

**EAT MY DUST:  
STEREOTYPES ABOUT FEMALE DRIVERS PERSIST BUT DO NOT  
AFFECT THEIR DRIVING**

YARA KADULINA

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School of Psychology

Department of Social Sciences

University of Ottawa

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## General Abstract

Although some descriptions of stereotypes about drivers are documented in the literature, the specific behaviours representing these stereotypes have not been previously explored. In addition to identifying specific behaviours associated with stereotypes about female drivers, this thesis looks at the way that these stereotypes may be affected by the age of the stereotyped driver. Furthermore, a debate exists in the field of social psychology about whether the awareness of these stereotypes affects the performance of drivers from the stereotyped groups through the phenomenon known as stereotype threat. This thesis explores these topics through a series of three studies. In the first study, participants watched videos illustrating a variety of driving behaviours and indicated whether the driver was more likely to be male or female. In the second study, participants were told to imagine male and female drivers of different ages approaching a car, and the participants were asked to indicate which driver was more likely to take the wheel of the car and whether that driver was the safer of the two. In the third study, which consisted of two experiments, female participants were invited to complete several driving scenarios in a driving simulator. The first of the two experiments had two conditions: stereotype threat and neutral; the second experiment had an enhanced stereotype threat and a counterstereotype condition. The findings of the first study elucidated the specific behaviours that are stereotypically associated with male and female drivers. The second study showed that in many ways, driving is still considered to be a man's prerogative, since men were frequently rated as more likely to drive and safer drivers than women. The results of the third study showed that the effects of these stereotypes on drivers can be difficult to detect using the stereotype threat paradigm in a driving simulator environment. Although stereotypes about male and female drivers from different age groups are still prevalent, their effects on the behaviour of the drivers from the stereotyped groups may be elusive and hard to reproduce in a simulated driving context.

Keywords: stereotypes, driving, stereotype threat, female drivers, male drivers, gender and driving

## Résumé général

Bien que certaines descriptions des stéréotypes sur les conducteurs soient documentées dans la littérature, les comportements spécifiques représentant ces stéréotypes n'ont pas été explorés auparavant. En plus d'identifier les comportements spécifiques associés aux stéréotypes sur les conductrices, cette thèse examine la façon dont ces stéréotypes peuvent être affectés par l'âge de la conductrice stéréotypée. En outre, un débat existe dans le domaine de la psychologie sociale pour savoir si la conscience de ces stéréotypes affecte la performance des conducteurs des groupes stéréotypés par le biais du phénomène connu sous le nom de menace du stéréotype. Cette thèse explore ces sujets à travers une série de trois articles. Dans la première étude, les participants ont regardé des vidéos illustrant une variété de comportements au volant et ont indiqué si le conducteur était plus susceptible d'être un homme ou une femme. Dans la deuxième étude, on a demandé aux participants d'imaginer des conducteurs masculins et féminins d'âges différents s'approchant d'une voiture, et on leur a demandé d'indiquer quel conducteur était le plus susceptible de prendre le volant de la voiture, et si ce conducteur était le plus sécuritaire des deux. Dans la troisième étude, qui consistait de deux expériences, les participantes ont été invitées à réaliser plusieurs scénarios de conduite dans un simulateur de conduite. La première des deux expériences comportait deux conditions : menace du stéréotype et neutre ; la deuxième expérience comportait une condition de menace du stéréotype renforcée et une condition de contre-stéréotype. Les résultats de la première étude ont permis d'élucider les comportements très spécifiques qui sont associés de manière stéréotypée aux conducteurs masculins et féminins. La deuxième étude a montré qu'à bien des égards, la conduite est toujours considérée comme une prérogative masculine, puisque les hommes sont souvent considérés comme plus enclins à conduire et comme des conducteurs plus sécuritaires que les femmes. Les résultats de la troisième étude ont montré que les effets de ces stéréotypes sur les conducteurs peuvent être difficiles à détecter en utilisant le paradigme de la menace du stéréotype dans l'environnement du simulateur de conduite. Bien que les stéréotypes sur les conducteurs masculins et féminins de différents groupes d'âge soient toujours répandus, leurs effets sur le comportement des conducteurs des groupes stéréotypés peuvent être insaisissables et très difficiles à reproduire dans un contexte de conduite simulée.

Mots clés : Stéréotypes, conduite, menace des stéréotypes, conducteurs féminins, conducteurs masculins, sexe et conduite.

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## CHAPTER 1: General Introduction

Driving a car can improve the well-being of those who drive and reduce the quality of life of those who can no longer drive (Dickerson et al., 2007). Identifying all factors that influence a person's ability to drive is therefore critical, considering the prevalence of this complex and multifaceted daily activity.

Driving is an activity that is, at the same time, mundane and deadly risky. Although many people engage in driving every day and often multiple times within a day, collisions can result in serious injuries and even death. Indeed, motor vehicle deaths account for approximately 40,000 deaths per year in the United States alone (National Safety Council, 2021). In Canada, the average number of fatal victims in motor vehicle collisions exceeded 2300 per year in the years 2000 to 2019 (Transport Canada, 2021).

A multitude of factors contribute to the risk of a collision. In Canada in 2019, environmental factors accounted for 22.3% of factors contributing to fatal collisions, and vehicle-related factors contributed another 5.4%. All remaining causes of collisions, including speeding, driving under influence, driving while distracted or tired, and not using seat belts, depended on the driver (Transport Canada, 2021). The integration of all the aspects that can affect driving safety into a coherent explanation can only be reached through comprehensive models of driving that give consideration to the physical, sensory, cognitive, and motor characteristics of the driver (Anstey et al., 2005). On top of those characteristics, the most recent models of driving include social factors that may influence mobility in general as well as driving



performance and decisions made while driving (Ang et al., 2019; Geber et al., 2021; Jeekel, 2014; Lindstrom-Forneri et al., 2010).

In this thesis, I explore one such social factor that may affect driving performance and decisions pertaining to driving – stereotypes about female drivers. I do this by identifying gendered stereotypes about drivers and appraising whether the stereotype threat influences driving reactions.

First, theoretical models of driving will be briefly described to demonstrate the relevance of including the social context in our understanding of driving safety. Following that, one specific aspect of social factors potentially impacting driving – stereotypes – will be explored, leading with an overview of stereotypes in general and proceeding with a discussion of specific stereotypes about drivers. Then, the concept of the stereotype threat and its anticipated detrimental effects will be described. Finally, four studies examining the existence of stereotypes about women drivers and the effects of these stereotypes on driving will be presented in the form of three scientific articles. The main goal of this thesis is to explore the nature of stereotypes about drivers from different gender and age groups and to investigate whether negative stereotypes about female drivers affect their driving performance as assessed through driving simulation.

## Models of Driving

In this section of the thesis, I will briefly describe theoretical models that integrate a variety of factors influencing driving reactions and decisions about driving. Many theoretical models of car driving have been proposed over the years (Bekiaris et al., 2003; Fuller, 2005;

Lindstrom-Forneri et al., 2010; Michon, 1985; Salvucci, 2006; Sheridan, 2004). Understanding theoretical models of driving is key to placing this work in its proper academic context and to appreciating how the studies that were conducted for this thesis fit into the overall understanding of the different factors that influence driving (Joanisse, 2012).

According to Jeekel (2014), when overviewing the trajectory of research in the mobility and transportation domain, it becomes apparent that the initial models emphasized the technical, engineering, and transport economics aspects of driving. Only more recently were social and emotional factors recognized for their potential influence on driving (Jeekel, 2014; Joanisse, 2012).

In an influential work on the conceptualization of human-machine interactions based on a cognitive engineering approach, which later inspired the development of driving models, Rasmussen (1986) proposed three levels of human behaviour: skill-based behaviour, knowledge-based behaviour, and rule-based behaviour. When these levels are applied to driving, skill-based behaviours encompass largely automatic, overlearned vehicle control; knowledge-based behaviours encompass the conscious formulation of driving actions and making decisions in unfamiliar driving situations; and rule-based behaviours encompass dealing with traffic regulations and following the rules learnt previously.

In modelling driving specifically, one of the most influential models is that of Michon (1985). Michon's model conceptualizes driving as including three levels: strategic (involving higher-level decisions, such as planning a trip), tactical (involving control over maneuvers and decision-making based on environmental demands), and operational (involving overlearned automatic reactions and direct control of the car) (Joanisse, 2012; Michon, 1985). At the

operational level, the driver operates within the shortest timeframe of milliseconds, including automatic reactions to environmental input. At the tactical level, the driver operates within a timeframe of seconds, such as maneuvering around obstacles. Finally, at the strategic level, the driver operates within a longer timeframe of days, hours, and minutes, such as assessing trip goals and evaluating costs and risks involved in the choice of an itinerary (Joanisse, 2012; Michon, 1985). Michon's model was comprehensive and thorough to the point of permitting the development of a support system for drivers, called the Generic Intelligent Driver Support (GIDS) system (Michon, 1985; Stanton, 1995), which aims to prevent a driver's sensory and cognitive overload.

Despite the fact that Michon's model and the GIDS system were later extended to a broadly influential GADGET (Guarding Automobile Drivers through Guidance Education and Technology) matrix (Bekiaris et al., 2003; Siegrist, 1999), Bekiaris et al. (2003) reported that the empirical relationship between the model's predictions and the risk of crashes remained weak (Bekiaris et al., 2003). In an attempt to address this shortcoming, Bekiaris et al. (2003) developed the DRIVABILITY model – an index of a combination of permanent and temporary factors assumed to influence driving (Bekiaris et al., 2003). Bekiaris et al. (2003) combined considerations about environmental, workload, and risk awareness factors with insights from both Michon's hierarchical levels (Michon, 1993) and Rasmussen's (1986) levels of human behaviour (knowledge-based, rule-based, and skill-based), as well as individual resources of a driver. The individual resources, one of the core elements of the DRIVABILITY model, include mental, physical, and socio-psychological capacities that all contribute to one's ability to drive (Bekiaris et al., 2003). The inclusion of the socio-psychological condition of the driver, which

accounts for the individual factors of each driver, such as the driver's current level of stress, concentration, reliance, trust, and vigilance, is particularly relevant for the purpose of this thesis.

Although the DRIVABILITY model includes the socio-psychological and cognitive condition of the driver as one of the factors (Bekiaris et al., 2003), it focuses specifically on the individual driving the car, and it does not consider societal factors or group relations, such as the way in which a whole group of drivers may be affected by the contemporaneous political and social climate. For example, Black drivers may be affected by their frequently negative interactions with the police and the sustained suspicion that they face, especially when driving through certain neighbourhoods (Christiani et al., 2021; Pierson et al., 2020). This is an example of the way in which social factors external to the driver, such as the opinion about the driver that other members of society may hold, can influence drivers' reactions in certain circumstances. As another example, women of a certain age have often been influenced by now mostly outdated social norms that prevented them from obtaining a driver's license and that made them count on male family members for their mobility needs – a situation that is perpetuated to this day in some areas (al-Lohaidan, 2013; Specia, 2019). Although the DRIVABILITY model incorporated individual resources as an important component contributing to driving ability, the larger social context, such as social factors described in the examples, were largely ignored.

Similarly to the DRIVABILITY model, another influential driving model, developed by Fuller (2005), focuses on an individual driver. Fuller (2005) introduced a framework that is called the Task-Capability Interface, which postulates that drivers try to maintain a certain level of task difficulty (Fuller, 2005; Joannis, 2012). Fuller's (2005) Task-Capability Interface model suggests that drivers evaluate the level of difficulty of the driving task in which they are engaged and make decisions to keep the difficulty within a certain range of their capability. How difficult

it is to drive at any particular moment is determined by interacting factors that include both the abilities of the driver and the inherent demands of the task (Fuller, 2005; Joannis, 2012). To keep control of the vehicle, the driver can choose certain demands of the task that affect the task's difficulty, such as road position, vehicle trajectory, speed of travel, and, to some degree, the environment in which they drive. This is impacted by the driver's own ability to handle driving in a given context, including constitutional features, training, and level of experience. When the driver's capabilities exceed the task's demands, the vehicle remains under control. However, when the task's demands exceed the driver's capabilities, the loss of control may result in a precarious and potentially harmful situation, such as a collision. Drivers' subjective evaluation of the task-capability balance also influences their driving reactions. Fuller's Task-Capability Interface model is very relevant in conceptualizing how individual differences and abilities affect a driver's behaviour and control of the vehicle, but external social influences, such as the belongingness of a driver to a certain group, are not explicitly included in this model.

Despite the high explanatory power for drivers' behaviours, Fuller's Task-Capability Interface model does not encompass a potential difference between the actual task difficulty and the subjective feelings of risk. This is important because while the former can be accounted for by an interaction of the task's demands and the driver's capabilities, the latter may require consideration of social factors, such as opinions of other people about the driver, which might affect the driver's confidence. The level of driver's confidence can result in an increased or reduced assessment of risk, which in turn would affect the driver's behaviour. These factors are not accounted for in Fuller's model.

A more comprehensive model, called Driving as an Everyday Competence (DEC), was developed by Lindstrom-Forneri, Tuokko, Garrett and Molnar (2010). The authors' intention was

to explain the driving performance and driving competence of older drivers specifically, making the model particularly relevant to any discussion of targeted groups of drivers. It integrates the contribution of the physical, environmental, and social contexts to driving performance. This model draws an important distinction between driving competence, which is the capability of the driver to perform certain driving tasks, and driving performance, which may not always reflect driving competence (Joanisse, 2012; Lindstrom-Forneri et al., 2010).

The DEC model accounts for three main groups of factors that can influence driving performance: individual, personal, and environmental factors. Individual factors include a driver's health and cognition. Personal factors include the emotional and sensory state of the driver, as well as the amount of driving experience and training the driver had. Environmental factors include various external aspects, such as social policy, laws, and attitudes of the driver. Additionally, the interaction between driving performance and driving competence can be influenced by moderating factors listed in the DEC model, which include the driver's self-monitoring, beliefs, awareness, and self-efficacy (Joanisse, 2012; Lindstrom-Forneri et al., 2010). These moderators can affect the strategic level of processing that the driver makes prior to or during the trip. This level of processing impacts the driver's strategy during the planning and execution of the trip and pertains to making decisions about whether to drive, when to drive, and which routes to take.

The DEC model illustrates how driving performance may not always reflect the level of competence of a driver but is the result of an interaction of all the factors listed above. The model postulates that driving competence can be understood through the interaction between environmental and individual factors, which are, in turn, affected by beliefs and awareness, leading to strategic-level decisions regarding driving behaviours. Factors outside the driver's

competence, including societal and environmental influences described above, may also affect driving performance, resulting in a lower-than-expected performance for a given level of competence (Lindstrom-Forneri et al., 2010).

The emergent appreciation of how important it is to include a broader variety of factors to improve the understanding of driving is well reflected in the DEC model by the addition of contextual influences on driving (Joanisse, 2012; Lindstrom-Forneri et al., 2010). While this comprehensive model makes a significant contribution to the advancement of theories on driving, some of its constituents have yet to be submitted to empirical tests (Wong et al., 2016, 2018). Social factors included in this model require further elaboration, and some authors claim that the empirical validity supporting the selection of factors that make up this model can be questioned because they were not a product of a systematic literature review or another empirically validated approach (Wong et al., 2016).

To address the limitations of the DEC model, Wong et al. (2016) developed the MOTRS model by conducting a systematic literature review. Through this process, they identified a variety of empirically supported predictors and concentrated on a new target — driving self-regulation. Even though the demographic focus of the MOTRS model was older adults, it also applies to other groups of drivers. The MOTRS model proposed that environmental and individual factors, such as gender, age, and availability of other modes of transportation, determine the practice of self-regulation related to driving. Following the development and publication of this theoretical model, it was subjected to empirical validation with a sample of 277 Australian drivers, by using structural equation modelling on the results of a standardized questionnaire that assessed the role of demographic, functional, and psychosocial factors in driving self-regulation. The results showed that sociodemographic factors, such as the gender of

the driver, can explain a large proportion of the variance in driving-related variables, including affective attitudes (how much drivers enjoy driving), driving confidence, avoidance of different driving situations, and driving space (the distance a person generally drives away from their home base; Wong et al., 2016, 2018). It can also explain, for example, the difference in the likelihood of driving a car between two male drivers: a young man who has no access to other transportation and a young man who has such access. All else being equal, a young man without access to any other transportation is more likely to drive, even if he is not in the best shape to undertake this task at a particular moment. It is within the conceptualization provided by this updated model of driving that we can elaborate on some of the factors explored in this thesis.

The MOTRS model of driving has an advantage over the DEC model in that it was created systematically through a literature review and was subjected to empirical validation. However, once compared with the DEC model, some limitations of the MOTRS model become apparent. The MOTRS model is significantly less comprehensive and focuses almost exclusively on factors that influence the self-regulatory behaviours of older drivers. A strong argument that can be made is that this model reflects a small part of the DEC model. Indeed, the MOTRS model is more specific, which gives it the advantage of being easier to validate, but it neglects how additional factors also contribute to driving behaviours and performance.

Nevertheless, both the DEC and the MOTRS model highlight the importance of demographic and social factors in our general understanding of driving. The DEC model clearly indicates that the social environment surrounding drivers can interact with their sense of self-efficacy and influence driving performance. In their article discussing the MOTRS model, Wong et al. (2016) specified that, in addition to demographic factors included in their model, a sense of mastery regarding driving can potentially influence driving-related self-regulation (Bandura,



1977; Bandura & Locke, 2003; Schwarzer, 1992), which warrants further investigation. In both models, societal factors are postulated to influence the behaviour of the drivers. It is within this framework that the impact of social factors on both driving performance and driving self-regulation was examined in this thesis. More specifically, the research presented here explored the beliefs that people hold about drivers from different groups (i.e., stereotypes) and the way that these beliefs might affect driving performance and self-regulation.

## Stereotypes

In this section, I introduce the concept of stereotypes and give a brief overview of the wide-ranging research on this topic. I start by giving both lay and professional definitions of the concept of stereotypes. Following that, I briefly describe how stereotypes are activated and how they can affect the way that people are perceived. Finally, I introduce the idea of automaticity of that activation, which will bring us to the next topic — the reasons why the activation of stereotypes is difficult to control and thus why stereotypes persist.

### Stereotypes: Definition

In its most simple definition, stereotypes are impressions that people have about people from a certain group (McGarty et al., 2002). It is often presumed that stereotypes contain some “kernel of truth” on the basis of which group differences are founded (Hamilton et al., 2015, 2015), even while acknowledging that stereotypes are crude overgeneralizations of genuine group differences (Allport, 1954). The existence of stereotypes, which can also be thought of as

relatively enduring cognitive systems of interrelated concepts that inform perceptions of members from certain groups (McGarty et al., 2002), is one of the social factors that may affect the driving performance and driving self-regulation of targeted groups of drivers.

The process of perceiving people is an interpretation process that activates stereotypical thinking (Macrae & Bodenhausen, 2000, 2001). Stereotypical thinking, in which perceivers regularly use categorical representations of other people, streamlines the person perception process (Macrae & Bodenhausen, 2001). Instead of perceiving a person as a combination of unique traits, people use categories (i.e., stereotypes) when constructing the concept of the other (Macrae & Bodenhausen, 2001). Therefore, the way that people evaluate and remember others is affected by their pre-existing beliefs about the members of the social groups with whom they interact (Macrae & Bodenhausen, 2000, 2001; Persson et al., 2021; Sherman et al., 2000). Previous research has clearly shown that attention, memory, judgments, and behaviours are all influenced by socially shared stereotypes (Hamilton et al., 2015).

The cognitive activation of stereotypes has been postulated to be automatic in nature (Brewer, 1988; Devine, 1989; Fiske & Neuberg, 1990; Wang et al., 2016). However, this activation may be influenced by the frequency of associations that are most often evoked in the perceiver's mind, such as when a humanitarian thinks regularly about counterexamples of negative stereotypes (Devine, 1989). Therefore, the perceivers' temporary processing objectives, cognitive limitations, and chronic beliefs about certain social groups also influence the extent to which stereotypes are strictly automatic in their nature (Macrae & Bodenhausen, 2000), which makes the activation of stereotypes more amenable to control of the perceiver. The need to control the use of stereotyping stems from the fact that negative stereotypes contribute to

everyday biases that can have negative impacts on the physical and mental well-being of the stereotyped persons (Major & O'Brien, 2005; Schnittker & McLeod, 2005).

### Stereotypes as a Cognitive Shortcut

It is largely recognized that the acceptance of false negative stereotypes may be very detrimental to the members of the stereotyped group (R. T. Harrison et al., 2020; Myers et al., 2020; Steele et al., 2002; Steele, 2011; Villanueva-Moya & Expósito, 2021). Despite this negative impact, stereotypes persist for several reasons. According to the classic postulation by Fiske and Taylor (1991), social perceivers are characterized as “cognitive misers,” recognizing that in most instances, people engage in just enough cognitive work to get by, rather than employ all the available resources to achieve optimum cognitive performance at all times. Stereotypes enable a description of individuals as belonging to a particular group and evoking the information associated with a typical group member. The use of stereotypes may allow people to reduce their cognitive load (Allport, 1954; Tajfel, 1969; Tajfel & Turner, 2004) by giving them the impression of understanding the individual before them.

The use of stereotypes can seem to have benefits to perceivers, especially in situations of increased cognitive load, such as when fast cognitive processing is required (Bodenhausen & Lichtenstein, 1987; Macrae et al., 1993, 1994; Pratto & Bargh, 1991; Sherman et al., 2000; Stangor & Duan, 1991). Stereotypes about outgroup members may also play a role in counteracting threats to an individual's self-esteem (Hogg & Abrams, 1988; Spencer et al., 1998). The results of three studies conducted by Fein and Spencer (1997) showed that people

were less likely to judge a member of a stereotyped group unfavourably after receiving a self-affirmation, and more likely to judge that person stereotypically after receiving a negative evaluation (Fein & Spencer, 1997). The studies suggest that stereotyping and prejudice against members of an outgroup play an important role in the maintenance of self-esteem (Fein & Spencer, 1997; Hogg & Abrams, 1988; Spencer et al., 1998).

### Gender Stereotypes

One of the most persistent and ubiquitous forms of categorical thinking in our society is stereotyping based on a person's gender (Brewer, 1988; Fiske & Neuberg, 1990; Slepian et al., 2011). Traits and characteristics associated with either male or female gender within a certain culture are sometimes referred to as sex or gender stereotypes (Unger, 1979). The perceived gender is one of the first categories that a perceiver identifies upon encountering a person (Fiske & Neuberg, 1990; Sato et al., 2020; Taylor et al., 1978). The simplified categorization of all humans into binary categories of male and female propagates stereotypes about representatives of these two groups. Identifying a person as belonging to one or another gender serves as a cognitive shortcut that gives perceivers a feeling of knowing more about the person than they would have known if they had to compile all the contextually relevant information in a bottom-up manner.

Women have been stereotyped as being empathic, communal, gentle, emotional, passive, and lacking leadership skills (Broverman et al., 1972; Deaux, 1995; Kelso & Brody, 2015; Rudman & Glick, 2021). In contrast, men are stereotyped as risk-takers, aggressive, unaffectionate, and control-oriented (Aries, 1996; Bem, 1981; Gana, 1995; Mahalik et al., 2003; Tollison, 2013, 2018). These gender-stereotyped characteristics are reliably replicable

(Broverman et al., 1972; Halpern, 2010; Rosenkrantz et al., 1968; Sczesny et al., 2007), with later investigations revealing the persistence of gender stereotypes over time, showing that recent gender stereotypes were highly similar to those observed in the middle of the last century.

The research on gender stereotypes is crucial because their existence influences how people interact and behave with one another. Gender stereotypes have direct impacts on one's daily life, which can be both pervasive and detrimental. For instance, it has been shown that gender stereotyping has an enormous influence on the choice of career path for both men and women. Occupational stereotyping (Basfirinci et al., 2019; Deaux, 1995; Ritter et al., 2021; E. H. Shinar, 1975; White & White, 2006) is associated with the idea that certain genders are better suited for certain professions (Holland, 1997). A typical example of occupational stereotyping is the fact that male nurses often face difficulties in their profession because of existing stereotypes and stereotype threat (Tollison, 2018).

The influence of gender stereotypes and stereotypes in general is known to vary according to the context in which they take place. Social environments may, under certain circumstances, interact with the gender stereotypes and have a greater impact on representatives of the stereotyped group. For instance, in online gaming communities, gender stereotypes result in pervasive sexism against female players, leading to harassment, rape jokes, rape threats, and death threats (Ashcroft, 2019; Seo et al., 2021). In addition to those hazards, Vermeulen et al. (2016) showed that when women play against male players, their perceptual skills lose their accuracy, and the presence of male players amplifies their emotional strain.

Similarly, being present in a classroom in a male-dominated area of science activates automatic stereotypic beliefs about gender roles, which was postulated to have the potential to

make female students underperform in such contexts (Dasgupta & Asgari, 2004). Interestingly, this negative influence can be mitigated by the presence of female faculty members (Dasgupta & Asgari, 2004) or even by imagining females in leadership roles (Allen & Friedman, 2016). The above contextual influences are known as stereotype threat and counterstereotype threat situations and are particularly relevant for the third article of this thesis.

