)) are reasonable in terms of seemingly being in line with real-world human decisions, such arguments and their follow-up efforts in selecting relevant attributes (e.g., [Klojgaard, 2012](#); [Coast and Horrocks, 2007](#)) are ultimately unable to eliminate the concern of information burden because they are unable to suggest a point at which respondents are free of such

burdens. Similarly, recent interest in investigating the role of ANA in processing strategies (e.g., [Erdem et al., 2015](#); [Colombo and Glenk, 2014](#); [Hess, 2014](#)) plays no role in mitigating these concerns.

The above-mentioned studies clearly show the unidentified trade-off between relevance and respondent burden; thus, it is necessary to revisit the issue of attribute presence in stated choice surveys. A common suggestion (derived from the results of conventional studies) is that respondents actually do not completely ignore unimportant attributes. This suggestion leads to the idea that respondents may process different levels of unimportant attributes—the existence of discontinuous preferences, zero preferences, and low preferences (e.g., [Alemu et al., 2013](#)). In other words, unimportant attributes are completely ignored only if they are really not needed in utility functions. This suggests that a matter of attribute importance is likely less important than a matter of attribute involvement (i.e., involved in the utility function) when deciding the accuracy of choice outcomes.

This matter of attribute involvement explained from the viewpoint of respondents can be referred to as “attribute sufficiency” (i.e., given attributes are sufficient or insufficient when making choices). The idea of attribute sufficiency is in accordance with the goal-frame theory ([Lindenberg, 2001a, 2001 b, 2006](#)). According to this theory, when respondents receive stated choice sets, they will predominantly activate a hedonic goal frame (i.e., “to feel better right now”)—i.e., they will search for the attributes needed to make a decision. Thus, what really happens is most likely an awareness of decision-making conditions, which vary from poor levels of sufficiency (i.e., not enough needed attributes) to good levels of sufficiency (i.e., enough needed attributes). Based on this idea of attribute sufficiency, respondents will determine different strategies of decision making (e.g., with or without bounded rationality). The presence of attributes in this context determines the level of the attributes’ perceived sufficiency, thus indirectly influencing choice quality.

In addition, note that the attribute relevance approach (e.g., [Hensher, 2010](#)), to some extent, is successful in arguing for the cognitive quality of the attributes in stated choice surveys. However, it seems weak in terms of representing cognitive quantity, which is necessary to identify the point at which the amount of information is within respondent acceptance. Therefore, to account for this quantitative aspect, the key concept explaining human heuristic strategies can be reasonably altered from “relevance” to “sufficiency.” The concept of attribute sufficiency is able to not only guarantee the relevance of attributes but also provide a sense of its amount. For example, respondents may perceive a complicated choice set as insufficient because of its lack of important attributes while considering a simple choice set as sufficient because it has enough necessary attributes to make a decision.

To the best of our knowledge, the concept of sufficiency in this context is still new to the literature; therefore, a PSA construct is herein introduced. This construct, in the context of stated choice surveys, implies that respondents perceive the sufficiency levels of attributes in choice sets. This perception allows respondents to be aware of decisional conditions, which is the basis for their ability to select appropriate strategies in the decision-making process. This is in accordance with heuristic decision making (e.g., [Gigerenzer and Goldstein, 1996](#)).

3. Hypothesis

Although the above-presented conceptual framework discusses the concept of PSA in a broad sense, it is impossible to test all hypotheses related to PSA in a single study because of its complicated characteristics. Varying perceptions of attribute sufficiency

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