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Communicating transportation carbon dioxide emissions information: Does gender impact behavioral response?

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ABSTRACT

General concern and knowledge on climate change have been increasingly studied over the past decades. Gender differences have been found for general environmental concern and knowledge, but mixed findings exist with respect to climate change. In transportation, research has examined potential relations between environmental attitudes and transportation behavior, with mixed findings as well. Recently, the use of carbon dioxide (CO_2) emissions information to influence choice has been tested with women being found more willing to pay to reduce their personal impacts, suggesting that women are either more willing to change or that their response to information on climate change is stronger. However, those studies used CO_2 mass and studies that examined understanding of CO_2 information as a mass have found that people struggle to understand it. If concern and knowledge about climate change differ amongst individuals, then, according to theories such as the Transtheoretical Model, the type of information used to motivate choices is likely important. Using a unique data set (n = 236) it is possible to take a first look at how gender might affect concern, knowledge, and action in terms of transportation and climate change. Further, it is also possible to examine behavioral responses to transportation climate change information. Finally, an empirical analysis is conducted of the effect of *how* the information is presented might differ by gender. Thus, this work aims to investigate whether gender differences might contribute to the explanation of individual behavioral responses (from concern to action) in a transportation climate change context.

1. Introduction

Environmental concern, knowledge, and action, and the links between them, have been studied for several decades. Gender differences were reported in such studies; specifically, findings show that women generally have higher concern of environmental issues and conduct more environmental action, though less activism. For climate change though, general concern and knowledge on the subject have been increasingly studied over the past decade, but evidence of gender differences on attitudes towards and knowledge of climate change are mixed. Information on climate change such as CO_2 emissions are increasingly available, and some evidence suggests that it can have an impact on choices. However, questions have been

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raised about whether the most common means of presenting that information, as a mass, motivates those who are not already convinced of a the need to reduce emissions.

Theories such as the Knowledge-Deficit theory suggest that a lack of knowledge is related to lower concern and lower action on a problem. Some research has found that more informed individuals felt less concerned about climate change and less personally responsible (Kellstedt et al., 2008), with men being more likely to report being concerned. In other research related to support for reducing greenhouse gas emissions, the cognitive component (i.e. knowledge) was the most strongly associated support (O'Connor et al., 2002). In that study, gender was not an influence. However, in those studies, how people responded to information on a behavior was given, so how they might *respond* to greenhouse gas (GHG) emissions information is not known.

In the domain of transportation, studies have examined how environmental attitudes might affect daily travel, but have either found that the environment was not considered (Beirão and Cabral, 2008), or that higher education was the defining characteristic for those who did (Anable, 2005). As well, people may be more willing to reduce domestic energy consumption than to change their transportation habits (e.g. O'Connor et al., 2002; Whitmarsh, 2009). Thus, transportation is an area that likely requires greater effort to induce change.

Despite the considerable role that transportation plays in anthropogenic greenhouse gas emissions (in particular carbon dioxide (CO_2)) that contribute to climate change (Ryley and Chapman, 2012), research in transportation has only recently examined how knowledge (through information) of climate change impacts might affect an individual's transportation behavior in choice experiments (e.g. Achtnicht, 2012; Gaker et al., 2011, 2010; Daziano and Achtnicht, 2014). In those studies, the information was found to have an impact on choice and women were generally found to be more willing to pay to reduce personal emissions. However, that research did not take into account knowledge or concern about climate change and used CO_2 emissions presented as a mass, which may not be useful to most people.

Useful can be interpreted as providing the individual with information that they can apply to their choices, or as a means to reduce society's overall impacts. Presumably, improving the first could help with the latter. Previous studies on the use of CO_2 emissions presented as a mass have found that people struggle to understand the information (Chatterton et al., 2009; Coulter et al., 2007). In those studies, gender influenced results related to *how* the information was presented. Thus, the question of whether changing how the CO_2 emissions information is presented might effect motivation to make choices that result in lower emissions.

As outlined above, there is evidence that men and women might have different levels of concern about climate change and might respond differently when presented with climate change relevant information such as CO_2 emissions. Work has suggested that if concern is taken into account, gender does not have an effect (O'Connor et al., 2002), but that research did not present the individuals with CO_2 emissions related to the possible behavior changes. Thus, the objectives of this research are to examine: (1) *how gender might relate to concern, knowledge, and action in terms of transportation and climate change*; (2) *behavioral responses to transportation climate change information*; (3) *whether how the information is presented might influence behavioral responses*. Put another way, this work aims to investigate whether gender differences might contribute to the explanation of individual behavioral responses (from concern to action) in a transportation climate change context. The results will be useful for any program that aims to use information to aid in reducing individual climate change impacts, in particular those that apply segmentation.

2. Background

2.1. Theoretical considerations

Knowledge and concern do not translate directly into action. This is often referred to as the attitude-action gap (e.g. Anable et al., 2006), where individuals may know and be concerned about a problem, but not take action. Anable et al. (2006) discuss how there are two opposing views on this. One suggests that if people had the relevant information they would behave appropriately (according to knowledge deficit theory), while the other suggests that information is necessary but not sufficient. Their review found that the latter is emerging as the consensus.

There are many different behavioral models that relate to how information might influence behavior (Avineri and Waygood, 2010; Chorus et al., 2006; Waygood et al., 2012). In this work a dynamic model is used as we focus on the process of change from having no concern about a problem behavior to a behavior that addresses that problem.

2.1.1. Transtheoretical model: stages of change

According to the Transtheoretical Model (TTM; Prochaska et al., 2008) people pass through different stages on the path to behavioral change and different information will be relevant at each stage (Waygood et al., 2012). These stages (Fig. 1) begin with not being concerned about the problem (*pre-contemplation*), then possibly moving to a point where an individual considers the pros and cons of changing behavior (*contemplation*). Individuals may remain for a long time, or even permanently at this stage where they are concerned about the problem, but are not sufficiently concerned that they truly consider changing. They may think about how they might change, but do not take steps to decide what action they will do.

Following that stage, the individual has now decided to do something and must find what possible behavior changes are relevant and decide which ones they might try (*preparation*). In the *action* stage, the individual has decided on a change in