### Stereotypes Pertaining to Driving

In a way similar to occupational stereotyping described above, when thinking of a driver from a specific group, people may use stereotypes in an attempt to predict a given driver's abilities. The most commonly described stereotypes about drivers belong to one of three main categories: female drivers as hesitant and clumsy (Berger, 1986; Harris & Miller, 2000; Lezotte, 2015), young male drivers as risky and aggressive (Arnett, 1996; Arnett et al., 2002; Özkan & Lajunen, 2006; Shinar & Compton, 2004; Westerman & Haigney, 2000), and older drivers as dangerous and overly cautious (Joanisse et al., 2012). Although all three categories of stereotypes will be explored in this thesis to some degree, stereotypes about female drivers are its principal focus.

### Gender Stereotypes in Driving and the Importance of Risk-Taking

This thesis examines the existence and the impact of the female driver stereotype on decision-making and driving performance. As stated above, what is expected of the drivers and how observed behaviours are perceived depends on the gender of the driver (Glendon et al., 1996). Women are often thought of as poor drivers (Chateignier et al., 2011) and have also been

described as incompetent, unsure, hesitant, less skillful, and overcautious behind the wheel (Berger, 1986; Clarsen, 2008; Lezotte, 2019).

Lawrence and Richardson (2005) suggested that, based on characteristics that are typically associated with men in general, a “male-pattern” driving style can be hypothesized against which female drivers are compared. This pattern features central elements such as agentive behaviour, risk-related behaviour, and decision-making processes while driving. Agentive behaviours in driving are based on stereotypes that men, unlike women, are more likely to act as agents of the events in which they participate, while women are perceived as objects of circumstances. Using this frame of reference, the authors suggested that motor vehicle collisions involving male drivers would be perceived as acts of commission, related to recklessness and risk-taking, which are stereotyped as more typical of male drivers (Lawrence & Richardson, 2005). On the other hand, collisions that involve female drivers would be interpreted as acts of omission, related to being confused, hesitant, or distracted, which are stereotyped as more typical of women than men (Lawrence & Richardson, 2005). After reading actual road accident reports, which included figurative drawings of the event and an image of the car involved, participants were asked to make judgments about the driver's carelessness and hostility before, during, and after the accident. The results showed that in spite of the fact that the acts of both drivers were maintained constant, the actions of the female driver were regarded as being more attributable to driver carelessness than to driver hostility or outside influences.

It is important to acknowledge that some gender stereotypes about drivers may contain a grain of truth about the “average” male and female drivers (Dontsov & Kabalevskaya, 2013; Reason et al., 1990). Differences in driving patterns have been found in studies examining the evidence for real, rather than perceived, gender differences in driving behaviour. For example, it

appears that male drivers report being more likely to violate the laws of the road, while female drivers report experiencing lapses in concentration while driving (Reason et al., 1990).

Moreover, Underwood et al. (1999) indicated that while violations (commission) tend to cause more major accidents, lapses in concentration (omission) tend to result in near misses, which may explain the documented gender differences in accident rates, found particularly among younger drivers (Clarke et al., 2002).

As indicated above, men have been thought of as having a greater tendency to take risks in the context of driving as well as in other contexts (Creighton & Oliffe, 2010; Powell, 2003; Styazhkina, 2010). They are more prone to risk-taking in financial decision-making (Meier-Pesti & Penz, 2008), as well as in social situations (Friedl et al., 2020). For example, in a study with over 600 participants, Harris et al. (2006) collected self-report assessments of participants' likelihood of engaging in a variety of risky activities, including gambling, health, recreation, and social domains. The participants were asked to estimate the enjoyment that they anticipated from those activities, the likelihood of negative outcomes, and the severity of those potential negative outcomes. Women reported expecting less enjoyment and a higher probability of negative outcomes in health, recreational, and gambling domains, while the opposite was true for male participants. The results showed that men and women are different in the way that they assess risks and rewards, which results in different rates of engagement in risky behaviours (C. R. Harris et al., 2006; M. B. Harris & Miller, 2000). Curiously, it is not so much the sex of participants but their psychological level of masculinity or femininity that seems to determine the propensity for risk-taking. Both men and women who score higher on the dimension of conformity to typical masculine traits are more likely to engage in risky practices than people conforming to typical feminine traits (Levant et al., 2020; Mahalik et al., 2003). This gender



difference in propensity for risk-taking behaviour is particularly noticeable in young people. Young men are particularly prone to engage in activities that carry physical risks (Apalkova et al., 2018).

Article 1, introduced below, further documents the features of male and female driver stereotypes through a series of short simulated driving videoclips in which the gender of the drivers can only be inferred. It is expected that observers will associate the behaviours depicted in the simulated scenes with female or male drivers based on the main features of the stereotypes about female and male drivers, respectively.

### Stereotypes About Older Adults and Older Drivers

Older adults face pervasive negative stereotypes simply based on their age (Dionigi, 2015). Assumptions that older adults have declining cognitive and physical functioning are ubiquitous and are among the main features of ageism (Cuddy & Fiske, 2002). Older adults are affected by stereotypes in a variety of contexts. For example, in a longitudinal study with older adults who regularly participated in an organized physical activity, Emile et al. (2015) demonstrated that the endorsement of negative stereotypes about ageing was associated with decreased subjective vitality (Emile et al., 2015).

As ageism is largely fed by misconceptions of cognitive decline and decreased physical strength and ability, it is not surprising that older individuals are subjected to negative stereotypes about their ability to operate a vehicle (Joanisse et al., 2012). In an empirical study conducted by Joanisse et al. (2012), young participants were shown video clips illustrating a variety of driving behaviours, some of which were designed to illustrate stereotypical ways of

driving for older and younger adults. Videos representing behaviours associated with older drivers, such as a video portraying a driver who was driving too slowly, were indeed rated as representative of older drivers. Additionally, when participants were asked to name characteristics of older drivers, they provided descriptions that portray older drivers as being overly cautious, uncomfortable behind the wheel, unwilling to drive in unfamiliar surroundings, and experienced but affected by cognitive and perceptual deficits; the participants even mentioned an image of a “white knuckled little old lady that can barely see over her dash” (Joanisse et al., 2012).

In contrast to negative stereotypes about older drivers, who have been described as “dangerous” by participants in the study by Joanisse et al. (2012), it is the young drivers who have been documented as more likely to engage in risky driving behaviours and to become involved in collisions and violations (Jonah, 1990; Jonah & Dawson, 1987; Simons-Morton et al., 2019). In a study comparing over 500 teenage drivers (16–20 years old) with more than 400 adult drivers (25–45 years old), male drivers reported engaging in risky driving behaviours more frequently than female drivers, and teen drivers reported engaging in risky driving behaviours more frequently than adult drivers, making young male drivers the riskiest drivers of all (Rhodes & Pivik, 2011). Yet the risk of a crash does increase in older individuals based on data provided by the field of accidentology. The latest observations on that matter indicate that the risk of a crash increased only after the age of 75 and is mediated by the distance driven annually (Ayuso et al., 2020; Joyce et al., 2021; Langford et al., 2006). Indeed, the older drivers who seem most at risk, when the driving distance is kept constant, are the ones who drive less. This finding indicates that the stereotypical image of the older driver is actually based on a subgroup of at-risk older drivers. The study described in Article 2 below dives into this intersection of gender and

age stereotypes in driving, by examining how decision-making about whether to drive or not in a social dilemma context is influenced by age, gender, and the interaction between the two.

### Stereotype Threat

The study of stereotypes in social psychology and other disciplines is important because of their repercussions on the life of stereotyped people. The need to control automatic prejudices depends on how stereotypes affect and distress members of the targeted groups. One way in which stereotypes may disturb the life of targeted individuals is described by the concept of *stereotype threat*.

The concept of stereotype threat inspired a substantial portion of the work presented in this thesis. The presentation of this concept in the thesis starts by describing it and highlighting some evidence for it. Doubts and scepticism based on our findings and other recent evidence are brought forward in the General Discussion section of the thesis.

Stereotype threat is a situation in which a person finds themselves on the verge of confirming a negative stereotype about a social group to which the person belongs (based on race, gender, age, ethnicity, or another salient identity characteristic), as a result of situational clues or overt displays of stereotypes (Kelso & Brody, 2015). When a person is afraid of confirming a negative stereotype about the affiliated group, stereotype threat effects can occur, resulting in diminished performance on activities relevant to the stereotype in question (Steele, 2011; Steele & Aronson, 1995).

Distinct stereotypes can be threatening depending on one's identity and context. For example, activating a stereotype of a woman may result in a stereotype threat affecting her

performance in the context of a math exam but not in a context of a writing exam in an English course. Previous studies suggested that stereotype threat can result in an inferior performance in a variety of stereotyped domains, alter cognitive processing, and generate negative emotions in the person under threat (Aronson et al., 1998; Spencer et al., 1999).

Some of the first foundational studies on stereotype threat looked at this phenomenon by assessing its effects on the intellectual performance of Black participants. In the seminal article on stereotype threat (Steele & Aronson, 1995), the concept was introduced as “a social-psychological predicament that can arise from widely-known stereotypes about one’s group” (Steel & Aronson, 1995). The mere existence of a negative stereotype meant that everything one does could be interpreted as confirming the stereotype in the eyes of others, and perhaps in one’s own eyes as well (Steel & Aronson, 1995). In a series of experiments, Steele and Aronson (1995) showed that when a task was presented as diagnostic of innate intellectual ability, Black participants performed significantly worse than White participants, but when the same task was presented as nondiagnostic, the performance of Black participants did not deteriorate (Steel & Aronson, 1995).

When the pattern of their results was looked at in more detail, it became apparent that participants in the stereotype threat condition required more time to complete the test and nevertheless committed more errors. Being encumbered in this specific way – taking more time and nevertheless making more errors – has previously been interpreted as the result of competition (Baumeister, 1984), the presence of an audience (Bond, 1982), concerns about being evaluated (Geen, 1985), and anxiety about a test (Sarason, 1972; Wine, 1971). These factors have been postulated as potential mechanisms underlying the stereotype threat effect.

The results of this study from Steele and Aronson (1995) suggested that the performance of stigmatized groups can deteriorate through the effects of stereotype threat. This line of research inspired further studies that showed the deleterious effects of stereotype threat on other negatively stereotyped groups. Since that study by Steele and Aronson (1995), articles showing effects of stereotype threat have been published in many domains. For example, people from lower socioeconomic status showed a decrease in their language skills when assessed in a stereotype threat condition (Croizet & Claire, 1998). Deleterious effects of stereotype threat have also been observed in sports (Stone et al., 1999) and in the workplace (Farr, 2003).

Stereotype threat can produce its effect in several ways, some less subtle than others. Unambiguous expressions of stereotypes, such as stating that men are better negotiators than women (Kray et al., 2001), can result in stereotype threat. Likewise, situational cues, such as being the only woman in a room full of men (Inzlicht & Ben-Zeev, 2000), can also activate stereotype threat.

As briefly mentioned above, the deleterious effect of stereotype threat has been reported in a variety of performance domains, but also in different populations, including the population of older adults. For older adults, performance decrements attributed to stereotype threat have been shown to occur in many domains, including cognition (Popham & Hess, 2015), physical activities (Horton et al., 2010; Swift et al., 2012), skill acquisition (Fritzsche et al., 2009), math (D. Abrams et al., 2008), memory (Cavanagh, 2011; Haslam et al., 2012; Thomas & Dubois, 2011), and driving (Joanisse et al., 2013; Lambert, 2011). A review and meta-analysis concerning age-based stereotype threat by Lamont et al. (2015) examined 32 articles (10 unpublished and 22 published) regarding the performance of older adults. Their analysis revealed a significant small to medium effect of stereotype threat, which was at its strongest when the

manipulations were stereotype-based rather than fact-based, when the dependent variable was measured shortly after the induction of the stereotype threat, and when the dependent variables consisted of cognitive measures (Lamont et al., 2015).

Since the publication of this review and meta-analysis, a study by Abdou et al. (2016) added another domain to the roster of domains in which older adults experience stereotype threat, that is, the domain of healthcare. For older adults, stereotype threat in the healthcare context was shown to result in worse physical and mental health, reduced satisfaction with health care, reduced willingness to receive the influenza vaccine, and distrust of physicians (Abdou et al., 2016). The authors postulated that health disparities of minority groups can in part be the result of health care systems inducing the stereotype threat of various stigmatized aspects of social identity (Abdou et al., 2016).

### Effects of Gender Stereotypes on the Performance of Women

As mentioned above, gender is a fundamental or primary category of social perception (Brewer, 1988; Fiske & Neuberg, 1990). When a person sees another person, they usually immediately categorize the person as a man or a woman (Sato et al., 2020; Taylor et al., 1978). It is not surprising that gender stereotypes have been postulated as having the potential to produce effects of stereotype threat. Gendered stereotype threat has been reported as affecting women in many domains, with math probably being the domain most often examined empirically. The seminal study of the effects of stereotype threat on women is undoubtedly that by Spencer et al. (1999), which has been cited in other empirical publications at least 1600 times as of today. In this persuasive article, the authors showed that women's performance on math tests deteriorated

when they were reminded of the stereotype that men are better at math. This result held true for women who were very successful in mathematics prior to engaging in the study (Spencer et al., 1999). This study remains highly influential and continues to inspire research projects, having been cited over 100 times in 2020 alone.

Following the Spencer et al. (1999) study, many other studies have been published reporting evidence of the impact of stereotype threat on women's performance in mathematics (Inzlicht & Ben-Zeev, 2000; Keller, 2002; Oswald & Harvey, 2000) and physics (Marchand & Taasobshirazi, 2013). The effect of counter-stereotyping has also been examined in this context. For instance, it has been found that the quantity of interactions an individual has with counter-stereotypical models, such as female mathematicians who embody the converse of a gender stereotype, influences the extent to which the stereotype threat impacts performance (Dasgupta & Asgari, 2004). A relatively recent review of the literature on stereotype threat completed in 2016 reported confirming the validity and strength of this phenomenon (Spencer et al., 2016), although it should be highlighted that this review was conducted by the same author who published one of the first most influential original articles on this topic.

### Effects of Gender Stereotypes on the Performance of Women Who Drive

When it comes specifically to driving, Chateignier et al. (2011) reported that women fail the driving license test more frequently than men. They hypothesized that this probably occurs in part because the testers tend to be men, who may judge women as unskilled, and in part because of an actual underperformance due to the activation of stereotype threat. Chateignier et al. (2011) completed an experimental investigation of the stereotype threat hypothesis by asking women to

answer multiple-choice questions related to driving, either under stereotype threat or in a control condition. The results presented the evidence that women under threat performed significantly worse than women in the control condition (Chateignier et al., 2011). This suggested that the stereotype threat paradigm can be applied to tasks related to driving, although it was addressed somewhat remotely in their study, and that the deleterious effect of the female driver stereotype can be induced experimentally.

The application of the gendered stereotype threat paradigm to driving has also been assessed using driving simulators, a methodology that is more directly related to actual driving and seen as a valid indicator of real-life on-road performance. The first simulator study that attempted to determine the effect of negative female driver stereotypes was conducted by Yeung and von Hippel (2008). Participants who were assigned to a group that received driving instructions evoking stereotype threat were more than twice as likely to collide with a jaywalking pedestrian in a driving simulator than participants who received neutral instructions before the simulated drive. One of the limitations of this study was the highly unpredictable nature of the jaywalking event. This extreme level of unexpectedness of the event was necessary to establish a high base rate of collisions to enable statistically meaningful comparisons between the two groups in this pioneering female driver stereotype threat simulator study. The event of hitting jaywalkers is rather unusual and is not typical of what happens in driving on a day-to-day basis. Additionally, hitting jaywalkers is not specifically associated with the stereotype about female drivers.

The effects of gendered stereotype threat on female drivers in a simulator were further examined in a study conducted by Moè et al (2015). In contrast with the study by Yeung and Von Hippel (2008), this simulator study was aimed at testing the effects of the female driver



stereotype threat on women's reactions under simulated conditions that have greater ecological validity. According to the authors, their simulated context better reflected daily driving situations in which the stereotype about women could potentially operate. In their first experiment, women in the stereotype threat condition were told that the aim of the study was to detect gender differences in driving. In the other condition, they received no specific information about the aim of the study. Women under stereotype threat produced twice as many mistakes as women who were not submitted to the threat. In their second experiment, women were exposed either to the same stereotype threat condition or to the *stereotype boost* condition, in which the alleged goal of the study that was communicated to the participants was to compare the driving performance of young versus old women. The mean age of the participants was 22. Telling young participants that the study will investigate the reasons why young drivers drive better than old drivers was supposed to alleviate the effect of stereotype threat associated with female drivers, who could have felt threatened even in the neutral condition of the first experiment, just because driving in general is associated with men. The findings revealed that the difference between the two conditions was even more pronounced than in the first experiment, with participants in the threat condition making even more mistakes than participants in the first experiment, and participants in the boost condition making even fewer mistakes than participants in the control condition of the first experiment. In sum, the contrast between the two conditions was enhanced by using a boost condition as a control condition — a methodological element that was also adopted in the second experiment of the third article of this thesis.

Although the two above-described simulator studies with women driving under stereotype threat inspired some of the research conducted for this thesis, particularly the research described in the third article, these studies are not without methodological shortcomings. The

methodology that we developed was specifically designed to address these limitations while taking into account the factors known to influence the magnitude of the effect of stereotype threat.

## Thesis Objectives

The overarching objectives of the thesis were the following: providing further evidence of the existence of the female driver stereotype in terms of its core features, illustrating how gendered stereotypes interact with age in a social dilemma context, and assessing how driving performance may be altered in a valid driving context in which female drivers are subjected to stereotype threat.

## Article 1

In preparation for the study described in the first article, we considered stereotypes about women in general as well as stereotypes about female drivers in particular. As mentioned above, women are often stereotyped as frightful and uncertain, and men as aggressive and daring (M. B. Harris & Miller, 2000; Hentschel et al., 2019; Locksley et al., 1980; Rosenkrantz et al., 1968). Compared with women, men are thought to have a greater tendency to take risks (Apalkova et al., 2018; Bem, 1981; Powell, 2003; Pratto & Bargh, 1991). We combined these descriptions about women in general with descriptions about female drivers to create specific simulated driving videos that display those characteristics in order to examine whether the stereotypes about women in general also apply to female drivers and the driving behaviours that can be observed on the road. We created a range of videos to illustrate those stereotypes. In this way, we

used a new approach to explore, confirm, and document information about female drivers' stereotypes that could be surmised from previous research but that had not been documented in the context of observed driving performance.

## Article 2

In the second article, we looked at how stereotypes about men, women, and drivers from different age groups can affect the decisions that people make about driving even before getting in the car. This article used a new approach to examine the question whether driving is still considered to be a man's prerogative. Specifically, it explored whether a man, rather than a woman, would always be judged as more likely to drive. If this is indeed the case, we wanted to investigate the potential explanation behind that judgment. Is a man more likely to drive because he is the safer driver? Does this depend on the age of the two drivers who are being compared? We thus included combinations of different ages and genders in comparisons to provide some indication as to whether the decision point about who would be more likely to take the wheel may be affected by the age and estimated safety of the two people in the dyad. Article 2 tapped into identifying the preconceived notions of participants about the likelihood of driving and driving safety as a mediator.

## Article 3

Once the negative stereotypes about women drivers were confirmed in Articles 1 and 2, Article 3 continued the investigation with the aim of exploring the effects of negative stereotypes in the context of a driving simulator through the stereotype threat paradigm. Our original

intention was to examine the moderating and mediating factors that can affect the magnitude of stereotype threat using state-of-the-art simulator methodology to both generate the threatening conditions and assess its outcome. Inspired by methods available in the literature, we conducted the two largest experiments ever accomplished on this topic using simulated driving performance with the hope of reproducing the documented effects on driving performance and strengthening the evidence for the validity of the stereotype threat effect on female drivers.

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## CHAPTER 2

### Gendered Stereotypes About Drivers: Women are Seen as Incompetent, Men as Reckless

Yara V. Kadulina

School of Psychology

Department of Social Sciences

University of Ottawa

Ottawa, 2022

### HIGHLIGHTS

- Stereotypes can affect the behaviour of people who hold them
- Women drive more safely than men yet are stereotyped as bad drivers
- Inept driving is seen as typical of female drivers
- Aggressive driving is seen as typical of male drivers
- Negative stereotypes about drivers of different genders are qualitatively different

### **Keywords:**

driving, stereotypes, gender

## Abstract

Even though the statistics regarding on-road crashes and driving infractions show women to be safer drivers than men, stereotypes according to which women are seen as less competent drivers are prevalent. In the current study, we aimed to determine more precisely what kinds of driving behaviours are stereotypically associated with female and male drivers. This was done by showing participants ( $N = 232$ ) 16 videos of various driving behaviours, including some safe ones, some dangerous ones, and some erratic/inept ones. After viewing each video, the participants were asked to rate how likely they thought the driver was to be male or female. Our findings suggest that incompetent driving behaviours, such as being unable to parallel park, tend to be associated with female drivers. In contrast, dangerous driving behaviours, such as cutting off another car, are associated with male drivers. The results were similar for male and female respondents, with a few exceptions in which the participants showed a slight in-group bias. Our findings clarify the results of prior studies by identifying which specific driving behaviours are associated with stereotypes about female and male drivers. We empirically confirmed that women are seen as unskilled drivers and that men are seen as dangerous drivers. These findings are important because previous work shows that stereotypes can affect behaviour. The potential impact of such stereotypes is discussed in the context of our findings.

## 1. Introduction

What people believe about others, including the stereotypes that people hold, affects how they act toward them (Kawakami et al., 2017; Macrae & Bodenhausen, 2000; Okoro et al., 2020; Subramani, 2020; van Ryn & Burke, 2000). In this study, we aim to elucidate the specific content of stereotypes about female and male drivers. Although statistics show that women are safer drivers than men (Aldred et al., 2021), they are often stereotyped as incompetent (Berger, 1986; Degraeve et al., 2015; Pravossoudovitch et al., 2015). One of the earliest academic studies on gendered stereotypes about driving was carried out by Berger (1986), who conducted a retroactive qualitative overview of media articles and reports representing stereotypes about male and female drivers starting in the early 20<sup>th</sup> century. Berger concluded that the emergence of folklore portraying female drivers as incompetent can be explained as an attempt to oppress women by curtailing their freedom of movement.

Berger (1986) rooted the historic public opinion in the accepted view that women's "physical and intellectual weaknesses... made them dependent on men, ... and ill-suited to drive motor cars without male companionship" (p. 259). Berger's contribution provides an important foundation to the research on stereotypes about women drivers, but the study itself is now over thirty years old, and the media it examined goes back to as early as 1908. While stereotypes about men and women have changed to a certain extent since Berger's work was published (Eagly et al., 2020; Hentschel et al., 2019), the few studies that have examined negative stereotypes about female drivers in recent years have gleaned some evidence showing that stereotypes about female drivers may still be prevalent (Degraeve et al., 2015; Pravossoudovitch et al., 2015).

In order to situate the stereotypes about female drivers in a context, we can also consider what the statistics tell us about male drivers, as well as examine whether the data about the quality of driving by male drivers match the public opinion and the stereotypes that people hold about male drivers. As the most common definitions of a “good driver” include the idea of getting from point A to point B without putting anyone’s life in danger (Barg et al., 2009; Carr, 2014; Nath & Sinha, 2014; NZ Transport Agency, 2021), stereotypes about female drivers, who are often portrayed as worse drivers than men, can be considered erroneous, because men are about three times more likely than women to be involved in a fatal collision (Road Safety Research Office, 2017; World Health Organization, 2002, 2020). The higher likelihood of collisions and fatalities is accounted for by the proneness to risk-taking and the higher rates of traffic law violations by male drivers, rather than by the number of kilometers driven (González-Iglesias et al., 2012; Moghaddam et al., 2020; Schmid Mast et al., 2008; Waylen & McKenna, 2002). Considering these data, it is not surprising that male drivers are stereotyped as careless and fast drivers who are likely to commit traffic violations (Coquelet et al., 2019; Degraeve et al., 2015; Krahé, 2018; Pravossoudovitch et al., 2015), although it is crucial to remember that stereotyping any group is problematic because it can result in wrongly pre-judging an individual group member based on the average or the stereotypes of the group to which the individual belongs.

More recent research on the topic of gendered driving stereotypes can be traced back to that of Granié and Papafava (2011), who used the free association method with children and adolescents to examine gendered driving stereotypes in that age group. The results of the thematic analysis of the responses of children and adolescents in their study showed that the male driver was stereotyped as skilled, involved in an activity that complies with social expectations, while being careless and committing driving offenses. Men who drive were perceived to act in accordance with their gender role, with their driving style being seen as skilled but risky (Granié & Papafava, 2011). In regard to women who drive, children and adolescents in this study expressed their stereotypes about female drivers as

unskilled but careful drivers who rarely have accidents and who comply with the rules. Additionally, they reported that female drivers were engaged in an activity that contradicts the social expectations about their gender group. Overall, their results revealed that women were perceived to be poor drivers, probably because of a mismatch between the role of women in society and what driving entails (Granié & Papafava, 2011). Degraeve et al. (2015) elaborated on the study by Granié and Papafava (2011) by extending their research to adults. By analysing social representations associated with men and women drivers using factor analysis, Degraeve et al. (2015) identified incompetence, prudence, and lack of self-control as stereotypically representative of female drivers. Carelessness, skills, and self-control were deemed representative of male drivers in their sample (Degraeve et al., 2015).

In a related study, Pravossoudovitch et al. (2015) measured the endorsement of stereotypes about male and female drivers by administering a 27-item questionnaire, which was developed and validated according to a hypothesized four-factor model of gendered driving stereotypes. The factors included compliance with traffic rules, driving skills, risk avoidance, and courtesy (Degraeve et al., 2015). The results indicated that male (but not female) drivers were rated as skillful drivers, while female (but not male) drivers were rated as compliant with traffic rules, courteous behind the wheel, and risk avoidant (Pravossoudovitch et al., 2015). One limitation of the foregoing studies (Degraeve et al., 2015; Granié & Papafava, 2011; Pravossoudovitch et al., 2015) is that they were all conducted in France using a questionnaire-based approach. Although it can be presumed that similar stereotypes are common in other countries as well, especially in those with lesser gender equity, very little empirical data exist regarding this point.

The particular importance of elucidating the nature of stereotypes stems from the idea that people's beliefs about themselves can affect their behaviour. Several mechanisms can contribute to this effect. It includes the desire to fit in by adhering to what people perceive to be the norms for their



gender, which seems to be especially germane to men (Akpanudo et al., 2018; Anderson & McCormack, 2018). Men are penalized for showing characteristics that are stereotypically associated with women (Mayer, 2018), such as asking for help (Rosette et al., 2015), advocating for others (Bosak et al., 2018), displaying empathy (Gentry et al., 2015), or crying (Brescoll & Uhlmann, 2008; Motro & Ellis, 2017).

Belief in the negative stereotypes about male drivers can affect their behaviour by making them behave in stereotypical ways in order to fit in their gender role. The fear of appearing feminine is a robust motivator for why men have a strong desire to act according to the norms for their gender (Bosson & Michniewicz, 2013; Bosson & Vandello, 2011; Heesacker & Snowden, 2013; Vandello et al., 2008; Vedantam et al., 2018). A different mechanism for how stereotypes about female drivers can affect women may be at play for female drivers since appearing masculine is less threatening for women than appearing feminine seems to be for men.

Because stereotypes about female drivers often imply that women are bad drivers, women are more likely be adversely affected by the existence of negative stereotypes about female drivers through a reduction in the sense of self-efficacy (Bandura, 1977; Bandura & Locke, 2003; Raeder et al., 2019; Rasskazova, 2020; Venkatesh & Morris, 2000). Additionally, in recent studies, negative stereotypes about drivers were posited to affect their behaviour through a phenomenon dubbed *stereotype threat* (Joanisse et al., 2013; Moè et al., 2015; Yeung & von Hippel, 2008), a psychosocial phenomenon whereby awareness of the negative stereotypes about one's group is likely to hinder one's performance on the related task. However, it should be noted that the strength, reliability, and validity of that effect is currently a topic of debate (Flore & Wicherts, 2015; Motyl et al., 2017; Schimmack, 2017).

Supporting and extending previous research, such as that by Pravossoudovitch et al. (2015) and Degraeve et al. (2015), the aim in conducting this study was to empirically disentangle which driving behaviours are more likely to be attributed to female or male drivers. In order to identify specific

stereotypical behaviours attributed to male and female drivers, as well as to elaborate on and confirm the previous findings described above, we showed participants a number of video vignettes, created using a driving simulator, and asked them to express their opinion as to whether they thought that the driving behaviour was representative of male or female drivers.

Consistent with prior research (Degraeve et al., 2015; Pravossoudovitch et al., 2015), we hypothesized that videos of bad and incompetent driving would be judged as more representative of women than men. Additionally, we expected that videos of reckless driving would be judged as more likely to be representative of male drivers. Finally, we expected that competent driving will be attributed to male drivers.

The specific research design chosen for this study allowed us to effectively test the hypotheses stated above because the videos created with a driving simulator objectively give no indication about the gender of the driver, providing an impartial way of assessing stereotypes about male and female drivers. The gender of the driver is inferred by the viewers, allowing us to gain access to their gendered driving stereotypes. It also allowed a variety of behaviours to be illustrated in video vignettes, which helped to determine which specific behaviours are more likely to be interpreted as feminine or masculine driving acts. Finally, the commonalities between the different driving situations shown to the participants were extracted using a principal component analysis to confirm the dichotomous nature of the driving reactions that differentiate stereotypes about female drivers from stereotypes about male drivers.

## 2. Methods and Materials

### 2.1. Participants

Two hundred and thirty-two participants (160 women, 70 men, and 2 others) ranging between 16 and 61 years old were recruited for the study. Participants were required to hold a valid driver's license. Most participants ( $N = 202$ , 87%) were recruited from an undergraduate subject pool at the University of Ottawa, while the remaining 30 participants (13%) were recruited from the general public through social media. The participants from the undergraduate subject pool received a class credit for completing the online survey. The participants from the general public were given the option to enter a draw to win a gift card.

### 2.2. Materials and Procedure

#### 2.2.1. *Simulated Driving Videos*

Following the methodology used in several previous studies (Glendon et al., 1996; Joannis et al., 2012; Matthews & Moran, 1986), video clips of simulated driving behaviours were generated using a driving simulator (STISIM, Systems Technology; see Joannis et al., 2012, for a similar empirical approach). The use of recordings of simulated driving behaviours allows participants to observe hazardous driving in an environment where the driver and the other road users always remain safe. Additionally, it improves control over potentially confounding variables, such as the complexity of the driving environment; the colour, brand, and type of the vehicle; and the road conditions, including weather, time of day, and variations in traffic flow (Glendon et al., 1996; Joannis et al., 2012; Matthews & Moran, 1986). Most importantly for the purpose of this study, the actual driver cannot be seen in the simulation, and gender can only be inferred based on the observable driving behaviours.

Sixteen video clips were created. In selecting which behaviours to portray in the stimulus videos, we employed a qualitative and semi-formal procedure. First, four members of the research team (two male and two female) performed internet searches for terms such as “women drivers” and “women behind the wheel” and recorded their results. The team then met and discussed themes that emerged from these searches. This discussion led to a consensus identifying five main themes regarding negative stereotypes about driving behaviours of women, which included, in order of approximate prevalence, a general stereotype that “women are bad drivers,” as well as more specific behaviours stereotypically attributed to female drivers, such as “women cannot park, especially parallel park,” “women get distracted when driving,” “women get lost and ask for directions a lot,” “women are hesitant and lack confidence when driving,” and “women drive slowly.”

Eight scenarios were designed by the team to illustrate these behaviours, and based on the scenarios, the videos were created (Table 1). A brief description of the videos follows here. Since describing videos in writing would not be efficient and result in excessive verbiage, and even then, it would not illustrate clearly what was shown, the videos are posted on the internet for viewing at the links in Table 1.

The following eight videos were developed to illustrate the behaviours potentially representative of negative stereotypes about female drivers: not being able to parallel park, changing lanes and crashing into a car in the driver’s blind spot, being distracted at traffic lights, driving too slowly, insufficient planning resulting in going through a red light, showing hesitation while driving, executing a slow left turn at an intersection leading to a crash, and getting lost.

The remaining eight videos were created as thematic opposites to the eight videos about female drivers. That is, they were designed as either illustrating the opposite of the themes about female drivers (i.e., four videos demonstrating good, competent driving; safe and effective parking; and fast and

confident driving) or illustrating the themes associated with negative stereotypes about male drivers (i.e., four videos demonstrating excessive speeding and reckless driving). The four clips displaying appropriate driving reactions that are typical of all competent drivers included the following: safe forward parking, safe driving at an intersection, stopping at a red light and proceeding safely when the traffic light turns to green, and overtaking other vehicles in a safe and appropriate manner. Finally, the four clips created to depict negative behaviours associated with male drivers included the following: speeding (reckless driving and swerving), speeding at night in the dark, tailgating, and passing and losing control leading to a crash (see Table 1).

The colour, make, and model of the car were chosen in a way to avoid any potential suggestion as to the gender of the driver (red Ford Taurus). Some clips (e.g., parallel parking) show the aerial view of the driver's reactions, and other clips are shown from the driver's point of view. In no case was the driver visible. The order of presentation of the videos was randomized for each participant.

**Table 1.***Stimulus Videos*

| Video title                                     | Valence  | Link to the video                                         | View: aerial or driver's point of view (POV) | Duration |
|-------------------------------------------------|----------|-----------------------------------------------------------|----------------------------------------------|----------|
| Unable to Parallel Park                         | Negative | <a href="https://osf.io/56xub/">https://osf.io/56xub/</a> | Aerial                                       | 0:41     |
| Distracted at Traffic Light                     | Negative | <a href="https://osf.io/7d25f/">https://osf.io/7d25f/</a> | Driver's POV                                 | 0:32     |
| Not Confident Hesitant Merging Attempts         | Negative | <a href="https://osf.io/ubf2z/">https://osf.io/ubf2z/</a> | Driver's POV                                 | 0:39     |
| Driving Too Slowly                              | Negative | <a href="https://osf.io/ukq58/">https://osf.io/ukq58/</a> | Driver's POV                                 | 0:37     |
| Lost in Urban Environment                       | Negative | <a href="https://osf.io/bvs2m/">https://osf.io/bvs2m/</a> | Driver's POV                                 | 0:49     |
| Changing Lanes, Crashing into Car in Blind Spot | Negative | <a href="https://osf.io/gvqiz/">https://osf.io/gvqiz/</a> | Aerial                                       | 0:24     |
| Slow Left Turn at Intersection, Crash           | Negative | <a href="https://osf.io/9kymu/">https://osf.io/9kymu/</a> | Driver's POV                                 | 0:28     |
| Not Braking at Yellow, Going Through Red Light  | Negative | <a href="https://osf.io/nkjmz/">https://osf.io/nkjmz/</a> | Driver's POV                                 | 0:18     |
| Speeding, Reckless, Swerving                    | Negative | <a href="https://osf.io/ufmb9/">https://osf.io/ufmb9/</a> | Driver's POV                                 | 0:14     |
| Speeding at Night in the Dark                   | Negative | <a href="https://osf.io/r2yv4/">https://osf.io/r2yv4/</a> | Driver's POV                                 | 0:19     |
| Tailgating                                      | Negative | <a href="https://osf.io/e9mbk/">https://osf.io/e9mbk/</a> | Aerial                                       | 0:14     |
| Passing Twice Too Fast Crashing                 | Negative | <a href="https://osf.io/cxwz8/">https://osf.io/cxwz8/</a> | Driver's POV                                 | 0:24     |
| Safe Simple Forward Parking                     | Positive | <a href="https://osf.io/4xiha/">https://osf.io/4xiha/</a> | Driver's POV                                 | 0:27     |
| Safe Right Turn After Stopping at Stop Sign     | Positive | <a href="https://osf.io/34bpy/">https://osf.io/34bpy/</a> | Driver's POV                                 | 0:16     |
| Safe Stop at Red Light, Go at Green             | Positive | <a href="https://osf.io/q7hix/">https://osf.io/q7hix/</a> | Driver's POV                                 | 0:23     |
| Switching Lane From Slow to Faster              | Positive | <a href="https://osf.io/hd7gp/">https://osf.io/hd7gp/</a> | Driver's POV                                 | 0:20     |

*Note.* "Valence" indicates whether the video illustrates good or bad driving behaviour.

### 2.2.2. Assessment of Video Clip Content

After viewing a clip, the participants answered the following two questions: “Are the driving maneuvers presented in this clip representative of the typical driver of male gender?” and “Are the driving maneuvers presented in this clip representative of the typical driver of female gender?” The order in which these two questions were presented was randomized. Answers to these two questions were given according to a 7-point Likert scale (1 = *not at all representative* to 7 = *extremely representative*). Video clips and the questions that followed were administered using the Qualtrics online survey system.

Detection of careless responding (Huang et al., 2012) or random responses (Beach, 1989; Berry et al., 1992; Meade & Craig, 2012), a bias in responding to surveys or questionnaires that has been referred to as *content nonresponsivity* (Nichols et al., 1989), was introduced by inserting four unexpected items at intermittent intervals (“Were there animals crossing the road in this video clip?”, “What was the posted speed limit in this clip?”, and “Please answer ‘moderately representative’ to this question,” as well as “I am massaged by ducks once a month,” with options to respond ranging from “strongly agree” to “strongly disagree”). Inappropriate answers to these questions were taken as an indication that the person lacked the diligence or the necessary motivation and attention to complete the task as instructed. In that case, the participants were shown a message asking them to pay closer attention to the task. The prompt appeared after one inappropriate answer. The page was then refreshed, and the participants were allowed to complete the survey once more starting from the video immediately preceding the wrong answer. If the participants failed the content nonresponsivity item again, they were directed to the sign-out page, and the survey was terminated. The data for the participants who started but did not finish the study ( $N = 29$ ), either by logging out themselves or by failing the content nonresponsivity items, were not retained for the analysis.

### *2.2.3. Procedure*

Participants were invited to participate in a study whose goal was to investigate how individuals evaluate on-road behaviours of other drivers. They were informed that they would have to watch a number of videos related to driving and answer questions about them.

The study was available in both English and French. All participants were required to hold a valid driver's license to enrol in the study. Eligible participants were provided with a link to the online study site. In compliance with the requirements of the ethics board, participants gave their consent to proceed with the survey after reading a brief description of the experiment.

## *2.3. Data Analysis*

### *2.3.1. Data Preparation*

For each video, difference scores were calculated for each participant by subtracting the rating of how representative the behaviour was of a male driver from the rating of how representative the behaviour was of a female driver. Thus, a negative difference score indicated that the participant felt that the portrayed driving behaviour was more representative of a male driver than of a female driver. A positive difference score indicated that the participant felt that the portrayed driving behaviour was more representative of a female driver than of a male driver. A difference rating that was not significantly different from zero indicated that a participant estimated the behaviour to be approximately equally representative of male and female drivers.



The data were screened for outliers and winsorized as follows. Difference scores for each video and each participant that exceeded three standard deviations (SDs) from the mean of that video were replaced with the next value within an interval of  $\pm 3$  SDs around the mean of that video. This resulted in changes to 54 difference scores, representing 1.45% of all the difference scores. Both the raw and the winsorized data are available on the OSF page for this project (Kadulina et al., 2020), at the link for which can be found at the end of this article.

### *2.3.2. Analysis With $t$ Tests*

Mean difference scores were calculated for each video. One-sample  $t$  tests were used to compare the mean values with the gender-neutral score of zero to determine whether a clip was rated as being more representative of a typical female or a typical male driver. Following that, additional analyses were conducted for each video to compare the results of male participants with the results of female participants using independent-samples two-tailed  $t$  tests.

### *2.3.3. Principal Component Analysis*

A principal component analysis was conducted to look for any commonalities between the ratings given to the video stimuli and to determine whether these correspond to the features of female driver stereotypes. As a first step, we calculated the correlation coefficients between the various videos using the participants' difference scores (see Table 5).

As a second step, the difference scores obtained on the 16 videos were submitted to an exploratory principal component analysis. In accordance with Kaiser (1960), factors with eigenvalues higher than 1 were retained for interpretation and rotation, which resulted in five factors. In agreement with the methodological literature (MacCallum et al., 1999), the number of observations with  $N = 232$  was deemed sufficient for proceeding with the number of factors originally identified and the number of

variables (videos) included (de Winter et al., 2009; Fabrigar et al., 1999; Velicer & Fava, 1998), with 16 videos covering five factors, potentially resulting in at least three videos per factor. The criterion of variable loadings higher than .3 on a factor was used (Tabachnick & Fidell, 2007) to determine the contribution of the variables and to label the factor based on commonalities between the ratings of the videos (if more than one) loading high on a given factor.

### 3. Results

#### 3.1. Results of *t* Tests

**Table 2.**

*Results of the One-Sample *t* Test for Participants of All Genders*

| Video                                              | One-sample <i>t</i> test (test value = 0) |           |          |                     |                         |       |
|----------------------------------------------------|-------------------------------------------|-----------|----------|---------------------|-------------------------|-------|
|                                                    | Means of difference scores*               | <i>SD</i> | <i>t</i> | <i>p</i> (2-tailed) | 95% Confidence interval |       |
|                                                    |                                           |           |          |                     | Lower                   | Upper |
| Unable to Parallel Park                            | 1.00                                      | 1.65      | 9.22     | <0.001              | 0.79                    | 1.21  |
| Distracted at Traffic Light                        | 0.40                                      | 1.15      | 5.29     | <0.001              | 0.25                    | 0.55  |
| Not Confident Hesitant Merging Attempts            | 0.88                                      | 1.62      | 8.21     | <0.001              | 0.66                    | 1.08  |
| Driving Too Slowly                                 | 1.19                                      | 1.72      | 10.60    | <0.001              | 0.97                    | 1.42  |
| Lost in Urban Environment                          | 0.62                                      | 1.39      | 6.74     | <0.001              | 0.44                    | 0.80  |
| Changing Lanes and Crashing Into Car in Blind Spot | -0.03                                     | 1.29      | -0.36    | 0.722               | -0.20                   | 0.14  |
| Slow Left Turn at Intersection, Crash              | -0.10                                     | 1.38      | -1.15    | 0.253               | -0.28                   | 0.07  |
| Not Braking at Yellow, Going Through Red Light     | -0.62                                     | 1.56      | -6.00    | <0.001              | -0.82                   | -0.41 |
| Speeding, Reckless, Swerving                       | -1.20                                     | 1.81      | -10.12   | <0.001              | -1.44                   | -0.97 |
| Speeding at Night in the Dark                      | -1.16                                     | 1.76      | -9.99    | <0.001              | -1.38                   | -0.93 |
| Tailgating                                         | -1.30                                     | 1.81      | -10.97   | <0.001              | -1.54                   | -1.07 |
| Passing Twice Too Fast Crashing                    | -1.87                                     | 1.95      | -14.54   | <0.001              | -2.12                   | -1.61 |
| Safe Simple Forward Parking                        | 0.42                                      | 1.45      | 4.39     | <0.001              | 0.23                    | 0.61  |
| Safe Right Turn After Stopping at Stop Sign        | 0.10                                      | 1.39      | 1.13     | 0.258               | -0.08                   | 0.28  |
| Safe Stop at Red Light, Go at Green                | 0.31                                      | 1.03      | 4.51     | <0.001              | 0.17                    | 0.44  |
| Switching Lane From Slow to Faster                 | -0.43                                     | 1.40      | -4.69    | <0.001              | -0.61                   | -0.25 |

*Note.* *df* = 231.

\*The difference scores were obtained by subtracting participants' estimation of how representative the behaviour in the video was of a male driver from the participants' estimation of how representative the behaviour in the video was of a female driver ("Representative of female driver score" – "Representative of male driver score"). This resulted in a difference score, with a negative value of the score suggesting that the participants estimated the behaviour to be more representative of a male than a female driver and a positive value of the score suggesting that the participants estimated the behaviour to be more representative of a female than a male driver. The mean difference was then compared with 0 (equally representative of either gender) using a two-tailed one-sample *t* test.

### *3.1.1. Results of t Tests, for All Genders Combined, on Video Clips Intended to Illustrate a Negative Stereotype About Female Drivers*

For five out of eight video clips intended to convey a stereotype about female drivers, the results are significant in the hypothesized direction (see Tables 2 and 3). The results for two video clips (“Changing Lanes and Crashing Into Car in Blind Spot” and “Slow Left Turn at Intersection, Crash”) were not significant ( $p > 0.05$ ) in either direction. The mean value for the video clip “Not Braking at Yellow, Then Going Through Red Light” suggests that the participants believed the behaviour to be representative of male drivers, which probably indicates that they saw this as resulting from risk-taking or aggression rather than inattentiveness or distraction.

### *3.1.2. Results of t Tests, for All Genders Combined, on Video Clips Intended to Illustrate Driving Behaviour Not Associated With Female Drivers*

The mean results for all four video clips intended to convey negative stereotypes associated with male drivers were statistically significant in the hypothesized direction. The results for two out of four video clips depicting good driving behaviour (“Safe Simple Forward Parking” and “Safe Stop at Red Light, Go at Green”) indicated that the participants believed the driver to be female. For the third video clip showing good driving behaviour (“Safe Right Turn After Stopping at Stop Sign), the participants indicated that the driver could be either male or female. For the fourth video clip (“Switching Lane from Slow to Faster”), the driver was believed to be more likely male.

**Table 3.***Summary of Results for t Tests for All Participants Combined: Hypothesized Stereotype vs. Obtained Results*

| Video                                               | Hypothesized gender stereotype | Participants' estimation of driver's gender |
|-----------------------------------------------------|--------------------------------|---------------------------------------------|
| Unable to Parallel Park                             | Female                         | Female                                      |
| Distracted at Traffic Light                         | Female                         | Female                                      |
| Not Confident Hesitant Merging Attempts             | Female                         | Female                                      |
| Driving Too Slowly                                  | Female                         | Female                                      |
| Lost in Urban Environment                           | Female                         | Female                                      |
| Changing Lanes and Crashing Into Car in Blind Spot  | Female                         | Either                                      |
| Slow Left Turn at Intersection, Crash               | Female                         | Either                                      |
| Not Braking at Yellow, Then Going Through Red Light | Female                         | Male                                        |
| Speeding, Reckless, Swerving                        | Male                           | Male                                        |
| Speeding at Night in the Dark                       | Male                           | Male                                        |
| Tailgating                                          | Male                           | Male                                        |
| Passing Twice Too Fast Crashing                     | Male                           | Male                                        |
| Safe Simple Forward Parking                         | Male                           | Female                                      |
| Safe Right Turn After Stopping at Stop Sign         | Male                           | Either                                      |
| Safe Stop at Red Light, Go at Green                 | Male                           | Female                                      |
| Switching Lane From Slow to Faster                  | Male                           | Male                                        |

### *3.1.3. Results of t Tests Comparing Gender Groups Across All Simulated Clips*

The results of the male and female participants were similar for 12 out of 16 videos (Table 4). For two videos illustrating a behaviour resulting in a crash (“Changing Lanes and Crashing into Car in Blind Spot” and “Slow Left Turn at Intersection, Crash”), the male participants attributed the behaviour to women, and the female participants attributed the behaviour to men. For the “Speeding, Reckless, Swerving” video, the female participants were much more likely to attribute this behaviour to men; both

male and female participants attributed this behaviour to men, but the difference was significant, with female participants attributing it even more strongly to male drivers. Both male and female participants attributed the behaviour illustrated in the “Safe Right Turn after Stopping at Stop Sign” video to drivers of their own gender. For the remaining videos, the responses from male and female participants were similar.

**Table 4.** *Comparison of Responses by Participants’ Gender*

| Video                                                 | Participant’s gender |      |                 |      | t Test for equality of means |              |                         |       |
|-------------------------------------------------------|----------------------|------|-----------------|------|------------------------------|--------------|-------------------------|-------|
|                                                       | Men (N = 70)         |      | Women (N = 160) |      | t                            | p (2-tailed) | 95% Confidence interval |       |
|                                                       | M                    | SD   | M               | SD   |                              |              | Lower                   | Upper |
| Unable to Parallel Park                               | 1.09                 | 1.59 | 0.94            | 1.67 | 0.63                         | 0.531        | -0.32                   | 0.61  |
| Distracted at Traffic Light                           | 0.29                 | 0.82 | 0.46            | 1.23 | -1.06                        | 0.291        | -0.49                   | 0.15  |
| Not Confident Hesitant Merging Attempts               | 1.03                 | 1.85 | 0.79            | 1.52 | 1.01                         | 0.314        | -0.22                   | 0.69  |
| Driving Too Slowly                                    | 1.13                 | 1.55 | 1.26            | 1.75 | -0.53                        | 0.599        | -0.61                   | 0.35  |
| Lost in Urban Environment                             | 0.83                 | 1.49 | 0.53            | 1.35 | 1.49                         | 0.138        | -0.10                   | 0.69  |
| Changing Lanes and Crashing Into Car in Blind Spot    | 0.33                 | 1.24 | -0.21           | 1.27 | 2.96                         | 0.003*       | 0.18                    | 0.89  |
| Slow Left Turn at Intersection Through Traffic, Crash | 0.23                 | 1.36 | -0.27           | 1.34 | 2.57                         | 0.011*       | 0.12                    | 0.88  |
| Not Braking at Yellow, Then Going Through Red Light   | -0.44                | 1.58 | -0.68           | 1.55 | 1.07                         | 0.288        | -0.20                   | 0.68  |
| Speeding, Reckless, Swerving                          | -0.77                | 1.74 | -1.38           | 1.82 | 2.37                         | 0.019*       | 0.10                    | 1.12  |
| Speeding at Night in the Dark                         | -0.94                | 1.72 | -1.26           | 1.77 | 1.27                         | 0.205        | -0.18                   | 0.81  |
| Tailgating                                            | -1.10                | 1.60 | -1.38           | 1.90 | 1.08                         | 0.280        | -0.23                   | 0.79  |
| Passing Twice Too Fast Crashing                       | -1.83                | 1.89 | -1.87           | 1.98 | 0.14                         | 0.886        | -0.51                   | 0.59  |
| Safe Simple Forward Parking                           | 0.29                 | 1.21 | 0.48            | 1.55 | -0.94                        | 0.350        | -0.61                   | 0.22  |
| Safe Right Turn After Stopping at Stop Sign           | -0.27                | 1.15 | 0.27            | 1.50 | -2.69                        | 0.008*       | -0.94                   | -0.14 |
| Safe Stop at Red Light, Go at Green                   | 0.10                 | 0.80 | 0.38            | 1.10 | -1.89                        | 0.060        | -0.56                   | 0.01  |
| Switching Lane From Slow to Faster                    | -0.64                | 1.41 | -0.34           | 1.37 | -1.54                        | 0.125        | -0.70                   | 0.09  |

Note. *Df* = 228.

\*The means (*M*) represent the difference scores that were obtained by subtracting participants’ estimation of how representative the behaviour in the video was of a male driver from the participants’ estimation of how representative the behaviour in the video was of a female driver (“Representative of female driver score” – “Representative of male driver score”). This resulted in a difference score, with a negative value of the score suggesting that the participants estimated the behaviour to be more representative of a male than a female driver and a positive value of the score suggesting that the participants estimated the behaviour to be more representative of a female than a male driver; a zero difference score meant equally representative of either gender. The means of the female participants for each video were then compared with the means of the male participants using a two-tailed one-sample *t* test.

### 3.2. Results of the Principal Component Analysis

#### *3.2.1. Correlations*

Many meaningful positive and negative correlations that were statistically significant were detected (see Table 5), which supported the feasibility of finding meaningful factors using a principal component analysis.

**Table 5.** *Correlation Matrix for the 16 Videos*

|                                                     | Speedy,<br>Reckless<br>,<br>Swerving | Speeding<br>at Night<br>in the<br>Dark | Safe<br>Simple<br>Forward<br>Parking | Tailgating | Safe<br>Right<br>Turn<br>After<br>Stopping<br>at Stop<br>Sign | Safe<br>Stop at<br>Red<br>Light, Go<br>at Green | Switching<br>Lane<br>From<br>Slow to<br>Faster | Driving<br>Too<br>Slowly | Slow Left<br>Turn at<br>Intersecti<br>on Crash | Not<br>Braking<br>at<br>Yellow,<br>Then<br>Going<br>Through<br>Red Light | Passing<br>Twice<br>Too Fast<br>Crashing | Changing<br>Lanes<br>and<br>Crashing<br>Into Car<br>In Blind<br>Spot | Unable to<br>Parallel<br>Park | Distracted<br>at Traffic<br>Light | Not<br>Confident<br>Hesitant<br>Merging<br>Attempts | Lost in<br>Urban<br>Environm<br>ent |
|-----------------------------------------------------|--------------------------------------|----------------------------------------|--------------------------------------|------------|---------------------------------------------------------------|-------------------------------------------------|------------------------------------------------|--------------------------|------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------|-------------------------------|-----------------------------------|-----------------------------------------------------|-------------------------------------|
| Speedy, Reckless, Swerving                          | --                                   |                                        |                                      |            |                                                               |                                                 |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Speeding at Night in the Dark                       | .476**                               | --                                     |                                      |            |                                                               |                                                 |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Safe Simple Forward Parking                         | -.211**                              | -.286**                                | --                                   |            |                                                               |                                                 |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Tailgating                                          | .426**                               | .408**                                 | -0.08                                | --         |                                                               |                                                 |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Safe Right Turn After Stopping at Stop Sign         | -.184**                              | 0.001                                  | .187**                               | 0.056      | --                                                            |                                                 |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Safe Stop at Red Light, Go at Green                 | -0.124                               | -0.095                                 | .260**                               | -0.108     | .234**                                                        | --                                              |                                                |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Switching Lane From Slow to Faster                  | .134*                                | .194**                                 | .134*                                | 0.034      | 0.063                                                         | 0.088                                           | --                                             |                          |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Driving Too Slowly                                  | -.483**                              | -.312**                                | .188**                               | -.336**    | .222**                                                        | .193**                                          | -0.102                                         | --                       |                                                |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Slow Left Turn at Intersection Crash                | -0.087                               | .195**                                 | -0.019                               | -0.028     | -0.028                                                        | -.218**                                         | -0.021                                         | 0.016                    | --                                             |                                                                          |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Not Braking at Yellow, Then Going Through Red Light | .249**                               | .302**                                 | -0.056                               | .197**     | -0.126                                                        | -0.033                                          | -0.017                                         | -.257**                  | .169**                                         | --                                                                       |                                          |                                                                      |                               |                                   |                                                     |                                     |
| Passing Twice Too Fast Crashing                     | .467**                               | .444**                                 | -.288**                              | .384**     | 0.025                                                         | -.159*                                          | .217**                                         | -.453**                  | 0.053                                          | .220**                                                                   | --                                       |                                                                      |                               |                                   |                                                     |                                     |
| Changing Lanes and Crashing Into Car In Blind Spot  | 0.025                                | 0.089                                  | -0.125                               | 0.013      | -.208**                                                       | -0.032                                          | -0.024                                         | -0.101                   | .288**                                         | 0.083                                                                    | 0.005                                    | --                                                                   |                               |                                   |                                                     |                                     |
| Unable to Parallel Park                             | -.423**                              | -.414**                                | .135*                                | -.352**    | -0.1                                                          | -0.01                                           | -0.041                                         | .379**                   | .183**                                         | -.139*                                                                   | -.459**                                  | .290**                                                               | --                            |                                   |                                                     |                                     |
| Distracted at Traffic Light                         | -.201**                              | -.216**                                | -0.059                               | -.232**    | -0.026                                                        | -0.067                                          | -.233**                                        | .280**                   | 0.023                                          | -.155*                                                                   | -.189**                                  | 0.055                                                                | .207**                        | --                                |                                                     |                                     |
| Not Confident Hesitant Merging Attempts             | -.360**                              | -.300**                                | .169**                               | -.240**    | -0.044                                                        | 0.118                                           | -0.104                                         | .406**                   | .207**                                         | -0.088                                                                   | -.462**                                  | .254**                                                               | .529**                        | .219**                            | --                                                  |                                     |
| Lost in Urban Environment                           | -.295**                              | -.296**                                | .144*                                | -.316**    | -0.031                                                        | 0.124                                           | -0.09                                          | .400**                   | 0.108                                          | -0.119                                                                   | -.429**                                  | 0.095                                                                | .485**                        | .139*                             | .497**                                              | --                                  |

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).



### *3.2.2. Principal Component Analysis*

Principal component analysis identified five main factors with an eigenvalue exceeding 1, which taken together accounted for 60% of the variance (Table 6). Visual inspection of the scree plot confirmed the validity of the top four components, but the curve leveled off between components four and five. Nevertheless, all five components are presented in the results for completeness. Based on the qualitative analysis of the themes for the videos that loaded onto each factor, they were assigned the following labels: (1) Gender, (2) Bad Driving, (3) Safe Driving, (4) Confident and Attentive Driving, and (5) Stops and Traffic Lights.

Every video variable was retained as an item for factor analysis because each video loaded at least above .3 on at least one, but usually more than one, factor. Only three videos loaded on just one factor each: “Speedy, Reckless, Swerving” loaded negatively (-.71) only on the factor Gender, “Safe Right Turn After Stopping at Stop Sign” loaded positively (.85) only on the factor Safe Driving, and “Switching Lane From Slow to Faster” loaded positively (.81) only on the factor Confident and Attentive Driver. All videos were retained to complete the principal component analysis with five factors, for which we used varimax rotation with Kaiser normalization (Kaiser, 1958).

The first factor explained 25.92% of the variance. It clearly differentiated the behaviours that participants attributed to male or female drivers (see Table 6). This factor contained significant positive loadings for most videos that were designed to illustrate the behaviours associated with female drivers, and it contained significant negative loadings for the videos designed to illustrate behaviours typical of male drivers. This factor was labelled Gender.

The second factor explained an additional 10.58% of the variance. It identified two videos that included crashes, as well as videos illustrating running through the red light, inability to parallel park, being hesitant while merging on the highway, and speeding at night. It was labelled Bad Driving.

The third factor explained an additional 8.4% of the variance. It highlighted the videos with appropriate driving behaviours following the rules, such as coming to a gradual but complete stop at a stop sign before appropriately and safely turning right and safely stopping at the red light and then proceeding at green. Additionally, this factor presented a positive loading on the video that illustrated driving too slowly for the apparent circumstances and a negative loading on changing lanes and crashing into a car in a blind spot. It was labelled Safe Driving.

The last factor that could be meaningfully interpreted, Factor 4, explained an additional 7.97% of the variance. One video that loaded highly on this factor illustrated a driver who follows a slow car in the right lane and then safely and confidently moves over to the faster lane on the left. Another video that loaded on this factor showed safe but simple forward parking that required some advance planning. The loading for the last video that was significant for this factor was negative. It illustrated a driver seemingly distracted at the traffic light, betraying a lack of attention. Factor 4 was therefore labelled Confident and Attentive Driver.

For Factor 5, although its eigenvalue exceeded 1, no meaningful interpretation could be surmised. The flattening of the scree plot between Factors 4 and 5 is also a tentative visual confirmation of the relatively small contribution that this factor can make in terms of its explanatory power. Nevertheless, Factor 5 accounted for an additional 6.95% of the variance and received the provisional label of Stops and Traffic Lights based on the videos that it picked up in its loadings.

**Table 6.***Results of the Principal Component Analysis of the Responses to Driving Behaviour Videos*

| Video                                               | Factor loadings |               |                |                                  |                            |
|-----------------------------------------------------|-----------------|---------------|----------------|----------------------------------|----------------------------|
|                                                     | 1 Gender        | 2 Bad Driving | 3 Safe Driving | 4 Confident and Attentive Driver | 5 Stops and Traffic Lights |
| Unable to Parallel Park                             | <b>.719</b>     | <b>.344</b>   | -.177          | .072                             | -.077                      |
| Not Confident Hesitant Merging Attempts             | <b>.656</b>     | <b>.415</b>   | -.021          | -.048                            | .158                       |
| Driving Too Slowly                                  | <b>.639</b>     | .080          | <b>.411</b>    | -.137                            | -.004                      |
| Lost in Urban Environment                           | <b>.631</b>     | .238          | -.001          | -.088                            | .085                       |
| Safe Simple Forward Parking                         | <b>.365</b>     | -.170         | .138           | <b>.519</b>                      | <b>.314</b>                |
| Distracted at Traffic Light                         | <b>.316</b>     | .050          | .154           | <b>-.543</b>                     | <b>-.309</b>               |
| Safe Stop at Red Light, Go at Green                 | .161            | -.148         | <b>.306</b>    | .041                             | <b>.688</b>                |
| Changing Lanes and Crashing Into Car in Blind Spot  | .083            | <b>.622</b>   | <b>-.337</b>   | -.020                            | .010                       |
| Slow Left Turn at Intersection Crash                | .031            | <b>.777</b>   | .144           | .011                             | -.107                      |
| Safe Right Turn After Stopping at Stop Sign         | -.061           | -.056         | <b>.853</b>    | .089                             | .143                       |
| Switching Lane From Slow to Faster                  | -.162           | .107          | .119           | <b>.806</b>                      | -.267                      |
| Not Braking at Yellow, Then Going Through Red Light | <b>-.387</b>    | <b>.352</b>   | -.226          | -.078                            | <b>.476</b>                |
| Tailgating                                          | <b>-.619</b>    | .082          | .016           | .035                             | .169                       |
| Speeding, Reckless, Swerving                        | <b>-.705</b>    | .045          | -.240          | .048                             | .030                       |
| Speeding at Night in the Dark                       | <b>-.707</b>    | <b>.378</b>   | .131           | .033                             | .007                       |
| Passing Twice Too Fast Crashing                     | <b>-.754</b>    | .086          | .082           | .082                             | -.218                      |
| Eigenvalues                                         | 4.15            | 1.69          | 1.34           | 1.28                             | 1.11                       |
| Percentage variance explained                       | 25.92           | 10.58         | 8.4            | 7.97                             | 6.95                       |

*Note.*  $N = 232$ . Principal component analysis was used as an extraction method. Rotation method: varimax with Kaiser normalization. Factor loadings above an absolute value of .3 are in bold.

## 4. Discussion

### 4.1. Video Clips Intended to Illustrate Negative Stereotypes About Female Drivers

On the basis of the existing literature, we created simulated videos that depicted the core elements of female driver stereotypes. It was hypothesized that the reactions would be attributed significantly more to a female than a male driver in the videos depicting what should be seen as inefficient or inappropriate driving reactions. For most of the clips (five out of eight) intended to illustrate negative stereotypes about female drivers, the stated hypotheses were confirmed. For two other videos, there was no significant difference in the attribution of the reactions to a male or a female driver, indicating that the participants considered the depicted driving reaction to be equally representative of drivers of either gender or that their answers were on the opposite ends of the scale and cancelled each other out. Indeed, the analysis comparing the ratings of male and female participants sheds some light on the underlying trend and is discussed below.

### 4.2. Video Clips Intended to Illustrate Driving Behaviours Not Associated With Female Drivers

Two categories of videos were created for the purpose of discriminating the driving reactions that belong exclusively to the female driver stereotype from those that do not. As such, we included reactions that could be depicted as more male-like as well as good and safe driving reactions. The results clearly confirmed all the hypotheses about the behaviours intended to illustrate stereotypes about male drivers. As for the video clips depicting good and safe driving behaviours, the results were divided and inconclusive. Out of four proper driving behaviours, two were attributed to a woman driver, one was attributed to either a man or a woman driver, and one was more strongly associated with a male driver.

### 4.3. Comparison of the Results Between Male and Female Participants

The work of Pravossoudovitch et al. (2015) indicates that gender stereotypes associated with driving can vary in strength and nature depending on the gender of the respondent. An examination of the ratings as a function of the participant's gender could reveal how prevalent the specific content of a stereotype is in men and women separately. Our first set of analyses considered all participants as a whole, which might have hindered some important underlying differences across gender in the attribution of the driving reactions to either a male or a female driver. Interestingly, the comparison of the ratings between male and female participants revealed that, most of the time, they concurred in their attribution of the driving behaviours to either male or female drivers. Indeed, in only four out of 16 videos were the results different between male and female participants. In each case, the participants reacted with an in-group bias, describing negative driving behaviours as less representative of the drivers from their own gender group, and positive driving behaviours as more representative of the drivers from their own gender group. Both men and women attributed the following two scenarios depicting inept driving behaviours to the other gender (men attributed them to women and women attributed them to men): a car that is changing lanes and crashes into another car in its blind spot; a car that needs to make a left turn across the incoming traffic, makes an attempt, and crashes. Both men and women attributed the scenario depicting an episode of good driving, i.e., a car that makes an appropriate safe right turn after stopping at a stop sign, to the drivers of their own gender – men attributed it to men and women attributed it to women.

Finally, a similar in-group bias was observed for the video in which one can see a car recklessly speeding and swerving. In this case, the participants of both genders agreed in their attribution of the driving behaviour to men, but the responses still exhibited an in-group bias. This was revealed by a

significant difference between the mean results for the male and female participants who rated the reactions as being more female or male like. The female participants were very confident when ascribing this behaviour to the male drivers. Even though the male participants also conceded that this behaviour was more representative of male than female drivers, their ratings were more moderate on average.

#### 4.4. Principal Component Analysis and Summary

The results of the principal component analysis yielded strong support for the specific nature of the driving reactions depicted in the videos and adequately informed whether or not they pertain to the stereotype of female or male drivers. Five distinct factors were identified.

Most importantly, the Gender factor was able to clearly differentiate between the behaviours that the participants ascribed to male and female drivers, indicating that very specific driving behaviours can be attributed differentially to male and female driving stereotypes. Three other factors explaining a significant portion of the variance also emerged from this analysis and portray drivers' characteristics that either are shared by male and female drivers (i.e., Safe Driving and Attentive and Confident Driving) or illustrate a set of driving reactions of saliently poor quality (i.e., Bad Driving).

To summarize the results, driving behaviours portraying incompetent driving were attributed more frequently to women than to men. Driving behaviours portraying reckless and aggressive driving were attributed more frequently to men than to women. Good driving behaviours were attributed to men and women with a similar frequency. Yet some of the observed differences need to be understood while considering the gender of the respondents.

#### 4.5. Implications

The findings contribute to our knowledge in important ways since, on the one hand, they confirm the previously held perception that women are seen as incompetent drivers regarding specific driving reactions and show that this perception is still present to this day. On the other hand, the results show that this perception cannot be constrained to a negative tone. The current results highlight that women are also seen as good drivers in terms of safety. This is indicated by the fact that the proper driving behaviours, which we originally hypothesized would be attributed to male drivers, were actually attributed slightly more often to female than to male drivers.

The results of this study support and confirm some of the previous findings about gendered driving stereotypes and add some new information that has previously not been illustrated in the empirical literature. Earlier studies such as those by Pravossoudovitch et al. (2015) and Degraeve et al. (2015) gathered compelling evidence regarding words and concepts associated with the stereotypes of female and male drivers. The present study extends those findings by demonstrating the specific driving behaviours that are associated with the documented stereotype contents in highly controlled contexts, which were lacking in previous empirical studies, thus filling an important gap in the previous research. The results of our study illustrate that men and women are stereotypically seen as very different kinds of drivers. As observed in a number of studies, society generally assumes women to be incompetent at driving. Male drivers are not entirely spared negative judgements, with evidence from this study confirming that men are seen as reckless or aggressive drivers.

The association of an individual with a stereotyped group based on socially shared attributes necessarily has detrimental bias effects. Attribution of an “incompetent driver” stereotype to a female driver may have potential effects on women’s sense of self-efficacy in driving. This, in turn, might reduce their willingness to drive, especially in the presence of people of the other gender. Knowing that driving

ability directly depends on the amount of practice, a reduced amount of driving exposure may further affect women's sense of competence in driving, with a potential for reducing women's mobility.

Decreased mobility, especially in an ageing population, has been shown to have significant deleterious financial and health effects (Siren & Haustein, 2015). Driving cessation and loss of mobility are associated with an increased risk of developing depression (Fonda et al., 2001), reduced life satisfaction, and increased isolation (A. Harrison & Ragland, 2003; Marottoli et al., 2000; O'Neill, 1997). Thus, it is important to address the false nature of stereotypes about female drivers in order to encourage women to drive. Improving their sense of driving self-efficacy can help increase their mobility (Ackerman et al., 2010).

Another important implication of this research involves the consequences of the way people change their behaviour based on the stereotypes that they hold. Because of the gendered stereotypes that disconnect women from cars, women have been held back in their access to vehicles (Lezotte, 2019), and women are still neglected in the marketing of automobiles and face difficulties negotiating with auto dealers (CBC News, 2017; Walsh, 2011). This results in a mutually disadvantageous situation, in which car dealers lose a large population of potential customers and women do not regularly experience the joy of confidently choosing her own car for a purchase.

Additionally, it is important to address negative stereotypes about male drivers. Although driving-related stereotypes about men do not discourage men from driving, they may affect the safety of male drivers. Since, as we observed in this study, speeding and other risky behaviours are stereotypically associated with male drivers, some men might feel compelled to engage in such behaviours in order to sustain their masculinity. Studies on masculinity suggest that the status of being manly is precarious, and it is often perceived as "hard won and easily lost" (Vandello & Bosson, 2013).



When society sees risky driving as an important attribute of being masculine, it can motivate some men to adhere to this stereotype under the pressure of gender-role stress (Bosson et al., 2009).

#### 4.6. Limitations and Future Directions

The obtained findings need to be interpreted in light of a number of methodological limitations. The number of female participants was larger than the number of male participants. An imbalance in the numbers of participants of different genders could have biased the results to some degree. Although the results concerning stereotypes about female drivers could have been stronger with an equivalent number of participants of both genders, the analysis dividing participants by gender confirms the existence of stereotypes in both gender groups. Considering the in-group bias that has been observed, a more balanced sample would have probably shown stronger stereotypes about female drivers.

Another limitation, which has been typical of all studies on this topic up to this day, is the potential lack of geographic and cultural generalizability of our findings. So far, all studies about female drivers have shown similar results, but it is conceivable that the pattern of observed results may differ across cultures and between countries. In fact, it is possible that in more patriarchal countries or in countries where women have only recently been allowed to drive (e.g., Saudi Arabia), stereotypes regarding female drivers are stronger and perhaps even more negative than we have observed in our study.

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## CHAPTER 3

### Driving as a Man's Prerogative: Influences of Age and Gender on Stereotypes about Drivers

Yara Kadulina

School of Psychology

Department of Social Sciences

University of Ottawa

Ottawa, 2022



## Abstract

Previous research showed the existence of stereotypes about drivers from different demographic categories, such as stereotypes about female drivers and older drivers. The combination of the two, however, has not been previously explored. This study examined stereotypes about drivers by looking at how perceptions about drivers of different genders are affected by the age category to which they belong. Subjective beliefs about drivers were examined by asking participants to imagine two people who approach a car. The two people in the dyad differed in their gender and age (young, middle-aged, and old). The participants were asked to estimate which of the two drivers in the dyad was more likely to take the wheel. Additionally, the participants expressed their subjective opinion about which member of the dyad was the safest of the two drivers. The results showed that, in comparison with men of the same age, women were consistently seen as less likely to drive. Among all combinations of age and gender, older women were believed to be the least likely to take the wheel. Safety was not a determining factor in who was estimated as more likely to drive, which can be concluded based on the fact that men were rated as more likely to drive even when they were rated to be less safe drivers. The combined influence of gender and age misconceptions about driving a car strongly influenced the judgments that were made, especially when stereotypes about older drivers were merged with those about female drivers, resulting in a particularly negative older female driver stereotype. The findings clearly indicate that driving is still considered to be a man's prerogative, since men are seen as most likely to drive when compared with women of the same age and are also almost always rated as the safest drivers.

*Keywords:* driving, stereotypes, gender, age, female drivers, older drivers

## 1. Introduction

Are men more likely to drive than women, even when they are not the safest drivers? Is driving still considered to be a man's prerogative? In this study, we examine two aspects of gendered driving stereotypes – the likelihood of driving and the comparative safety of the driver – taking into account the age group of the perceived driver.

Although gender roles are becoming somewhat more blurred (Abrams, 2012; Basar & Demirci, 2018; Nesterova & Baranov, 2017; Parker et al., 2017; Rehel, 2013; Rehel & Baxter, 2015; Solis & Hall, 2011), some differences in the way that people of different genders are perceived remain remarkably persistent. One such domain in which men and women appear to be appraised differently is driving.

Historically, driving has been associated with men and masculinity (Berger, 1979, 1986). Indeed, in a seminal study by Berger (1986), which looked at the origins of folklore about women as bad drivers, driving was described as being associated with masculinity from the moment when driving became widespread – when cars became affordable and mechanically accessible to common users. “Everything about the car seemed masculine, from the coordination and strength required to operate it, to the dirt and grease connected with its maintenance” (Berger, 1986, p. 257). Driving has also been connected with masculinity and manhood in various accounts, including media studies (Cohan et al., 2002), historical analyses (Boutle, 2012), and empirical inquiries (Harré & Sibley, 2007; Sibley & Harré, 2009).

The idea that anything to do with cars and car driving is masculine is learned in early childhood. Toy cars and trucks are judged to be boys' toys by children as young as 2½ years old (Conry-Murray & Turiel, 2012; Ruble et al., 2006). Driving and masculinity have been linked to such an extent that the development of autonomous vehicles, which deprives men of the necessity to drive, has been described as an affront to masculinity, especially when it comes to trucks (Collingwood, 2018).

Even though driving has been seen as a man's prerogative, women have always shown interest in driving as well, notwithstanding that female drivers have been denigrated since their earliest attempts to drive. Even though men have been more likely to drive than women for most of the automotive history, the proportion of women who drive has been steadily increasing in each generation. In the United States, in 1963, women constituted 39.6% of all drivers, while they made up 50.5% of all drivers in 2013 (Sivak, 2015).

Even though women have caught up with men in terms of number of drivers, male and female drivers differ in the way they operate a vehicle. One of the differences between male and female driving patterns stems from a general difference in proneness to thrill-seeking. A large body of research demonstrates that masculinity is associated with risk-taking (Apalkova et al., 2018; Bem, 1981; Gana, 1995; Granie, 2013; Vdovichenko, 2014). Women are often stereotyped as frightful and uncertain, while men are seen as more aggressive and daring (Braly et al., 2018; Broverman et al., 1972; M. B. Harris & Miller, 2000; Locksley et al., 1980).

In addition to the general tendency to take higher risks, the association between masculinity and risk-taking has also been clearly shown in the context of driving (Rezapur-Shahkolai et al., 2020). Male drivers expose themselves to extra risks of injuries when driving (Gonzalez-Sanchez et al., 2018; Lucas et al., 2017; Massie et al., 1995). They express lower motivation to comply with traffic laws than women (Yagil, 1998). As a consequence of their risk-taking driving behaviours and violations of traffic rules, men comprise three out of every four fatalities on the road (World Health Organization, 2002, 2020), significantly exceeding traffic mortality rates of women even when the differences in mileage driven are taken into account (Fu & Wilmot, 2008; Massie et al., 1995; NHTSA, 2018).

In seminal studies on gender and risky driving behaviours by Özkan and Lajunen (2005; 2006), drivers were administered questionnaires that measured their levels of femininity and masculinity, as

well as an assessment of their driving behaviours. Low levels of femininity and high levels of masculinity were associated with aggressive traffic violations and the highest levels of accident involvement (Ozkan & Lajunen, 2005). Male sex predicted the number of both active and passive accidents, while high scores on femininity had a positive correlation with safety skills on the road (Özkan & Lajunen, 2006).

In addition to gender, another factor that influences one's propensity for risky behaviour is age. Research has shown that proneness to taking risks varies greatly across age groups (Cosenza et al., 2017; Spurrier & Blaszczynski, 2014). In a study by Hatfield and Fernandes (2009), participants recruited outside the premises of motor vehicle registries completed measures of risk perception, risky driving, and general risk attitude. Hatfield and Fernandes (2009) observed that young drivers, more so than mature drivers, had a high propensity for taking risks that could lead to crashes, expressed lower aversion to risk, and displayed strong motives for risky driving, such as sensation seeking, excitement, seeking of prestige, and peer pressure. Similarly, younger drivers were found to underestimate risk and to consider risk personally irrelevant. Young drivers, on average, were also found to be more likely to value thrill and adventures than to be afraid of the threat associated with risky driving (Hatfield et al., 2014).

As discussed above, being male and being young are two characteristics that independently predict risk-taking in driving. It is thus not surprising that the combination of the two characteristics creates a specific profile of a driver particularly prone to risk-taking behaviour. Compared with other demographic groups, young male drivers have been shown to use seat belts least frequently (Jonah & Dawson, 1987); engage in more violations, speeding, and aggressive driving (Jonah, 1990); and have a tendency to take more risks (Deery, 1999). Moreover, they are overrepresented in vehicle collision statistics (Blockey & Hartley, 1995; Doherty et al., 1998).

In a study on the subjective ratings of one's ability to drive based on the comparative optimism framework, researchers have revealed that middle-aged experienced male and female drivers feel that they are better drivers than other age groups (young and older) on average, while younger drivers estimate that they are better than older drivers (Gosselin et al., 2010). Older drivers also expressed that they are better drivers on average than younger drivers. The subjective assessment of one's ability to drive seems to be largely influenced by the age and experience of the drivers, but the interaction between gender and age was not considered in that study. Indeed, age-based and gender-based driving stereotypes have rarely been examined in an interactive way regardless of the methodology used.

Evidently, the social image of male and female drivers, as well as that of drivers of young and old age, cannot be applied to every single individual driving a car, and one's driving ability or behaviour cannot be perfectly predicted by gender or age alone. Yet gendered driving stereotypes as well as age-based driving stereotypes are largely recognized. Pravossoudovitch et al. (2015) developed a questionnaire that specifically assessed participants' endorsement of stereotypes that male drivers are skillful and that female drivers are compliant with traffic rules, courteous behind the wheel, and avoidant of risk when driving. Answers to that questionnaire revealed that female and male participants agreed that female drivers are courteous behind the wheel and compliant with traffic rules. When it came to other aspects of driving, men evaluated women's driving skills lower than women did, while women assessed the positive quality of risk avoidance of female drivers higher than men did. The authors suggested that a limitation of their study was that they did not specify the age of the imaginary drivers, which can contribute to the perception of stereotypes about drivers from different demographic groups (Pravossoudovitch et al., 2015).

In this article, we will build on the study conducted by Pravossoudovitch et al. (2015) and address this limitation by specifying both gender and age of individuals in scenarios in which two

imaginary drivers are involved. In addition to that, although we know that certain behaviours (e.g., risk-taking, unskillful driving) are likely to be attributed to drivers of certain ages and genders, it remains unknown whether these factors have a combined impact on the social perception of who is more likely to be driving a vehicle, a decision that is being made in a context in which either one of two individuals could be the potential driver of a vehicle. If a man is always seen as more likely to drive than a woman, this would confirm that driving a motor vehicle is still considered to be a task mainly associated with men. In that case, this study can also explore whether the reason that people associate driving with manliness is that they think that men are safer drivers than women. As the relationship between how likely someone is seen as a driver and how safe a driver they are perceived to be may be affected by the age of the driver, the comparisons are performed across different age groups, as suggested in Pravossoudovitch et al. (2015).

This was explored through the use of a novel approach in which participants had to consider both age and gender when estimating who, among two potential drivers, would be driving a car. After the participants imagined pairs of drivers of different age and gender combinations approaching a car (e.g., an older man or a young woman), they were told to estimate which person in the pair is more likely to take the steering wheel and which person in the pair is the safer driver.

Based on previous research that showed a strong association between men and driving a car, we expected that men would be rated as more likely to drive than women. We also explored the comparative likelihood of driving for all other age and gender combinations. We then looked at whether stereotyped opinions about the safety of the driver could be the reason why people think that drivers from some demographic groups are more likely to drive. Additionally, we wanted to see how very specific combinations of demographic characteristics affect people's opinions on the likelihood of driving and the comparative safety of the drivers. Specifically, the combination of age and gender could

be most relevant for the group of young male drivers and the group of old female drivers. Since proneness to risk-taking is associated with youth and being male, we hypothesized that young male drivers would be rated as less safe when compared with other drivers. Since driving is associated with masculinity and older women are more likely to adhere to traditional gender roles and thus be less masculine, we hypothesized that older women would be rated as less likely to drive and less safe when compared with other drivers. This exploration allows us to clarify whether differential perception regarding safety could be a likely explanation for the driver designation.

## 2. Methods and Materials

### 2.1. Participants.

The sample consisted of 218 participants (139 women;  $M_{\text{age}} = 22.39$ ,  $SD_{\text{age}} = 5.91$ ), including both the University of Ottawa psychology undergraduate participant pool and the general public (see Table 1). The participants from the undergraduate participant pool were compensated with a small credit towards their final grade in an introductory psychology course, while the participants from the general public who enrolled in the study were entered in a draw to win a gift card. All participants gave their informed consent before participating in the study in compliance with the University of Ottawa research ethics guidelines.

Two questions designed to prevent and detect inattentive responses were presented at random positions within the questionnaire. One of them requested the participants to specifically select the answer “either one is equally likely” on the presented scale. The other asked the participants to agree or disagree with the statement “It takes me 50 minutes a day to brush my teeth.” Originally, 241 participants signed up to complete the online survey. All the data from participants who failed on either

one of the questions (missing an answer, selecting anything other than “either one is equally likely,” or agreeing with the statement about brushing teeth for 50 minutes) were removed, resulting in the exclusion of 23 participants.

**Table 1***Sociodemographic Characteristics of the Participants*

| Baseline characteristic                                 | Undergraduate pool; women<br>( <i>N</i> = 130) | Undergraduate pool; men<br>( <i>N</i> = 73) | General public; women<br>( <i>N</i> = 9) | General public; men<br>( <i>N</i> = 6) | Total<br>( <i>N</i> = 218) |
|---------------------------------------------------------|------------------------------------------------|---------------------------------------------|------------------------------------------|----------------------------------------|----------------------------|
| <b>Age, <i>n</i> (%)</b>                                |                                                |                                             |                                          |                                        |                            |
| 16–20 years                                             | 86 (66.2%)                                     | 43 (58.9%)                                  | 1 (11.1%)                                | 1 (16.7%)                              | 131 (60.1%)                |
| 21–30 years                                             | 42 (32.3%)                                     | 26 (35.6%)                                  | 3 (33.3%)                                | 3 (50%)                                | 74 (33.9%)                 |
| 31+ years                                               | 2 (1.6%)                                       | 4 (5.5%)                                    | 5 (55.5%)                                | 2 (33.3%)                              | 13 (6%)                    |
| <b>Kilometers (miles) driven per week, <i>n</i> (%)</b> |                                                |                                             |                                          |                                        |                            |
| 0–20 km (0–12 miles)                                    | 55 (42.3%)                                     | 29 (39.7%)                                  | 0 (0%)                                   | 1 (16.7%)                              | 85 (39%)                   |
| 21–50 km (13–31 miles)                                  | 34 (26.2%)                                     | 17 (23.3%)                                  | 2 (22.2%)                                | 3 (50.0%)                              | 56 (25.7%)                 |
| 51–100 km (32–62 miles)                                 | 15 (11.5%)                                     | 13 (17.8%)                                  | 5 (55.6%)                                | 2 (33.3%)                              | 35 (16.1%)                 |
| Over 100 km (over 62 miles)                             | 26 (20%)                                       | 14 (19.2%)                                  | 2 (22.2%)                                | 0 (0%)                                 | 42 (19.3%)                 |
| <b>Times driven per week, <i>n</i> (%)</b>              |                                                |                                             |                                          |                                        |                            |
| Less than one                                           | 17 (13.1%)                                     | 13 (17.8%)                                  | 0 (0%)                                   | 1 (16.7%)                              | 31 (14.2%)                 |
| One or two                                              | 15 (11.5%)                                     | 16 (21.9%)                                  | 0 (0%)                                   | 0 (0%)                                 | 31 (14.2%)                 |
| Three or four                                           | 37 (28.5%)                                     | 14 (19.2%)                                  | 2 (22.2%)                                | 1 (16.7%)                              | 54 (24.8%)                 |
| Five or six                                             | 26 (20%)                                       | 17 (23.3%)                                  | 4 (44.4%)                                | 3 (50.0%)                              | 50 (22.9%)                 |
| Every day                                               | 35 (26.9%)                                     | 13 (17.8%)                                  | 3 (33.3%)                                | 1 (16.7%)                              | 52 (23.9%)                 |

*Note.* Complete data set is available on the Open Science Foundation page for this project (Kadulina et al., 2021).



## 2.2. Materials and procedure

The participants were presented with very brief scripts of scenarios (see Figure 1) in which they were required to imagine a dyad approaching a car. The people in the dyad differed in terms of their gender and/or age (male or female; young, middle-aged, or old). Each dyad represented two out of six possible different drivers (young men, middle-aged men, old men, young women, middle-aged women, old women) resulting in 15 possible comparisons (e.g., young women vs. young men, young women vs. middle-aged men, young women vs. older men, young women vs. middle-aged women, and so on). See Table 2 for the list of all scenarios.

These imagined scenarios were followed by two questions (see Figure 1 for an example). One question asked participants to estimate which person in the dyad was more likely to take the wheel (*likelihood of driving*). The other question asked which person in the dyad was more likely to be a safer driver (*safety of the driver*). The order of questions was randomized (*likelihood of driving* and *safety of the driver* questions could appear first or second following each scenario). The participants answered each question using a seven-point Likert scale that ranged from complete certainty that one of the two people would take the wheel to complete certainty that the other person would take the wheel. Analogously, the participants answered questions about which of the two drivers is the safer one in their opinion, ranging from complete certainty that one of the two drivers would be the safer one to complete certainty that the other driver would be safer. At the center of the scale (4), the drivers were estimated as equivalent: "either one is equally likely to drive" or "either one is equally safe." In the example of the first question illustrated in Figure 1, if the average of the participants' ratings was significantly higher than 4, it would indicate that the middle-aged woman, rather than a younger man, was rated as more likely to take the wheel on average. Similarly, a mean value significantly higher than 4

on the second question would indicate that the participants rated the middle-aged woman as a safer driver than the younger man.

The questions were counterbalanced to ensure that each gender was presented on either end of the scale an approximately equal number of times (e.g., women were listed first in eight comparisons, and men were listed first in the remaining seven comparisons). Similarly, questions were also counterbalanced to ensure that each age group was presented on either side of the scale an equal number of times (five times each). Questions about each one of the 15 comparisons were presented in random order by the online survey program Qualtrics.

**Figure 1**

*Examples of Comparison Questions and Their Associated Response Scales*

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Imagine two people: a younger man (in his late teens or early 20s) and a middle-aged woman (in her 40s).

1. Which one of them is more likely to take the wheel?

- |                                                             |                                                            |                                                            |                                                                |                                                                      |                                                                         |                                                                       |
|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <input type="checkbox"/> Certainly<br>the<br>younger<br>man | <input type="checkbox"/> Most likely<br>the younger<br>man | <input type="checkbox"/> Probably<br>the<br>younger<br>man | <input type="checkbox"/> Either<br>one is<br>equally<br>likely | <input type="checkbox"/> Probably<br>the<br>middle-<br>aged<br>woman | <input type="checkbox"/> Most<br>likely the<br>middle-<br>aged<br>woman | <input type="checkbox"/> Certainly<br>the<br>middle-<br>aged<br>woman |
|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|

2. Which one of them do you think is a safer driver?

- |                                                             |                                                            |                                                            |                                                                |                                                                      |                                                                         |                                                                       |
|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <input type="checkbox"/> Certainly<br>the<br>younger<br>man | <input type="checkbox"/> Most likely<br>the younger<br>man | <input type="checkbox"/> Probably<br>the<br>younger<br>man | <input type="checkbox"/> Either<br>one is<br>equally<br>likely | <input type="checkbox"/> Probably<br>the<br>middle-<br>aged<br>woman | <input type="checkbox"/> Most<br>likely the<br>middle-<br>aged<br>woman | <input type="checkbox"/> Certainly<br>the<br>middle-<br>aged<br>woman |
|-------------------------------------------------------------|------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
-

## 2.2. Data Analysis

Before undertaking the main data analyses, the variables were winsorized, with outliers “tucked in” – replaced with the nearest valid value. Winsorizing is a common way of addressing outliers and has been shown to improve the quality of the data (Dixon, 1980). An outlier was defined as an observation that was more than 2.5 standard deviations (SD) away from the mean for that variable. Outlying observations were replaced with a value that was 2.5 SD away from the mean. A total of 60 outlying observations were addressed according to this method, representing 1.5% of the data.

The mean ratings of the participants' subjective estimates of the likelihood of taking the wheel and the perceived drivers' safety were compared with the middle value of 4 (i.e., “either one is equally likely to drive” or “either one is equally safe”) using the two-tailed one-sample *t* test for all comparisons. In total, 15 one-sample *t* tests were employed to determine which responses were statistically significantly different from 4 for each of the two dependent variables that were computed. Some variables were reverse-scored prior to analysis to improve the clarity of presentation.

### 3. Results

#### 3.1. Subjective Ratings of the Likelihood of Driving

In accordance with our prediction, men in each age group were rated as more likely to drive than women of the same age (see Table 2). As also predicted, men from the middle-aged group dominated all other comparisons, with the biggest difference appearing in the comparison of middle-aged men and older women. Middle-aged men were rated as the most likely to drive when compared with every other demographic group.

Middle-aged women were also rated as more likely to take the wheel when approaching a car with a person from most demographic groups, middle-aged men being the only exception.

Young men, in addition to being rated as more likely to drive than young women, as described above, were rated as more likely to drive than older men and older women.

Finally, young women were rated as more likely to drive than older women but less likely to drive than older men. Older women stood out as being the least likely to drive in every comparison (see Table 2).

**Table 2***Participants' Subjective Ratings of the Likelihood of Taking the Wheel*

| Group             | Compared with     | <i>M</i> | <i>SD</i> | <i>t</i> | <i>p</i> * | <i>d</i> | Direction         |
|-------------------|-------------------|----------|-----------|----------|------------|----------|-------------------|
| Middle-aged men   | Young women       | 2.82     | 1.03      | -16.91   | <.001      | -1.15    | Middle-aged men   |
|                   | Young men         | 3.14     | 1.22      | -10.42   | <.001      | -0.7     | Middle-aged men   |
|                   | Middle-aged women | 3.05     | 0.98      | -14.37   | <.001      | -0.97    | Middle-aged men   |
|                   | Old men           | 2.78     | 1.08      | -16.67   | <.001      | -1.13    | Middle-aged men   |
|                   | Old women         | 2.52     | 1.06      | -20.55   | <.001      | -1.4     | Middle-aged men   |
| Middle-aged women | Young men         | 3.44     | 1.30      | -6.35    | <.001      | -0.43    | Middle-aged women |
|                   | Young women       | 3.20     | 1.13      | -10.47   | <.001      | -0.71    | Middle-aged women |
|                   | Old men           | 3.66     | 1.39      | -3.65    | <.001      | -0.24    | Middle-aged women |
|                   | Old women         | 2.78     | 0.99      | -18.25   | <.001      | -1.23    | Middle-aged women |
| Young men         | Young women       | 3.27     | 1.28      | -8.43    | <.001      | -0.57    | Young men         |
|                   | Old men           | 3.67     | 1.45      | -3.41    | 0.001      | -0.23    | Young men         |
|                   | Old women         | 3.20     | 1.34      | -8.86    | <.001      | -0.6     | Young men         |
| Young women       | Old men           | 4.23     | 1.37      | 2.52     | 0.013      | 0.17     | Old men           |
|                   | Old women         | 3.31     | 1.26      | -8.09    | <.001      | -0.55    | Young women       |
| Old men           | Old women         | 2.91     | 1.02      | -15.68   | <.001      | -1.07    | Old men           |

*Note.* *df* = 217. Mean rating values indicate participants' mean rating, on a scale of 1 to 7, of which person in the comparative scenario is more likely to take the wheel. That value is compared with 4 (the middle rating, indicating that either person in the scenario is equally likely to take the wheel) using the two-tailed *t* test. Direction indicates who was rated as more likely to take the wheel.

\* Exact *p* values could not always be presented within the format of this table because of the limited number of digits allowed following zero. Exact values, as well as the raw data and syntax that allow the computations to be reproduced, are available at Open Science Foundation [https://osf.io/4qapz/?view\\_only=97007bcf3e194f2d9b5b38e1bed6ad2c](https://osf.io/4qapz/?view_only=97007bcf3e194f2d9b5b38e1bed6ad2c).

### 3.2. Subjective Ratings of Drivers' Safety

When men were compared with women in terms of the participants' subjective perceptions of their driving safety, middle-aged men were rated as the safer drivers in each dyad, except in the comparison with middle-aged women, in which the difference between the two demographic groups was not statistically significant (see Table 3). Apart from the comparison with middle-aged men, as reported above, middle-aged women were rated as being safer in all other dyads.

In comparisons involving the younger group of drivers, young men were rated as less safe drivers than young women. In contrast, young men were rated as safer drivers in comparison with older women, but there was no significant difference in the participants' subjective perception of driving safety in the comparison involving young men versus older men.

Similarly, no significant difference was found in the participants' subjective perception of driving safety in the pairing of young women versus older women. However, young women were rated as safer drivers in comparison with older women. In their own age group, older women were also deemed significantly less safe than older male drivers. As specified in all the comparisons detailed above, older women were rated as the least safe drivers in every comparison (see Table 3).

**Table 3***Participants' Subjective Ratings of Drivers' Safety*

| Group             | Compared with     | <i>M</i> | <i>SD</i> | <i>t</i> | <i>p</i> * | <i>d</i> | Whom participants rated as safer |
|-------------------|-------------------|----------|-----------|----------|------------|----------|----------------------------------|
| Middle-aged men   | Young men         | 2.73     | 1.08      | -17.26   | <0.001     | 1.18     | Middle-aged men                  |
|                   | Young women       | 3.1      | 1.13      | -11.73   | <0.001     | 0.8      | Middle-aged men                  |
|                   | Middle-aged women | 3.88     | 1.14      | -1.61    | 0.109      | 0.11     | No difference                    |
|                   | Older men         | 2.99     | 0.98      | -15.33   | <0.001     | 1.03     | Middle-aged men                  |
|                   | Older women       | 2.97     | 0.96      | -15.7    | <0.001     | 1.07     | Middle-aged men                  |
| Middle-aged women | Young men         | 3.02     | 1.2       | -12.05   | <0.001     | 0.82     | Middle-aged women                |
|                   | Young women       | 3.26     | 1.19      | -9.18    | <0.001     | 0.62     | Middle-aged women                |
|                   | Older men         | 3.21     | 1.13      | -10.4    | <0.001     | 0.7      | Middle-aged women                |
|                   | Older women       | 2.76     | 1.02      | -17.94   | <0.001     | 1.22     | Middle-aged women                |
| Young men         | Young women       | 4.21     | 1.35      | 2.3      | 0.022      | -0.16    | Young women                      |
|                   | Older men         | 3.94     | 1.35      | -0.7     | 0.483      | 0.04     | No difference                    |
|                   | Older women       | 3.47     | 1.49      | -5.26    | <0.001     | 0.36     | Young men                        |
| Young women       | Older men         | 3.89     | 1.33      | -1.22    | 0.224      | -0.08    | No difference                    |
|                   | Older women       | 3.73     | 1.23      | -3.26    | 0.001      | 0.22     | Young women                      |
| Older men         | Older women       | 3.74     | 0.97      | -3.92    | <0.001     | 0.27     | Older men                        |

*Note.* Mean rating values indicate participants' subjective mean rating, on a scale of 1 to 7, of which person in the comparative scenario is the safer driver. That value is compared with 4 (the middle rating, indicating that either person in the scenario is an equally safe driver) using the two-tailed *t* test.

\* Exact *p* values could not always be presented within the format of this table because of the limited number of digits allowed following zero. Exact values, as well as the raw data and syntax that allow the computations to be reproduced, are available at Open Science Foundation [https://osf.io/4qapz/?view\\_only=97007bcf3e194f2d9b5b38e1bed6ad2c](https://osf.io/4qapz/?view_only=97007bcf3e194f2d9b5b38e1bed6ad2c).



### 3.3. Correlations between Driving Likelihood and Estimated Safety

Pearson product-moment correlation coefficients were computed to estimate the relationship between the subjective ratings of drivers' safety and the likelihood that they will take the wheel (Table 2). The results revealed a statistically significant but low positive association between the two measures in all dyads except one. In the dyad in which young men were compared with young women, the correlation between the subjective rating of drivers' safety and the likelihood that they will take the wheel was not significant. The four highest correlations between the likelihood of driving and the estimated safety of the driver included drivers from the older cohort: The highest correlation was found when middle-aged men were compared with old men, and the second-highest correlation was obtained when middle-aged men were compared with old women, followed by young men compared with old men and middle-aged women compared with old men (see Table 4).

**Table 4**

*Means and Pearson Product-Moment Correlation Coefficients Between Participants' Subjective Ratings of the Safety and Likelihood of Taking the Wheel, for Each Dyadic Comparison*

| Comparison                            | Likelihood<br>(M) | Safety<br>(M) | Pearson<br>correlation | <i>p</i> (2-tailed) |
|---------------------------------------|-------------------|---------------|------------------------|---------------------|
| Middle-aged men vs. young men         | 3.14              | 2.73          | .338                   | <0.001              |
| Middle-aged men vs. young women       | 2.82              | 3.10          | .360                   | <0.001              |
| Middle-aged men vs. middle-aged women | 3.05              | 3.88          | .376                   | <0.001              |
| Middle-aged men vs. old men           | 2.78              | 2.99          | .447                   | <0.001              |
| Middle-aged men vs. old women         | 2.52              | 2.98          | .427                   | <0.001              |
| Young men vs. young women             | 3.27              | 4.21          | -.051                  | 0.455               |
| Young men vs. middle-aged women       | 4.56              | 4.98          | .274                   | <0.001              |
| Young men vs. old women               | 3.20              | 3.47          | .221                   | 0.001               |
| Young men vs. old men                 | 3.67              | 3.94          | .406                   | <0.001              |
| Old men vs. young women               | 3.77              | 4.11          | .339                   | <0.001              |
| Old men vs. middle-aged women         | 4.34              | 4.79          | .418                   | <0.001              |
| Old men vs. old women                 | 2.91              | 3.74          | .298                   | <0.001              |
| Young women vs. middle-aged women     | 4.80              | 4.74          | .388                   | <0.001              |
| Young women vs. old women             | 3.31              | 3.73          | -.046                  | .496                |
| Middle-aged women vs. old women       | 2.78              | 2.76          | -.195                  | .004                |

*Note.* Exact *p* values could not always be presented within the format of this table because of the limited number of digits allowed following zero. Exact values, as well as the raw data and syntax that allow the computations to be reproduced, are available at Open Science Foundation [https://osf.io/4qapz/?view\\_only=97007bcf3e194f2d9b5b38e1bed6ad2c](https://osf.io/4qapz/?view_only=97007bcf3e194f2d9b5b38e1bed6ad2c).

*Comparisons Based on Participants' Gender*

The large sample size of this study allowed us to examine whether the answers about the likelihood of driving and the perceived driving safety were different between male and female respondents. For all imagined dyads, male and female participants were in agreement about the gender of the person who was most likely to drive. When it came to a subjective estimate of safety, male and female participants disagreed in only two comparisons, and they showed a clear in-group bias (see Table 5). Indeed, when participants were asked to imagine a young man and a young woman approaching a car together, even though male and female participants agreed that the young man is more likely to take the wheel, they disagreed in their subjective estimate of the driving safety of young male and female drivers. Male participants indicated that a young man is a safer driver, and female participants indicated the opposite that a young woman is a safer driver, with a statistically significant difference between their opinions.

An analogous pattern of results was observed in the only other dyad for which male and female participants disagreed about the gender of the driver, which was revealed in the comparison of subjective beliefs about the safety of middle-aged men and women. When asked to imagine this dyad approaching a car, male and female participants again agreed that the man is more likely to drive; but when asked whether the man or the woman is a safer driver, the participants showed the same in-group bias as for the young dyad. Indeed, male participants indicated that the man was a safer driver, while female participants rated the woman as a safer driver.

In all other comparisons, male and female participants agreed about the gender of the hypothetical driver, in both comparisons of the likelihood of driving and the estimated safety.

**Table 5***Selected Comparisons by the Gender of the Participants*

| Comparison                                                                                                              | Male participants |                | Female participants |                | <i>t</i> | <i>p</i> (2-tailed) | 95% Confidence interval of the difference |        |
|-------------------------------------------------------------------------------------------------------------------------|-------------------|----------------|---------------------|----------------|----------|---------------------|-------------------------------------------|--------|
|                                                                                                                         | Mean              | Std. deviation | Mean                | Std. deviation |          |                     | Lower                                     | Upper  |
| If a young man and a young woman approach a car together, who is more likely to drive? (1 = man, 7 = woman)             | 3.16              | 1.35           | 3.32                | 1.25           | -.88     | 0.381               | -0.516                                    | 0.197  |
| Who is a safer driver, a young man or a young woman? (1 = man, 7 = woman)                                               | 3.82              | 1.34           | 4.43                | 1.32           | -3.26    | 0.001               | -0.977                                    | -0.241 |
| If a middle-aged man and a middle-aged woman approach a car together, who is more likely to drive? (1 = man, 7 = woman) | 2.97              | 0.95           | 3.09                | 0.99           | -0.86    | 0.388               | -0.390                                    | 0.152  |
| Who is a safer driver, a middle-aged man or a middle-aged woman? (1 = man, 7 = woman)                                   | 3.49              | 1.19           | 4.09                | 1.05           | -3.87    | <0.001              | -0.905                                    | -0.294 |

*Note.* *df* = 216. Exact values, as well as the raw data and syntax that allow the computations to be reproduced, are available at Open Science Foundation [https://osf.io/4qapz/?view\\_only=97007bcf3e194f2d9b5b38e1bed6ad2c](https://osf.io/4qapz/?view_only=97007bcf3e194f2d9b5b38e1bed6ad2c).

## 4. Discussion

In the last decades, even though gender roles have been shifting and becoming more egalitarian (Geiger & Parker, 2018; Horowitz et al., 2017), stereotypes about male and female drivers have remained prevalent. Based on the results of this survey, it can be concluded that driving is still considered to be a man's prerogative, since men of every age group were rated as most likely to drive when compared with women of the same age. The association with the role of a driver was the most pronounced for middle-aged men, who were rated as the most likely to take the wheel in all age and gender combinations. This observation agrees with the trend reported in the literature, in which driving is associated with men, manhood, and masculinity (Berger, 1986; Boutle, 2012; Cohan et al., 2002; Collingwood, 2018; Sibley & Harré, 2009; Terry et al., 2015).

The results also suggest that presumed driving experience may be an element that is considered while making a judgment about the likelihood of driving. Indeed, similarly to middle-aged men, middle-aged women were also perceived as very likely to drive in many of the suggested dyads. Middle-aged women were rated as more likely to take the wheel when approaching a car with a person from most other gender and age groups, middle-aged men being the only exception. Safety also seems to be associated with presumed car driving experience, with middle-aged drivers of either gender perceived as the safest drivers.

The negative stereotypes towards drivers seemed to be at their greatest strength when gender is combined with older age or lack of driving experience. Among all age and gender groups, older women were perceived as the least likely to drive. Young women were also perceived as very unlikely to take the wheel, as they were rated as less likely to drive when approaching a car with a person from any other demographic group, older women being the only exception. Conversely, young men were rated as more likely to drive when pictured in a dyad with a young woman or an older woman.

The exposed pattern of results highlights the necessity to take into account the interactive contribution of age and gender when describing the socially shared stereotypes pertaining to car drivers. Even though propensity for risk-taking has been associated with masculinity in previous research (Bem, 1981; Coquelet et al., 2019; Granie, 2013; Ozkan & Lajunen, 2005), our results indicate that participants do not associate middle-aged men with unsafe driving and view only young men as unsafe. Thus participants' perceptions of young male drivers match the actuarial information, which suggests that on average younger men are the least safe drivers of all (IIHS, 2021; Svendby & Lilleaas, 2019). Not only were young men rated as less safe than middle-aged men, but they were also associated with reduced safety when compared with almost any other demographic group, older women being the only exception.

The combination of stereotypes about older drivers with stereotypes about female drivers resulted in a particularly negative stereotype of older female drivers. Older women were stereotyped to be the least safe drivers. Combined with the finding that indicates that older women are rated as the least likely to drive, this observation suggests that the cohort of older women is perceived as having a reduced ability to safely drive a car, and a reduced likelihood of driving a car when compared with other drivers of different age groups or male drivers of the same age group.

As was just highlighted, estimates of safety only partly explained the likelihood of driving in the social context that we created in the depicted scenarios. The results of the present study indicate that the perceived likelihood of driving and the perceived safety of drivers are indeed associated with and determined by recognized stereotypes about driving as they pertain to the gender and age of the driver. When thinking about different groups of drivers (men, women, young, middle-aged, old), the participants indicated that members of demographic groups who were more likely to drive were frequently, but not always, seen as safer drivers on average. This interpretation is supported by the significant correlations between the perceived likelihood of driving and the subjective estimate of driving safety. In other words, safety is an element that might have been considered by the respondents when deciding which driver was more likely to drive, and this was especially true when a member of

the dyad was from the older age group. Indeed, the highest correlations between the likelihood of driving and the estimated safety were within dyads in which young and middle-aged drivers were compared with older drivers. Specifically, the highest correlation was in the dyad in which a middle-aged man was compared with an old man, followed by the dyad of middle-aged man versus old woman, middle-aged woman versus old man, and young man versus old man. This indicates that reduced safety is a determinant feature of the older driver stereotype, and it was particularly salient for female drivers. Here, perceived reduced safety from the older driver stereotype and perceived lower driving skills from the female driver stereotype were likely contributors to the judgments made, resulting in a particularly negative stereotype about older female drivers. However, in all cases, the estimation of who will drive was only partly based on the assumed safety of the hypothetical drivers.

In one group in particular, the association between the likelihood of driving and the perceived safety went in the opposite direction. Specifically, even though young women were rated as safer drivers in comparison with young men, they were also rated as less likely to drive the car than their male counterparts. Similarly, young women were rated as the least likely to drive in comparison with older men, even though the subjective comparative estimates between young women's and old men's safety ratings did not differ significantly. Thus, unlike in most other demographic combinations, in which the person who was rated as most likely to drive was also rated as the safer driver, when it came to young women, this pattern did not hold true. They were rated as less likely to drive the car in comparison with men of the same age and men of older age – a finding that cannot be explained by the perception of their safety as drivers. In this case, negative biases against female drivers may have overshadowed negative biases against older drivers. This finding is indicative of the multi-faceted nature of the female driver stereotype, including lower driving skills (Dontsov & Kabalevskaya, 2013; Lezotte, 2019). The nature of the differences observed indicates that the negative tone of this stereotype was probably counteracted by an assumption of more extensive driving experience based on the fact that middle-aged female drivers were considered the second safest group in all the comparisons.

Another question that we examined was whether male and female participants would respond differently to the questions of this survey, an approach similar to the one undertaken by Pravossoudovitch et al.(2015) . Unlike Pravossoudovitch et al. (2015), who found several differences between male and female participants' ratings of the stereotypes about drivers of different genders, we observed that male and female participants responded very similarly and showed high agreements in their estimates of both subjective safety and the likelihood of driving for most demographic dyads. Thus, unlike Pravossoudovitch et al. (2015), we cannot conclude from our results that the perceptions expressed in the survey were dependent on the respondent's gender. Nevertheless, when a different pattern of results was observed between male and female respondents, it agreed with the in-group bias pattern of results in Pravossoudovitch et al.'s (2015) study.

The differences in the pattern of results obtained with those observed in Pravossoudovitch et al. (2015) are not surprising, considering the differences in the methodology and dissimilarities in the questions that were asked of participants. The age of the imagined driver was not specified in the study by Pravossoudovitch et al. (2015). In our study, when the survey respondents were asked to imagine drivers of a specific age and gender, male and female respondents were more likely to agree than they did in Pravossoudovitch et al. (2015), probably because the prompt in our study evoked a combination of two stereotypes. It is not surprising, for example, that two study participants respond very differently if, when asked to imagine a male driver, one of them imagines a young male driver while the other imagines a middle-aged male driver. Specifying the age of the hypothetical driver allows clarifying the differences between beliefs about drivers from different age groups, and in our study the specificity of the evoked stereotypes revealed a frequent agreement between male and female survey respondents (Gosselin et al., 2010).

In keeping with other research on gender stereotypes and intergroup relations in general, our results showed that people have a tendency to denigrate the out-group and promote the in-group (Pravossoudovitch et al., 2015; Tajfel & Turner, 2004). When differences were found, they were similar to those found in Pravossoudovitch et al. (2015). In fact, in our study, only two questions yielded a significant difference between the opinions of male and



female participants – subjective estimates of drivers' safety for male and female drivers in the young dyad and in the middle-aged dyad. In these two comparisons, female participants indicated that female drivers were safer, and male participants indicated that male drivers were safer, for both age groups. This is similar to results found across different age groups in the comparative optimism and driving study executed by Gosselin et al. (2010). In their study, drivers of different age groups exhibited comparative optimism about their driving abilities and personal risk; they also estimated themselves as better drivers when compared with drivers of their own age group (Gosselin et al., 2010; Harré & Sibley, 2007; P. Harris & Middleton, 1994; Shepperd et al., 2002). However, the results of our study indicate that age alone was not sufficient to describe a demographic group of drivers and that gender moderates the self-perception of driving safety. Even though female participants differed from male participants in their opinion about which driver is safer in the comparison of young male and female drivers, they agreed that young male drivers are more likely to drive, even if their safety is a matter of concern. Similarly, female and male participants disagreed about the safety ratings of middle-aged female and male drivers, but they agreed once again about which driver is more likely to take the wheel, with both groups of participants indicating that a middle-aged male driver is more likely to drive when approaching a car with a middle-aged female driver. Female and male participants also agreed in their subjective rating of the safety of older drivers, with both groups believing that older women are less safe than older men and that older men are more likely to drive than older women. There was also no difference in the opinions of female and male participants when it came to all other age and gender combinations.

All else being equal, men were judged as more likely to drive. People were more likely to associate driving with men than with women and considered middle-aged men to be the safest drivers in almost all comparisons. Older drivers were judged to be the least safe drivers, especially older women. Older women as a group were the least associated with successful driving – they were rated as the least likely to drive and the least safe.

Specifying the age of the hypothetical driver in combination with gender is the distinguishing feature of the current study and is one of the ways in which it makes a novel contribution to the research on stereotypes about male and female drivers. This article is

unique in the way that it combines looking at both gender and age stereotypes. Previous research looked at stereotypes about older drivers (Joanisse et al., 2012) or about women and men (Pravossoudovitch et al., 2015). In this article, the gender and the age of the driver are combined and contrasted against other drivers of unique gender and age combinations. This allows us to explore how age, gender, and the combination of the two affect the stereotypes that people hold about drivers.

The obtained findings are in line with our predictions favoring men in terms of driving safety and their standing regarding driving a vehicle. An alternative explanation of the obtained pattern of results is the historical trend that associates car driving with males rather than with females (Berger, 1979, 1986; Lezotte, 2019). However, since this trend has changed (Lezotte, 2012, 2013) and women also drive in large numbers in developed countries (Sivak, 2015), driving should no longer be considered a man's prerogative. The reason why participants answered the way they did may reflect their use of a representativeness heuristic, in which the likelihood of an occurrence is estimated by how much it is similar, in its important features, to its previous occurrences (Kahneman & Tversky, 1972). In other words, participants estimated the likelihood that the man was going to take the wheel of the car by comparing this imagined event to existing prototypes in their mind, in which in similar events the man had usually taken the wheel of the car. According to this interpretation, participants employ an unconscious stock of dyads of drivers that they have observed in their lifetime and estimate the probability of who is more likely to drive based on the information they have been exposed to. The fact that people imagine men as more likely to drive than women does not mean that men have more rights to drive, or even that they are more motivated to drive. This judgment is simply a reflection of a shared belief of the expected outcome, but it is not necessarily what they think should happen. The pattern of results observed might reflect existing stereotypes about male and female drivers, which have a strong influence on the subjective perception of gender roles, constraining to some extent the decisions that are being made and thus putting both men and women at a disadvantage (Carlson et al., 2016, 2018; Pedulla & Thébaud, 2015; Scarborough et al., 2019).

One of the limitations of this study is the population from which the sample was drawn. Most of the participants were 1st- or 2nd-year university students. In addition to age, the biases that may have affected the results are the cultural background and years of education. This may explain why the female and male participants showed an in-group bias in their estimates of driving safety of different groups. It is also possible that this in-group bias is even stronger than in the general population. Interestingly, Gosselin et al. (2010) examined the subjective assessment of participants of different age groups and different backgrounds and found that the subjective ratings were consistent across all three age groups. Nevertheless, future studies should take into consideration the level of education and the age of participants together with cultural differences as these factors contribute to the emergence of social constructs (Degraeve et al., 2015; Pravossoudovitch et al., 2015). Future research might look into the generalizability of these results across different cultures. The pattern that was observed in this study might not be the same in other countries with more egalitarian attitudes. Conversely, the results are likely to reveal even more prejudice in countries with less egalitarian attitudes. Future research could address these limitations by evaluating the stereotypes associated with driving cross-culturally.

Additionally, the results of this study are likely to reflect the state of stereotypes about drivers only at this moment in time. Since gender roles are changing and are becoming more egalitarian, if this trend continues, stereotypes about male and female drivers may change with passing generations or even become entirely antiquated and irrelevant. Thus this article represents a record of current beliefs about different drivers, and this record might be restricted in time, which in itself is an interesting topic that could be investigated.

The results presented here are noteworthy, considering that they demonstrate how the social perception of drivers based on age and gender may control the decisions made by individuals even prior to driving a car. Using imaginary scenarios, we were able to show that these a priori age and gender expectations have an influence on who is supposed to take the responsibility to drive a car. Women are likely to refrain from driving, while men would be expected to drive more often. Knowing that female drivers are at least as safe as male drivers, and even more so than younger male drivers who tend to engage in more risky behaviours while driving, drivers of both genders should feel equally entitled to drive a car.

Research has demonstrated that the ability to drive is better preserved in drivers who drive more frequently. In younger females, this impact might be negligible as younger females who own a car will probably drive their car even in the kind of social dilemma described in our scenario. In older women, however, the impact might be more significant as they might have the tendency to let a male family member take the wheel, which is likely to result in a reduced number of driving trips at the wheel of a car. With fewer opportunities to drive, women may decide to quit driving earlier than they should as driving becomes more challenging through the years due to a lack of practice. This article is a step towards increasing the awareness of stereotypes associated with male and female drivers, which can help to address and alleviate the pressure that rigid gender roles related to driving pose on men and women.

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## CHAPTER 4

### Women Behind the Wheel:

### Stereotype Threat Does Not Affect Female Drivers

Yara Kadulina

School of Psychology

Department of Social Sciences

University of Ottawa

Ottawa, 2022

## Abstract

Stereotype threat has been posited as an explanation for a variety of phenomena, such as the inferior performance of women in math and women's lower ability to drive a vehicle. Recently, an opposing viewpoint has emerged. It questions the strength of the stereotype threat effect and argues that publication bias, as well as questionable research practices, might account for the poor reproducibility of the initial discoveries. This article describes findings that support the latter point of view, suggesting that the effect of stereotype threat on women in the context of driving may be negligible or small at best. In the first experiment, 112 women were randomly assigned to a stereotype threat or a neutral condition. They drove through six well-validated simulated scenarios. The two experimental groups were compared on a variety of validated driving indicators. The second experiment was designed as a conceptual self-replication using an improved method of inducing stereotype threat and a larger sample of participants ( $N = 250$ ). The results of the two experiments did not reveal any convincing evidence for the effects of stereotype threat. Based on these findings, combined with other studies in the recent literature that fail to find this effect, the strength of the stereotype threat effect may be put into question.

*Keywords:* stereotype threat, female drivers, driving simulator, counterstereotype

## 1. Introduction

The first study that showed the effects of gendered stereotype threat was the seminal publication by Spencer et al. (1999). In their article, the authors reported finding the effect of this threat in three different studies. In the first study, they found that in a highly selected sample of men and women, women in the stereotype threat condition underperformed on difficult math tests, but no such effect was found on easier tests. In the second study, the experimenters were able to eliminate the threat effect by highlighting to the participants that the tests they were about to undertake had not generated gender differences previously. Finally, in their third study, the authors were able to replicate the effect found in the initial study, but this time in a sample drawn from the general population. The effect size of the stereotype threat was large, generated multiple follow-up studies, and instigated several research programs on the topic of stereotype threat pertaining to gender (Bedyńska et al., 2019; Casad et al., 2019; Casad & Bryant, 2016; Harrison et al., 2020; Myers et al., 2020; Steele, 2011; Steele et al., 2002; Wheeler & Petty, 2001).

The influence of gendered stereotype threat has also been studied in regard to car driving – a domain of performance in which female and male abilities are often contrasted, with women being seen as less competent drivers (Clarsen, 2008; Dontsov & Kabalevskaya, 2013; Lezotte, 2015a; Scharff, 1992; Wajcman, 1991; Walsh, 2006, 2008, 2011; Wosk, 2003). Yeung and von Hippel (2008) examined the effect of stereotype threat on female drivers using a driving simulator as a controlled laboratory setting for inducing the threat and measuring its influence. Participants were randomly assigned to one of two conditions and shown a video of an ostensible Transportation Research Center employee, who told participants in the control condition that the purpose of the experiment was to investigate the mental processes involved in driving. Participants in the stereotype threat condition were told that the purpose of the study was to understand why men are better drivers than women. Additionally, the message

conveyed that the task that the participants were about to engage in was specifically designed to determine why there was a gender difference in driving abilities.

The participants drove through an 8.8-km-long scenario, on a rural two-lane highway without intersections. They were told to complete the route as quickly as possible while respecting the posted speed limit. Slower cars in one of the lanes forced participants to switch between lanes. Once in every 4.6 meters of distance covered, the simulator recorded the speed of the vehicle as well as the variability in the lateral position of the vehicle. This variability was defined as the mean value of the distance between the participants' cars and the lane's centerline. Until the last segment of the road, the drive was uneventful, but then a group of jaywalkers appeared and started to cross the road. The participants had a short window of 3.1 seconds to brake and avoid hitting the jaywalkers. The researchers found that the participants submitted to the stereotype threat were more likely to hit the pedestrians (59%) than the control participants (25%). Being in a stereotype threat condition did not affect driving speed or lateral position variability. No other differences between the two conditions were reported.

In the second study described in their article, the authors attempted to address the mechanism through which the stereotype threat may confer its effect by adding a task on alternating segments of the driving route. The task required the participants to listen to audio recordings of sentences containing statements about the alphabetical order of two letters, and the participants had to answer true–false questions about the veracity of the sentences. For example, a sample item was “B precedes A. AB,,” and the correct answer for this item was false. The task was extremely difficult, and the participants were able to answer correctly only 60% of the time. The participants were requested to engage in this demanding working memory task on alternating segments of the road course.

Looking at the performance of the participants when their attentional capacities were diminished by engaging in the taxing working memory task, no difference could be observed between

the stereotype threat condition and the control condition. Looking at the performance of the participants when they had their full attentional capacities available to them, the effects of stereotype threat became apparent, judging by the fact that the participants in the stereotype threat condition collided with jaywalkers significantly more often. Diminished working memory capacity or exposure to stereotype threat were similarly detrimental to the percentage of participants who struck the pedestrians. Therefore, according to Yeung and von Hippel (2008), the effect of the stereotype threat was at least as strong as the effect of executing an extremely difficult secondary task that explicitly tasked the participants' working memory while driving without threat. Considering that the effect of stereotype threat was statistically comparable to the effect of a distracting and difficult working memory task on the participants' capacity to react to an unexpected event while driving, this suggests that the effect size of stereotype threat on the performance of female participants must have been large. The authors did not find the effect on other driving parameters recorded by the simulator but concluded nevertheless that the threat induced "performance decrements" in female drivers – a conclusion based on a single event embedded in their scenario.

Using a different methodological context, Chateignier et al. (2011) also conducted a study with female drivers who were assigned to either a stereotype threat or a control condition. To induce stereotype threat, the participants were told that they will be asked to complete a task that will determine their driving abilities and could highlight the differences in driving abilities between men and women. Participants in the control condition were told that their responses will be used to develop questions for future studies. They were then asked to answer questions in response to driving-related scenes presented on the screen. The situation displayed a range of events that a driver might encounter on the road, and the participants needed to correctly answer the questions pertaining to each image. For example, the participants may be shown a situation in which one car is overtaking another car, and the participants were asked to imagine what they would do if they were in that situation. They were

given multiple answers to choose from, and the number of correct responses (out of 40) was computed. In this study, the scores of the participants tested under the stereotype threat condition were significantly lower than those of the participants assigned to the control condition (Chateignier et al., 2011).

A large effect of stereotype threat induction was also found in a more recent series of studies conducted by Moe et al. (2015). In their first study, female participants assessed in a simulator were subjected either to a stereotype threat or to a control condition. To induce stereotype threat, the women were told that the aim of the study was to detect gender differences in driving. The goal of the study was not specified to the participants in the control condition. In both conditions, two independent raters sitting on each side of a participant manually noted the mistakes while the participants drove in the driving simulator for five minutes. The possible mistakes included taking the wrong side of the road, fully crossing an intersection under a red traffic light, following the wrong direction, delays in accelerating, late braking, unmotivated stops, road edge excursions, collisions and crashes, and crossing the centerline.

Moè et al. (2015) reported that the participants exposed to the stereotype threat made twice as many mistakes as the participants in the control condition. Even though a very large difference between the results of the participants in the two conditions was already observed, the authors nonetheless hypothesized that the participants in the control condition may have been underperforming because of the inherently threatening context of driving for women. To alleviate the threat, Moe et al. (2015) introduced what they called a “stereotype boost” condition in their second study, to replace the neutral control condition. In the stereotype boost condition, the participants were given encouraging information about the driving abilities of people from their own gender group. Comparison of the results of the participants in the stereotype threat condition with those of the participants in the stereotype



boost condition revealed an even more impressive difference than in the first study. In the course of a five-minute drive in the simulator, the participants in the stereotype threat condition committed more than three times the number of mistakes than the participants in the stereotype boost condition. The findings reported in this study showed an incredibly large effect of gender-based stereotype threat on driving performance.

This study by Moe et al. (2015) had a number of important limitations. Driving performance was assessed using a 5-min driving task (in comparison to 8 km of driving in the study by Yeung and von Hippel, 2008), which is very short and may not be able to detect the range and variety of driving behaviours that would be sufficiently representative of the participant's driving ability. Instead, it may simply reflect the stress that participants felt by having to perform a task in a very unfamiliar situation while being observed by two individuals sitting on each side of the participant. The authors also neglected to use the objective data collected by the simulator. Instead, two raters subjectively noted down the mistakes that the participants made in the five minutes that they drove in the simulator. No mention was made about how the two raters were prevented from influencing each other. Since they were not separated visually or physically, noting down errors by one rater would be apparent to the other rater. Additionally, the subjective nature of scoring the driving performance may have been affected by the knowledge of the testing condition since no information about the procedures for blinding of the raters was described. Without a clear description of the procedures, potential biases of the raters cannot be excluded.

To alleviate these shortcomings, our study was designed to use a significantly elaborated sequence of scenarios in terms of the amount of time participants would be required to drive, as well as in terms of the available range of driving skills on which they would be assessed. A pre-recorded presentation of the instructions given to participants was used to eliminate any confounding factors.

Additionally, instead of a subjective rating of participants' performance, data collection was performed by the simulator, and automation was used to extract the validated driving outcomes from the output.

To improve the generalizability of the obtained findings and to make the driving assessment more realistic, the more extensive driving assessment that was used in our study examined parameters of vehicle positioning, velocity, and collisions. Vehicle positioning variables included the number of centerline crossings, the number of road edge excursions, the percentage of time spent driving out of lane, and the percentage of distance spent driving out of lane. Velocity variables included the number of speed exceedances, the time in seconds that it took to complete a scenario, the percentage of time spent driving over the speed limit, and the percentage of distance spent driving over the speed limit. Collision variables included the total number of collisions, the number of off-road accidents, and the number of pedestrians hit.

We hypothesized that women under stereotype threat, compared with women in the control condition, would have a higher total number of collisions and would commit more driving errors related to vehicle positioning. The secondary hypothesis was bi-directional. Based on the earlier literature, we expected that women under the stereotype threat condition would drive differently from women in the control condition, but whether they would drive faster or slower could not be predicted from prior research, because no prior research has identified the direction in which the speed would change under stereotype threat. Thus, we hypothesized that in addition to the differences in collisions and vehicle positioning, other differences would be found between the two conditions in the variables related to velocity, including the number of speed exceedances, the percentage of distance spent speeding, and the percentage of time spent speeding; but the nature of the differences was not specified in advance for speed-related variables. These enhanced driving performance assessment procedures were implemented to elaborate and extend the previous research and to make it more generalizable.

As described below, after the effect was not found with the planned number of participants in Experiment 1, we doubled the number of participants to enhance the statistical power to detect the difference. When the effect was still not found, we conducted Experiment 2, in which we quadrupled the number of participants, enhanced the induction of the stereotype threat condition, and alleviated the potential stereotype threat in the control condition.

## 2. Experiment 1

### 2.1. Method

#### *Sample Size Planning*

Some of the most prominent and relevant publications on the topic of stereotype threat were used to estimate the sample size that would be required to obtain the effect. In Spencer et al. (1999), the effect was found in the first study, which had 56 participants with a 2 x 2 design (approximately  $N = 14$  per cell), and in the second study, which had 54 participants in a 2 x 2 design (approximately  $N = 13$  per cell). The effect of stereotype threat was also found in the third study, which had 67 participants and a 2 x 2 design, resulting in about 17 participants per condition. In their article, Spencer et al. (1999) did not report the most important results, such as the mean number of correct answers on the math tests, which precludes a precise calculation of the size of the effect obtained. Instead of reporting the results numerically, they presented an illustration (Figure 1 in their article) from which the reader could approximate those means. Since the means were not reported and the effect sizes could not be calculated, we used this seminal publication on stereotype threat as just the first estimate in planning

our sample sizes. Spencer et al. (1999) provided us with enough information to surmise that it was possible to observe the effects of stereotype threat with sample sizes ranging between 13 and 17 participants per condition, which suggests a very large effect size.

Yeung and von Hippel (2008), who were the first to investigate stereotype threat using a driving simulator, obtained evidence of the effect with a sample size of 88 participants split over two conditions in their first study. They reported that 50% of the participants in the stereotype threat condition and only 25% of the participants in the control condition had hit jaywalkers, with  $p < .01$ . In their second study, with  $N = 80$  and a  $2 \times 2$  design, the authors also claimed evidence for stereotype threat based on the fact that the  $p$  value equaled exactly .05. Finding evidence of a stereotype threat effect with those sample sizes also suggests a large effect size.

It was the most recent study looking specifically at the effect of stereotype threat in a driving simulator (Moè et al., 2015) that provided all the information necessary for calculating the effect size. In this study, the effects of stereotype threat were found with a sample of 80 women in the first experiment, with women in the stereotype threat condition making more mistakes ( $M = 6.50$ ,  $SD = 3.94$ ) than those in the control condition ( $M = 3.27$ ,  $SD = 2.97$ ),  $t(78) = 4.16$ ,  $p < .001$ . According to the authors, the “Cohen  $d$  is .84: a large effect.” However, it is worth indicating that our own recalculation of their effect size based on the information about means and standard deviations provided in their article leads to a Cohen  $d$  value of .93, which is even larger than the one computed by the authors (Cohen, 1988; Stangroom, 2021). However, if we accept the authors’ smaller Cohen  $d$  of .84 in planning the sample size for our study, the conservative minimum total sample size required to achieve 80% power would be 48 participants (24 per group) for a two-tailed hypothesis and 38 participants (19 per group) for a one-tailed hypothesis (Abramowitz & Stegun, 1965; Soper, 2021; Stangroom, 2021).

In their second experiment, 70 women were assigned either to the stereotype threat or to the stereotype boost condition. The participants in the stereotype threat condition made more mistakes ( $M = 8.29$ ,  $SD = 3.17$ ) than those in the stereotype boost condition ( $M = 2.77$ ,  $SD = 2.16$ ),  $t(68) = 8.50$ ,  $p < .001$ . The authors reported their calculation of Cohen  $d = 1.42$ , which, according to our own calculations, was again an underestimate. The value should instead be 2.03, an even greater effect size (Stangroom, 2021). Either one of the calculations indicates an extremely large effect. With an effect size suggested by the authors of  $d = 1.42$ , the minimum total sample size for a two-tailed hypothesis would be  $N = 18$  with just 9 persons per condition for a statistical power of .8 (Abramowitz & Stegun, 1965; Cohen, 1988; Soper, 2021).

Based on all this information, we initially planned a very conservative total sample size of 50 participants for Study 1. This sample size is so conservative in order to account for and counteract unforeseen differences and thus a possibly smaller effect size, considering that our study is not an exact replication of theirs. After an initial period of testing with the 50 participants that were planned, we ran the data analysis, which did not reveal significant differences between the two conditions. Therefore, we decided to increase the sample size ( $N = 115$ ) to ensure that our findings could not be explained by a lack of statistical power.

### *Driving Simulation*

The driving simulator environment was identical to that used in Joannis et al. (2013). The driving simulation program (STISIM version 3) was developed by Systems Technology Inc. (STISIM, 2021) and was installed on three Dell Dimension 9200 computers using Windows XP SP2. The driving simulation was projected via three BenQ W1060 DLP projectors (with a brightness of 2000 ANSI Lumens, a contrast ratio of 5000:1, and a dual HDMI interface with an HD resolution of 1920 x 1080) at 30 frames

per second onto three white boards, which each were 75 cm high and 90 cm wide. The projection provided a compressed field of view with a viewing angle of 180 by 135 degrees. The participants sat in a car seat 144 cm away from the projected images. The simulated drive had realistic audio effects that included acceleration and deceleration cues, such as the sounds of a motor revving up or tires braking. Instructions to the drivers (asking them to turn left or right, to change lanes, etc.) were pre-recorded to ensure that they were identical in all conditions and that they occurred at the exact same moment during the drive. The instructions were given through the speakers located behind the projection panels.

All simulated data from the scenarios were collected through the STISIM3 system. The system performs the preliminary data processing, supplying a text output for each driver in each scenario, which included a summary of variables (e.g., the total number of crashes, the total number of speed exceedances) that were analysed in this study. Examples of raw .txt data files are available on the Open Science Framework (OSF) public page for this project at the link provided in the references (Kadulina & Gagnon, 2021).

### *Simulated Driving Scenarios*

The participants were asked to complete six different simulated driving scenarios with short breaks in between. Videos of completed scenarios being driven through are available on the OSF page for this project. The first scenario was designed for training purposes and was not processed in the data analysis. The remaining scenarios included a wide range of events that assessed a variety of driving skills. Five of these scenarios were previously validated as being able to detect various driving behaviours comparable to those observed in real life (Maxwell et al., 2020). The last scenario was inspired by Yeung and Von Hippel (2008) and was previously effectively used in another study on stereotype threat, with older drivers (Joanisse et al., 2013).

Scenario 1, called “Orientation,” involved getting familiar with the controls of the simulator and was employed to acclimate the participants to the simulated driving environment. Scenario 2, dubbed “Construction,” was a scenario in which the participants were asked to drive through busy construction zones delimited by cones, with a gradually increasing level of difficulty (the delimited road got narrower, and the turns became sharper). Scenario 3, “Orientation to Turns” or “Turns,” involved making sharp turns at intersections in the simulated environment. In Scenario 4, called “Gaps,” the participants were asked to make left turns when it was safe to do so, through traffic in the oncoming lane (i.e., when there was a large enough gap between the oncoming cars). Scenario 5, “Highway Merging,” involved driving on various highways, switching lanes, and using on-ramps and off-ramps. All these scenarios have been validated and are described in detail in Maxwell et al. (2020). Finally, Scenario 6, “Unexpected Events,” was added to imitate the unexpected events described in Yeung and Von Hippel (2008) and Joanisse et al. (2013). This scenario involved measuring the driver’s ability to avoid unexpected dangerous road events, with other drivers “cutting off” the participant’s way, running red lights, or suddenly driving in the oncoming lane toward the participant.

### *Participants*

One hundred fifteen women aged between 17 and 44 ( $M = 19.5$ ,  $SD = 2.4$ ) took part in the study. Participants were recruited through the Integrated System of Participation in Research at the University of Ottawa. All participants were required to hold a valid driver’s license. They gave their formal consent prior to testing in compliance with the University of Ottawa Research Ethics Board requirements. The participants were randomly assigned either to the stereotype threat or to the neutral condition.

### *Materials: Induction of the Stereotype Threat*

Prior to the simulated driving task, the participants were asked to watch a video clip that, as they were told, would provide them with instructions about how to proceed in the experiment. In this video, among other instructions, the director of the laboratory explained a fictional objective of the study. The participants in the stereotype threat condition were told that the objective of the study was to learn why female drivers are less efficient and less competent than male drivers. The participants in the neutral condition were told that the objective of the study was to observe driving reactions at the wheel in the context of a driving simulator to determine whether they resemble those on the road, thus checking how well the simulator can approximate realistic driving behaviours. Scripts for the condition induction videos can be accessed at the OSF for this project.

### *Procedure*

Simulator testing took place in the University of Ottawa Cognitive Aging and Driving Lab. The participants completed a screening questionnaire and made an appointment online through the Integrated Participation in Research System. Upon arrival in the laboratory, they were greeted by a female experimenter. After signing a consent form, they proceeded to the simulator room and were seated in the driver's seat. They then watched the condition induction video and completed an orientation circuit, which allowed them to practice driving in the simulator and included familiarization with the way the pre-recorded auditory instructions were given through the speakers. Following that, the participants drove through the five scenarios while being monitored for symptoms of simulator sickness. The simulation was stopped when the participants completed all the scenarios or if they exhibited significant simulator sickness symptoms. Next, the participants were debriefed about the real



nature of the study and were given the choice to withdraw from the study or to sign a second consent form indicating their willingness to retain their data in the study. None of the participants withdrew their original consent. Each testing session lasted over one hour.

### *Sample Attrition*

The participants were monitored for simulator sickness discomfort (car-sickness-like symptoms). If they reported significant symptoms, they were thanked for their participation and were not required to continue driving. The use of driving simulation in research is known to generate simulator sickness syndrome in some participants. The symptoms could appear at different moments during the assessment depending on the participant's susceptibility to such a condition, as well as the nature of the drive (the number and degree of turns, the number of intersections, etc.). The occurrence of such symptoms was closely monitored, and some participants could not complete all the scenarios. Data for the last three scenarios were missing for one participant, data for the last two scenarios were missing for an additional six participants, and two participants failed to complete the last scenario. Some data were also not recorded because of a technical malfunction of the software. A total of nine participants had one scenario out of six failing to operate normally. Lastly, due to an experimenter error, the data of two scenarios were missing for two participants. A total of 95 (out of 115) participants completed all six scenarios, and the majority of the other participants completed most scenarios. The data of the participants were included in the analysis only if they had fully completed a scenario.

Considering the initial sample size, the attrition rate is well within the range of attrition rates observed in other simulator studies (Mullen et al., 2010). The participants for whom some data were missing were compared with the participants who completed all scenarios with respect to several

characteristics, including driving experience, age, and the condition to which they were assigned, and the analyses performed on these variables did not yield any significant differences.

### *Data Analysis*

The summaries of the variables were created automatically by the STISIM software for each participant and scenario and produced a text file. The summaries were then extracted from the text file using a .vbs program, a copy of which is available at the OSF for this project. The program placed them into an Excel file, which allowed preliminary data processing before inputting the data into SPSS for analysis.

For each of the five scenarios, 10 variables were considered. The variables included assessed vehicle positioning, velocity, and collisions. Vehicle positioning variables included the number of centerline crossings, the number of road edge excursions, the percentage of time spent driving out of lane, and the percentage of distance spent driving out of lane. Velocity variables included the number of speed exceedances, the time (in seconds) that it took to complete the full run of a scenario, the percentage of time spent driving over the speed limit, and the percentage of distance spent driving over the speed limit. Variables from the collision category included the total number of collisions and the number of off-road accidents. Furthermore, two scenarios (“Construction” and “Unexpected Events”) had an additional variable in the collision category: the number of pedestrians hit. This resulted in a total of 52 variables that were extracted and compared.

Several ways of analysing the data were undertaken, following the logic of multiverse analysis (Steege et al., 2016). First, the data were analysed in their raw form. For the second and third ways of analysing the data, outliers were addressed through the process of winsorizing, which is a common method of improving the quality of the data by “tucking in” outliers – replacing them with a pre-determined valid value (Dixon, 1980). For the second way of analysing the data, an outlier was defined

as an observation that was more than three standard deviations away from the mean. For the third way of analysing the data, an outlier was defined as an observation that was more than two and a half standard deviations away from the mean. Since the results of the three multiverse analyses were not meaningfully different, only the results of the first analysis with the raw data are presented here. The results of the other two analyses are available in the supplemental materials on OSF.

The results of the two groups were compared using *t* tests. Since many variables were compared, a somewhat more conservative *p* value of .01 was chosen as a threshold of significance to reduce the probability of a Type 1 error, which had a higher likelihood of appearing because of the large number of comparisons.

## 2.2. Results and Brief Discussion of Experiment 1

All variables extracted from the STISIM summaries were compared across conditions and are presented in Table 1. Out of the 52 variables that were compared between the two groups, not a single variable showed a statistically significant difference with the  $p < .01$  criterion (Table 1). A weak suggestion of potential differences may be observed in the variables related to vehicle positioning in the “Construction” scenario (see Table 1), but they were not statistically significant with the pre-determined significance threshold of  $p < .01$ .

**Table 1**

Results of the Comparison Between the Participants in the Stereotype Threat and Neutral Conditions

| Scenario                           | Aspect of driving   | Variable                       | Group              |                    | <i>t</i> | <i>p</i><br>(2-tailed) |
|------------------------------------|---------------------|--------------------------------|--------------------|--------------------|----------|------------------------|
|                                    |                     |                                | Neutral            | Stereotype threat  |          |                        |
|                                    |                     |                                | Mean ( <i>SD</i> ) | Mean ( <i>SD</i> ) |          |                        |
| Construction<br>( <i>df</i> = 113) | Vehicle Positioning | Number of Centerline Crossings | 1 (0.94)           | 1.18 (0.78)        | -1.089   | 0.278                  |
|                                    |                     | Number of Road Edge Excursions | 2.9 (0.58)         | 2.7 (0.6)          | 1.771    | 0.079                  |
|                                    |                     | Out of Lane (% Time)           | 5.14 (1.55)        | 5.91 (2.8)         | -1.841   | 0.068                  |
|                                    |                     | Out of Lane (% Distance)       | 3.94 (0.93)        | 4.62 (2.24)        | -2.127   | 0.036                  |
|                                    | Velocity            | Number of Speed Exceedances    | 0.74 (0.98)        | 1.09 (1.15)        | -1.733   | 0.086                  |
|                                    |                     | Run Length (Time in seconds)   | 539.41 (91.02)     | 550.58 (99.37)     | -0.629   | 0.531                  |
|                                    |                     | Over Speed Limit (% Time)      | 0.68 (1.24)        | 0.81 (1.04)        | -0.599   | 0.550                  |
|                                    |                     | Over Speed Limit (% Distance)  | 1.65 (2.89)        | 2.12 (2.67)        | -0.917   | 0.361                  |
|                                    | Collisions          | Number of Collisions           | 3.9 (2.77)         | 3.63 (2.14)        | 0.573    | 0.568                  |
|                                    |                     | Number of Off-Road Accidents   | 0 (0)              | 0.04 (0.19)        | -1.440   | 0.153                  |
|                                    |                     | Number of Pedestrians Hit      | 0.03 (0.18)        | 0.02 (0.13)        | 0.566    | 0.573                  |
| Turns<br>( <i>df</i> = 110)        | Vehicle Positioning | Number of Centerline Crossings | 0.39 (0.77)        | 0.45 (0.79)        | -0.464   | 0.643                  |
|                                    |                     | Number of Road Edge Excursions | 1.26 (1.19)        | 1.35 (1.29)        | -0.351   | 0.726                  |
|                                    |                     | Out of Lane (% Time)           | 0.49 (0.53)        | 0.64 (1.09)        | -0.912   | 0.364                  |
|                                    |                     | Out of Lane (% Distance)       | 0.49 (0.65)        | 0.53 (0.78)        | -0.303   | 0.763                  |
|                                    | Velocity            | Number of Speed Exceedances    | 8.88 (2.77)        | 8.75 (2.73)        | 0.254    | 0.800                  |

|                               |                     |                                |                 |                 |        |       |
|-------------------------------|---------------------|--------------------------------|-----------------|-----------------|--------|-------|
| Gaps<br>( <i>df</i> = 111)    | Vehicle Positioning | Run Length (Time)              | 469.53 (48.33)  | 474.12 (58.39)  | -0.454 | 0.651 |
|                               |                     | Over Speed Limit (% Time)      | 29.94 (12.49)   | 29.66 (12.62)   | 0.114  | 0.909 |
|                               |                     | Over Speed Limit (% Distance)  | 42.12 (17.66)   | 42.49 (18.4)    | -0.108 | 0.914 |
|                               |                     | Collisions                     |                 |                 |        |       |
|                               |                     | Number of Collisions           | 0.25 (0.47)     | 0.33 (0.51)     | -0.877 | 0.382 |
|                               |                     | Number of Off-Road Accidents   | 0 (0)           | 0.04 (0.27)     | -1.018 | 0.311 |
|                               |                     | Number of Centerline Crossings | 0.68 (1.27)     | 0.91 (2.11)     | -0.693 | 0.490 |
|                               |                     | Number of Road Edge Excursions | 1.12 (1.78)     | 1 (2.25)        | 0.322  | 0.748 |
|                               |                     | Out of Lane (% Time)           | 0.46 (0.76)     | 0.72 (1.85)     | -0.975 | 0.331 |
|                               |                     | Out of Lane (% Distance)       | 0.72 (1.25)     | 1.11 (2.66)     | -0.995 | 0.322 |
|                               |                     | Velocity                       |                 |                 |        |       |
|                               |                     | Number of Speed Exceedances    | 8.32 (4.48)     | 9.23 (4.32)     | -1.107 | 0.271 |
|                               |                     | Run Length (Time in seconds)   | 631.81 (113.02) | 668.96 (143.76) | -1.529 | 0.129 |
|                               |                     | Over Speed Limit (% Time)      | 16.49 (12.85)   | 15.97 (12.51)   | 0.215  | 0.830 |
|                               |                     | Over Speed Limit (% Distance)  | 30.23 (23.35)   | 29.59 (21.17)   | 0.151  | 0.880 |
| Highway<br>( <i>df</i> = 104) | Vehicle Positioning | Collisions                     |                 |                 |        |       |
|                               |                     | Number of Collisions           | 0.6 (0.7)       | 0.84 (1.12)     | -1.378 | 0.171 |
|                               |                     | Number of Off-Road Accidents   | 0.02 (0.13)     | 0.04 (0.19)     | -0.596 | 0.552 |
|                               |                     | Number of Centerline Crossings | 1.15 (1.25)     | 1.44 (1.21)     | -1.230 | 0.222 |
|                               |                     | Number of Road Edge Excursions | 4.15 (2.58)     | 4.37 (2.14)     | -0.471 | 0.639 |
|                               |                     | Out of Lane (% Time)           | 3.84 (3.49)     | 4.39 (3.51)     | -0.803 | 0.424 |
|                               |                     | Out of Lane (% Distance)       | 3.93 (3.44)     | 4.69 (3.98)     | -1.055 | 0.294 |

|                                        |                     |                                |                |                |        |       |
|----------------------------------------|---------------------|--------------------------------|----------------|----------------|--------|-------|
| Unexpected Events<br>( <i>df</i> = 96) | Velocity            | Number of Speed Exceedances    | 14.06 (4.74)   | 14.37 (3.98)   | -0.364 | 0.717 |
|                                        |                     | Run Length (Time)              | 643.17 (66.13) | 666.94 (80.71) | -1.662 | 0.100 |
|                                        |                     | Over Speed Limit (% Time)      | 38.87 (12.31)  | 37.02 (10.67)  | 0.826  | 0.411 |
|                                        |                     | Over Speed Limit (% Distance)  | 44.93 (13.01)  | 43.58 (10.54)  | 0.588  | 0.558 |
|                                        | Collisions          | Number of Collisions           | 1.02 (1.34)    | 0.79 (1.09)    | 0.968  | 0.335 |
|                                        |                     | Number of Off-Road Accidents   | 0.02 (0.14)    | 0 (0)          | 0.981  | 0.329 |
|                                        | Vehicle Positioning | Number of Centerline Crossings | 0.52 (0.74)    | 0.48 (0.62)    | 0.297  | 0.767 |
|                                        |                     | Number of Road Edge Excursions | 2.3 (1.31)     | 2.21 (0.97)    | 0.392  | 0.696 |
|                                        |                     | Out of Lane (% Time)           | 3.51 (1.86)    | 3.1 (1.49)     | 1.194  | 0.235 |
|                                        |                     | Out of Lane (% Distance)       | 2.28 (1.8)     | 1.88 (1.19)    | 1.293  | 0.199 |
|                                        | Velocity            | Number of Speed Exceedances    | 9.14 (3.84)    | 8.79 (4.35)    | 0.421  | 0.675 |
|                                        |                     | Run Length (Time)              | 625.24 (65.16) | 623.66 (70.83) | 0.115  | 0.909 |
|                                        |                     | Over Speed Limit (% Time)      | 19.18 (12.38)  | 19.84 (14.09)  | -0.248 | 0.805 |
|                                        |                     | Over Speed Limit (% Distance)  | 28.75 (16.77)  | 29.68 (20.14)  | -0.247 | 0.805 |
|                                        | Collisions          | Number of Collisions           | 1.84 (1.11)    | 1.77 (1.17)    | 0.300  | 0.765 |
|                                        |                     | Number of Off-Road Accidents   | 0.08 (0.27)    | 0.08 (0.28)    | -0.060 | 0.953 |
|                                        |                     | Number of Pedestrians Hit      | 0.7 (0.51)     | 0.67 (0.48)    | 0.336  | 0.738 |

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Despite an improved methodology compared with that of previous studies on gender stereotype threat in driving as assessed in the context of driving simulation, the results of this experiment suggest that the effect may be weaker than originally reported. Based on the analysis of the data obtained in the driving simulator, in which female participants drove through several complicated scenarios after having watched an instructional video that was intended to induce a stereotype threat by either telling them that women are good drivers or telling them that women are bad drivers, the first experiment showed that the effects of stereotype threat found in previous studies could not be replicated. In our experiment, more participants were assessed than in previous studies, many driving variables were examined, and yet no significant differences were uncovered, suggesting that the effect of the threat was either very weak or impossible to detect in a simulation context. Based on the above, we can surmise that the effect size of stereotype threat on female drivers may be smaller than initially predicted.

Replicability of the stereotype threat effect appears more difficult to observe than what would be expected based on the magnitude of the effect size documented in earlier studies. We developed the study in the hope of providing a stronger design to assess the influence of the female driver stereotype. We examined driving performance in a driving simulator in different contexts, in which the difficulty was carefully controlled by making the drives more complex as the drivers were progressing through the scenario. None of the prior studies on female drivers requested their participants to drive such a distance in the simulator. We also collected many driving-related variables, and we induced the threat through a description of the objectives of the study by a senior male experimenter. It is possible that the way in which we induced the effect was not sufficiently powerful to produce a strong threat. The female participants in the neutral condition, which was intended to serve as a control condition, may have felt the effects



of stereotype threat by the mere fact of participating in driving – an activity that is associated with men and masculinity (Boutle, 2012; Cohan et al., 2002; Lezotte, 2015a, 2015b; Ruble et al., 2006; Sibley & Harré, 2009). The neutral condition may have induced a threat in itself, thus reducing the contrast with the intended threat condition.

Moreover, it is possible that the statistical power was not sufficient to make the effect of the threat observable in a significant way because of our, albeit seemingly amply sufficient, sample size; with a larger sample size a difference might have been found. Finally, some weak indications of differences caused by the threat were observed in the data of the first scenario, which may be interpreted as a short-lasting effect of the threat – a finding that deserves to be examined further before being considered as a reliable effect of the threat manipulation. In Experiment 2, we addressed these limitations by increasing the effect of the stereotype threat using a male experimenter rather than a female experimenter in the stereotype threat condition. We also intended to reverse the stereotype threat effect in the control condition by testing a group of female drivers using a threat reversal method, described below. Finally, even more participants were tested in each condition.

### 3. Experiment 2

Previous research has demonstrated that the effects of stereotype threat can be alleviated if the achievements of the members from the stereotyped group are highlighted prior to their engagement in the task. This procedure has been dubbed “stereotype boost” (Armenta, 2010; Gaither et al., 2015), in which the group under threat is “boosted” to alleviate the threat. This concept is somewhat similar to the concept of “stereotype lift” – a situation in which

highlighting negative stereotypes about a denigrated outgroup boosts the performance of the members of the non-stereotyped group (Walton & Cohen, 2003).

A stereotype boost procedure was successfully used in McIntyre et al. (2003), who conducted two studies on the effects of gendered stereotype threat on math performance of women. In the first study, the women were told that they make better participants than men in psychology experiments in general. In the second study, the participants read about the achievements of women in law, architecture, inventions, and medicine. In both studies, the women performed significantly better if presented with positive information about their gender group. Other studies have used similar methodologies to counteract the effects of stereotype threat generated by the control condition (Armenta, 2010; McIntyre et al., 2003; Moè et al., 2015; Shih et al., 2012).

Since the terms stereotype lift and stereotype boost have been used interchangeably by different researchers in the past, and neither term clearly conveys the underlying concepts, we selected an alternative term – “counterstereotype” – to refer to the condition in which the threat of negative stereotypes about female drivers was alleviated. The counterstereotype condition, referring to the control group, emphasizes the nature of the instructions given to the control group. Following the methodology of McIntyre et al. (2003), in our counterstereotype condition we gave the participants a set of instructions that highlighted women’s driving competence. The instructions mentioned that women receive fewer fines for traffic violations, that they are less at risk to be involved in an accident due to their fault, and that car insurance premiums are less expensive for women than for men.

Another factor that can affect the performance of women is the threatening nature of the environment in which they are tested. Inzlicht and Ben-Zeev (2000) showed that the

performance of women on math tests was negatively affected by the presence of men and that the deficits were proportional to the number of men in their group. Thus, an additional contrast between the two conditions in our experiment was implemented by ensuring the presence of only male investigators in the lab for participants assigned to the stereotype threat condition. The opposite was done for female participants tested in the counterstereotype condition. In this case, only female experimenters and female lab members (if any) were allowed on the lab premises when testing occurred.

### 3.1. Sample Size Justification

Considering the results from Experiment 1, the estimate for the effect size was adjusted from large to medium (Cohen, 1988). With  $d = .5$ , we estimated that with an enhanced condition induction, 64 participants was the minimal sample size per group for a two-tailed hypothesis to reach a statistical power of .8 (Abramowitz & Stegun, 1965; Soper, 2021). We also reduced the number of scenarios from six to four, retaining the two scenarios (“Construction” and “Unexpected Events”) that seemed most promising based on the results from Experiment 1 and the previous literature, with the other two scenarios (“Orientation” and “Orientation to Turns”) as necessary steps for preparing the participants for the two scenarios of primary interest (“Construction” and “Unexpected Events”).

After having tested 100 participants, we conducted a preliminary examination of the findings, the results of which indicated that the differences between the conditions were again minimal. For that reason, we increased the sample size even more to ascertain the existence of the stereotype threat effect on female drivers and to set aside the question of statistical power.

The number of participants invited to the experiment was more than doubled to make sure that we had sufficient power to detect the effect if it were real, ending up with an initial 249 participants overall.

## 3.2. Method

### 3.2.1. Participants

In total, 249 participants aged between 17 and 39 ( $M = 21$ ,  $SD = 1.9$ ) were recruited through the Integrated System of Participation in Research at the University of Ottawa. Participants were required to hold a valid driver's license. All participants gave formal consent prior to testing in compliance with the University of Ottawa Research Ethics Board requirements. They were then randomly assigned to the stereotype threat or the counterstereotype condition.

### Attrition

As in Experiment 1, the participants were monitored for simulator sickness discomfort. In case a participant reported significant symptoms, she was thanked for her participation and was not required to continue driving. Some participants could not complete all the scenarios: Data for the last two scenarios are missing for three participants, and 13 participants failed to complete the last scenario. Some data were also not recorded because of a technical malfunction of the software. A total of 19 participants had one scenario failing to operate normally. Lastly, due to an experimenter error, the data for two scenarios are missing for one participant. A total of 213 participants completed all scenarios, and most other participants completed most scenarios. The data of the participants were included in the analysis only if they

had fully completed at least the “Orientation” and “Construction” scenarios, which resulted in a total sample of 248 participants who completed at least the first two scenarios and 244 participants who completed at least the first three scenarios. Considering the initial sample size, this attrition rate is again well within the attrition rate observed in other simulator studies (Mullen et al., 2010). The participants for whom some data were missing were compared with the participants who completed all scenarios with respect to demographic variables, including driving experience, age, and the condition to which they were assigned. As in Experiment 1, no significant differences were found.

### *3.2.2. Materials*

The video pertaining to the stereotype threat condition remained the same as in Experiment 1. The video for the counterstereotype condition that was presented to the participants with purported instructions on how to proceed during the simulation was different from the neutral video in Experiment 1. In the counterstereotype condition, the participants were told that the objective of the study was to observe appropriate driving reactions of women in the context of a driving simulator to understand why women are more competent drivers than men. Other information, such as a reminder that women are safer drivers based on crash occurrence statistics and that their car insurance premiums are on average lower, was also introduced in the video segment. The script for what was said in the condition induction videos is openly available at the OSF for this project.

### *3.2.3. Procedure*

The induction of the stereotype threat condition followed the procedure used in Experiment 1, but in addition to the presentation of the stereotype threat induction video, the social context within the lab was changed to make it more threatening to female drivers. In the threat condition, the testing session was under the responsibility of a male experimenter, and only male lab members were allowed on the lab premises at the time testing occurred.

The counterstereotype condition was also enhanced in the direction of alleviating any potential threat. The video shown to the participants reminded them that female drivers are good drivers. Additionally, only female experimenters and female lab members were allowed to be present in the lab to alleviate the potential threat from being a female driver taking part in an experiment in a driving lab.

### *Simulated Driving Task*

The same simulator setup and software as in Experiment 1 were used, as well as the same four scenarios. The scenarios retained for all participants included the first three scenarios from the first experiment (“Orientation,” “Construction,” “Turns”), as well as the scenario (“Unexpected Events”) that seemed the most promising based on the previous literature (Joanisse et al., 2013; Yeung & von Hippel, 2008).

### *3.2.4. Data Analysis*

The data analysis for Experiment 2 was purposefully identical to the data analysis conducted in the previous experiment to maintain consistency across the two experiments and by the same token to reduce the researcher degrees of freedom (Simmons et al., 2011; Wicherts et al., 2016).

As was done for Experiment 1, the data were analysed in three different ways following the logic of multiverse analysis (Steegen et al., 2016): in their raw form and with two different winsorizing methods. Since the results of the three multiverse analyses were not meaningfully different, only the results of the first analysis, with raw data, are presented here. The results of the other two analyses are available in the supplemental materials on the OSF for this project.

**Table 2.***Results of the Comparison Between the Participants in the Stereotype Threat and the Counterstereotype Condition*

| Scenario                        | Aspect of driving   | Variable                       | Group              |                                             | <i>t</i> | <i>p</i><br>(2-tailed) |
|---------------------------------|---------------------|--------------------------------|--------------------|---------------------------------------------|----------|------------------------|
|                                 |                     |                                | Counterstereotype  | Stereotype threat with<br>male experimenter |          |                        |
|                                 |                     |                                | Mean ( <i>SD</i> ) | Mean ( <i>SD</i> )                          |          |                        |
| Construction ( <i>df</i> = 246) | Vehicle Positioning | Number of Centerline Crossings | 1.34 (1.07)        | 1.29 (1.05)                                 | 0.403    | 0.687                  |
|                                 |                     | Number of Road Edge Excursions | 2.86 (0.55)        | 2.75 (0.55)                                 | 1.479    | 0.141                  |
|                                 |                     | Out of Lane (% Time)           | 5.6 (2.3)          | 5.28 (1.78)                                 | 1.225    | 0.222                  |
|                                 |                     | Out of Lane (% Distance)       | 4.51 (2.55)        | 4.23 (1.51)                                 | 1.045    | 0.297                  |
|                                 | Velocity            | Number of Speed Exceedances    | 0.71 (1.21)        | 0.7 (1)                                     | 0.066    | 0.947                  |
|                                 |                     | Run Length (Time)              | 544.63 (84.32)     | 565.4 (73.96)                               | -2.060   | 0.040                  |
|                                 |                     | Over Speed Limit (% Time)      | 0.88 (2.92)        | 0.55 (0.92)                                 | 1.215    | 0.226                  |
|                                 |                     | Over Speed Limit (% Distance)  | 1.9 (4.72)         | 1.45 (2.4)                                  | 0.947    | 0.344                  |
|                                 | Collisions          | Number of Collisions           | 3.29 (2.69)        | 3.52 (2.51)                                 | -0.675   | 0.501                  |
|                                 |                     | Number of Off-Road Accidents   | 0.02 (0.15)        | 0.02 (0.16)                                 | -0.040   | 0.968                  |
|                                 |                     | Number of Pedestrians Hit      | 0.01 (0.09)        | 0.03 (0.18)                                 | -1.392   | 0.165                  |
| Turns ( <i>df</i> = 243)        | Vehicle Positioning | Number of Centerline Crossings | 0.44 (0.86)        | 0.33 (0.63)                                 | 1.124    | 0.262                  |
|                                 |                     | Number of Road Edge Excursions | 0.97 (0.95)        | 0.95 (0.97)                                 | 0.152    | 0.880                  |
|                                 |                     | Out of Lane (% Time)           | 0.41 (0.71)        | 0.39 (0.71)                                 | 0.160    | 0.873                  |
|                                 |                     | Out of Lane (% Distance)       | 0.4 (0.78)         | 0.33 (0.48)                                 | 0.801    | 0.424                  |
|                                 | Velocity            | Number of Speed Exceedances    | 8.7 (2.51)         | 8.87 (2.94)                                 | -0.503   | 0.615                  |
|                                 |                     | Run Length (Time)              | 486.93 (60.77)     | 508.62 (54.86)                              | -2.927   | 0.004                  |
|                                 |                     | Over Speed Limit (% Time)      | 28.73 (12.76)      | 25.71 (12.22)                               | 1.886    | 0.061                  |
|                                 |                     | Over Speed Limit (% Distance)  | 41.48 (18.44)      | 38.32 (18.59)                               | 1.333    | 0.184                  |
|                                 | Collisions          | Number of Collisions           | 0.36 (0.57)        | 0.42 (0.67)                                 | -0.793   | 0.429                  |
|                                 |                     | Number of Off-Road Accidents   | 0.02 (0.15)        | 0.02 (0.13)                                 | 0.386    | 0.700                  |



|                                         |                     |                                |                |                |        |       |
|-----------------------------------------|---------------------|--------------------------------|----------------|----------------|--------|-------|
| Unexpected Events<br>( <i>df</i> = 211) | Vehicle Positioning | Number of Centerline Crossings | 0.52 (0.76)    | 0.36 (0.63)    | 1.683  | 0.094 |
|                                         |                     | Number of Road Edge Excursions | 2.23 (1.34)    | 2.23 (1.3)     | 0.024  | 0.981 |
|                                         |                     | Out of Lane (% Time)           | 3.21 (1.58)    | 3.04 (1.88)    | 0.708  | 0.479 |
|                                         |                     | Out of Lane (% Distance)       | 1.82 (1.25)    | 1.86 (1.63)    | -0.178 | 0.859 |
|                                         | Velocity            | Number of Speed Exceedances    | 7.76 (3.97)    | 7.58 (3.62)    | 0.334  | 0.738 |
|                                         |                     | Run Length (Time)              | 650.66 (65.36) | 647.08 (59.55) | 0.416  | 0.678 |
|                                         |                     | Over Speed Limit (% Time)      | 15.19 (11.84)  | 15.46 (11.42)  | -0.168 | 0.867 |
|                                         |                     | Over Speed Limit (% Distance)  | 23.49 (16.92)  | 23.61 (16.29)  | -0.054 | 0.957 |
|                                         | Collisions          | Number of Collisions           | 2.06 (1.36)    | 1.73 (1.21)    | 1.860  | 0.064 |
|                                         |                     | Number of Off-Road Accidents   | 0.04 (0.25)    | 0.06 (0.24)    | -0.443 | 0.658 |
|                                         |                     | Number of Pedestrians Hit      | 0.77 (0.44)    | 0.64 (0.48)    | 1.958  | 0.051 |

### 3.3. Results and Brief Discussion of Experiment 2

Only one of the 32 variables that were compared showed a statistically significant difference between the groups. The participants in the stereotype threat condition with a male experimenter took significantly more time to complete the “Turns” scenarios (see Table 2).

Experiment 2 was designed as a conceptual replication of Experiment 1. In Experiment 2, we significantly improved the methodology so as to increase the likelihood of detecting the negative influence of stereotype threat if it existed. Additionally, in order to enhance the statistical power, we quadrupled the sample size in comparison with the initial sample size estimates. From an already conservative  $N = 50$ , which should have been more than sufficient based on the results of the study by Moe et al. (2015), we tested over 200 participants.

The data analysis of Experiment 2 computationally reproduced the data analysis of Experiment 1. Like Experiment 1, Experiment 2 did not yield convincing evidence for the effect of the gender stereotype threat on the performance of female drivers. One variable out of 32 showed a statistically significant difference, but an interpretation of its true meaning would be speculative at best. The participants in the counterstereotype condition appeared to have completed the route 3% faster than the participants in the stereotype group. This, probably spurious, finding is most likely the result of having compared a large sample size of participants on many variables. No other variable was statistically different between the two conditions.

This failure to obtain the effect of stereotype threat on the simulated driving performance of female drivers may be indicative of the general uncertainty about the strength of this effect on driving in a typical driving lab setting.

## 4. Discussion

Scholars have debated the specific nature of circumstances under which the effects of the stereotype threat may be observed (Hermann & Vollmeyer, 2017; Laurin, 2020; Pérez-Garín et al., 2017; Picho-Kiroga et al., 2021) or whether the effect of stereotype threat exists at all (Chaffee et al., 2020; Schimmack, 2017). Our findings seem to demonstrate, with a reasonably good sample size and a seemingly strong way of inducing the effect of the stereotype threat, that the empirical evidence supporting this effect is weak at best, especially if one takes into consideration the many facets of driving performance that can be empirically examined.

According to Fisher (1926) (see also Schimmack, 2020), one should consider the results of an experiment to be meaningful only when the researchers can reproduce the statistically significant effect most of the time, with a clear understanding of the necessary conditions to produce the effect. This is not the case that can be stated here based on the results of the two experiments that we executed. Therefore, the strength of the effect of gender stereotype threat on the driving performance of women should be put into question, since the results of the first experiment, which was based on effect size estimates from the previous literature, did not reveal any statistically significant differences between the stereotype threat condition and the neutral condition. Moreover, in a conceptual and enhanced self-replication conducted in the second experiment, the contrast between the two conditions compared was magnified. The stereotype threat condition was designed to be more threatening given the social context in which it was instigated, with only male experimenters and lab members present during testing. The other condition – the counterstereotype condition – attempted to alleviate any trace of stereotype threat that could have been present because of the association between masculinity and driving. The women assessed in this group received encouraging messages about female drivers, and the

social context was designed to remove the threat with only female experimenters and lab members allowed on the lab premises during testing. Additionally, the statistical power to detect the effect was even further increased through an even larger sample size than in Experiment 1. In fact, no other published study has tested such large samples of participants to assess stereotype threat through driving simulation. Despite the enhanced conceptual difference between the two conditions and the improved statistical power, no substantial evidence for stereotype threat was revealed in the second experiment either. One variable showed a statistically significant difference between two conditions – the length of time that it took participants to complete the route in one of the scenarios. Considering the rather large number of variables that were compared between the conditions, finding just one significant difference makes its interpretation difficult. The fact that the participants under threat took more time to complete the route might represent the participants' efforts to be more careful in order to counteract the effects of stereotype threat. However, other indicators related to speed within the same scenario did not differ between the conditions. Time to complete the scenario was not significantly different in the other scenarios. Moreover, previous research that inspired this study and that was conducted using simulation did not report any effect of threat on velocity indicators (Yeung & von Hippel, 2008).

The one significant difference that we found could be an artifact of the specific group of experimenters who administered the different conditions. Unlike in Experiment 1, in which all the experimenters participated in all conditions, in Experiment 2 the experimenters were necessarily segregated by gender, even if more than one male and one female experimenter were involved in testing. The effect observed could therefore reflect some experimenter-specific bias. For instance, one male experimenter may have inappropriately emphasized that driving under the speed limit was extremely important.

The difference also needs to be interpreted in the context of the design used in this type of study. A between-subject design does not allow the performance of every participant to be compared under the two different conditions. Without a baseline (no threat) measure, it is hard to estimate the effect of threat if the differences in performance could be bidirectional. For instance, in terms of velocity, some participants under threat might drive slower and others faster. In a between-subject design, it is assumed that all participants under threat would react the same way. In the case of driving a car under different types of road conditions that vary in complexity, assuming that all participants would react the same way may not be warranted. Nevertheless, the cautious take on the findings of the second experiment is that the driving reactions of the female drivers were not influenced by the induction of stereotype threat or attempts to alleviate it, since participants prone to various reactions would be equally distributed across the two conditions through random assignment.

The findings obtained in both experiments stand in contrast with the ones observed in the literature on the effects of stereotype threat in driving simulators, such as those obtained by Yeung and von Hippel (2008) and Moe et al. (2015), in which the effect of stereotype threat on the performance of female drivers was large. These two studies, however, suffered from several methodological flaws, such as a short duration of the test drive, the examination of a limited subset of data, and data that were collected in a very subjective manner. In the field of simulated driving, all participants that undergo any form of testing are first familiarized with the simulated driving setup and procedures for at least 5 minutes and considerably longer in most cases. In the current study, all the participants underwent such a familiarization phase. Moe et al.'s (2015) study, however, did not seem to have a familiarization phase, and the duration of the test drive was even shorter than what could be estimated to be necessary for proper adjustments and familiarization to the simulated driving context to take place.

In Yeung and von Hippel (2008), only one event was examined, which is a serious limitation of the study. The selection of the event itself is also problematic based on its face validity. Hitting jaywalkers is by no means a feature of the female driver stereotype, which limits the external validity of the findings. Moreover, no other differences were reported by the authors. Driving speed should have been a factor, considering that the drivers only had 3.2 s to react to this event; a faster speed is expected to lead to an increased probability of hitting walkers, but no such difference was reported. The authors' main argument is that working memory was taxed, limiting the attention of drivers under threat. However, no direct evidence of this relationship was provided in their research.

The series of experiments presented in this article implemented significant methodological improvements. Induction of the threat was more powerful even in the first experiment, and then further enhanced in the second experiment. The control condition was also improved from the first to the second experiment to alleviate the potential inherent threat associated with being a female and driving. Additionally, the statistical power to detect a result in both experiments exceeded by a large amount the power estimated a posteriori from both Yeung and von Hippel (2008) and Moe et al. (2015). Indeed, in both experiments we tested a larger sample size, improved the procedures for the induction of the threat, and examined a larger number of variables. Moreover, the conceptual self-replication from Experiment 1 to Experiment 2, which obtained similar results, confirms the validity of the findings.

The elusive nature of stereotype threat effects on the performance of female drivers in the context of simulation is in line with other publications that found the evidence for the existence of stereotype threat to be not convincing (Finnigan & Corker, 2016; Flore et al., 2018; Moon & Roeder, 2014; Pennington et al., 2019; Shewach et al., 2019; Stricker & Ward, 2004; Tsui et al., 2011; Zigerell, 2017). It also seems that our study fits the pattern observed in the literature, in which studies with a small sample size and doubtful methodology are able to observe the effect of stereotype threat, while

studies using larger sample sizes and high-quality methodologies do not replicate the effect initially obtained (Lewis & Michalak, 2021; Zigerell, 2017).

Nevertheless, the results of this study do not give us a definitive answer to the question of whether and how negative stereotypes about female drivers affect women. First of all, it is clear from the literature that those stereotypes exist and are prevalent in society (Berger, 1986; Kadulina et al., 2021). Both men and women are aware of them (Kadulina et al., 2021), and they affect the way that women see themselves in relation to cars and car driving (Lezotte, 2012, 2013, 2015b). It is possible that negative stereotypes about female drivers affect different women in diametrically opposite ways, cancelling out the differences that can be observed in the driving simulator. Alternatively, the effect may be so subtle that even a study with a strong statistical power to detect it, such as this one, could not quite capture it. Yet it is clear that this effect is weaker than has previously been described.

This failure to replicate the effect of stereotype threat on the simulated driving performance of female drivers suggests that other researchers should think twice before undertaking further studies involving stereotype threat in a driving simulator, because the results of these experiments show that this effect may be elusive even with a strong induction of the stereotype threat and a large sample size. In the words of L. Jussim, the concept of stereotype threat may be “overcooked, overstated, and oversold” (Jussim, 2015).

## Conclusion

This series of experiments took a further step in determining the reliability of the stereotype threat effect on female drivers by examining its influence on the performance of women in a driving simulator. Based on the results of this study, we posit that this effect may be small or negligible.

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## CHAPTER 5: General Discussion

This thesis looked at the social determinants of driving, one of the factors influencing driving that has recently been integrated into theoretical models of mobility and transportation. The research described in this thesis is therefore on the cutting edge of contemporary psychosocial theories of driving behaviour. In addition to exploring the social context of driving by examining gendered stereotypes about drivers, we also presented a line of research that looked at one way in which the social context of driving might affect driving performance, that is, the potential effect of stereotype threat.

The topic of research in this thesis – stereotypes pertaining to female drivers – is extremely important because stereotypes are ubiquitous (Bordalo et al., 2016; Nosek et al., 2009) and thus have a high potential to make an impact on the nature and type of interactions that people are likely to have in a social context as well as on their perception of self-efficacy. Although most people are familiar with the general characteristics of stereotypes outlined in this thesis, identifying the specific features that comprise female drivers' stereotypes and how they affect decisions, perceptions, and behavioural performance was at the core of our approach. Based on the existing literature on driving and on stereotypes more broadly, we hypothesized that stereotypes alter the behaviour of individuals who believe in those stereotypes, which include both the group being stereotyped (in terms of performance and decision-making) and the group who holds the stereotypes (in terms of their perception of others), with differences and commonalities between the two groups.

For the purpose of offering an appropriate theoretical background to our quest on the influences of female drivers' stereotypes, numerous theoretical models of driving were described in the General Introduction. These models were used to highlight the importance of social factors



in our knowledge of safe driving and to showcase the evolution of driving models that now promote a broader understanding of driving. Considering that a variety of social factors could influence driving outcomes and performance, a specific form of social influence was examined – stereotypes. A central and unique feature of our approach to stereotypes about female drivers consisted of observing their influence in different contexts (perception and judgement, decision-making and driving performance) in relation to age, by contrasting female drivers with male drivers while paying attention to in- and out-group differences.

Stereotypical thinking is a cognitive system of interconnected concepts that shapes the perception of members from certain groups (McGarty et al., 2002). Previous research has demonstrated unequivocally that stereotypes influence attention, memory, judgement, and behaviour (Hamilton et al., 2015; Hamilton & Sherman, 1994) – all aspects that are involved in the process of perceiving other drivers, making decisions about driving, and actively performing a driving activity. Four experiments on the nature and implications of driving stereotypes were presented in the form of three scholarly articles, exploring the existence of stereotypes about female drivers and the consequences of these biases for driving.

## [Return on the Theory](#)

The relevance of the research accomplished in this thesis was justified within the context of two recent theoretical models of driving and transportation: the Driving as an Everyday Competence (DEC) model (Lindstrom-Forneri et al., 2010) and the MOTRS driving model (Wong et al., 2016), both of which were detailed in the General Introduction. In agreement with other authors (e.g., Wong et al., (2018), we highlighted that the social factors included in the

DEC model have not received sufficient empirical support, a limitation that we were hoping to alleviate with the presented research. Both the DEC and the MOTRS theoretical models emphasized the significance of socioeconomic and demographic factors influencing driving. Both models also allow for the possibility of considering how societal factors could influence many aspects of the driver's behaviour. Wong et al. (2016) suggested in their article on the MOTRS model that, in addition to the demographic variables included in their model, a sense of self-efficacy and mastery in driving can influence driving-related self-regulation (Bandura, 2004; Schwarzer, 1992), which, according to them, could merit future research. The social environment in which the driver operates may interact with the self-efficacy and mastery factors, affecting driving performance regardless of the driver's actual level of competence. This stand resonates strongly with the postulates brought forward in the DEC model. It is at the conjunction of the DEC and MOTRS theoretical models that this thesis examined one prominent aspect of the social influences on driving – the beliefs that people have about drivers from various groups (also known as stereotypes) and the way that those beliefs may have multiple influences on drivers.

According to those driving models, it is vital to consider and identify all aspects that influence a person's ability to drive successfully. Yet not all drivers are equivalent in regard to driving, so the impact of social determinants may vary according to the social context and individual characteristics. This thesis examined a social factor that may alter driving performance, that is, how female drivers are perceived and feel threatened in contexts in which they are exposed to socially shared negative perceptions about their ability to drive.

## Overarching Objectives

What does the social context of driving look like for women? This was the primary overarching question that this thesis sought to provide an answer to. This was achieved by contrasting the nature of stereotypes about drivers of various genders and ages, and we determined whether unfavourable stereotypes about female drivers have a negative effect on their driving performance using driving simulation as a controlled laboratory setting.

## Women are Seen as Incompetent, Men as Reckless (Article 1)

The first article presented in this thesis elaborated on the existing knowledge about gender stereotypes. Therefore, this line of research fits within the larger field of gender stereotypes and social psychology. Stereotyping by gender is one of the most pervasive and widespread forms of categorical thinking (Brewer, 1988; Fiske & Neuberg, 1990; Slepian et al., 2011). The perceived gender is one of the first categories that perceivers assign to a person upon their initial encounter (Fiske & Neuberg, 1990; Sato et al., 2020; Taylor et al., 1978). Gender stereotype research is needed because gender stereotypes affect numerous aspects of human functioning, with real consequences in one's daily life, such as influencing one's career choice (Basfirinci et al., 2019; Deaux, 1995; Ritter et al., 2021; E. H. Shinar, 1975; White & White, 2006) or, in the context of leisure, the widespread sexism against female gamers (Vermeulen et al., 2016).

Broad and general stereotypes about men as risk-takers, aggressive, unaffectionate, and control-oriented (Aries, 1996; Bem, 1981; Gana, 1995; Mahalik et al., 2003; Tollison, 2013) and women as empathic, communal, gentle, emotional, passive, and having little capacity for

leadership (Broverman et al., 1972; Deaux, 1995; Kelso & Brody, 2015; Rudman & Glick, 2021) served as part of the theoretical basis and inspiration for the development of the stimuli for the study described in the first article of this thesis. Additionally, stereotypes specifically about female drivers, who are frequently thought of as bad drivers (Chateignier et al., 2011), served as a more defined impetus for this thesis. Female drivers have been described as nervous, hesitant, less skilled, and excessively careful behind the wheel (Berger, 1986; Clarsen, 2008; Harris & Miller, 2001; Lezotte, 2019). The first article examined whether a stereotype about female drivers, and a sort of “female driving pattern,” can be demonstrated through a series of short videos. It examined whether study participants could reliably distinguish a pattern that was supposed to illustrate behaviours stereotypically associated with female drivers from other patterns of driving. The unique methodology of showing videos that were produced by the driving simulator, which permitted the gender of the driver to be disguised, allowed illustrating the behaviours potentially associated with female drivers without influencing the opinion of the viewer by revealing who was driving the simulator.

It was hypothesized that inefficient or inappropriate driving reactions, illustrated in simulated videos that depicted the core elements of the female driver stereotype, would be attributed significantly more often to female drivers than to male drivers. Indeed, for the majority of clips (five out of eight) intended to illustrate negative stereotypes about female drivers, the stated hypotheses were confirmed. Because previous research found differences between male and female participants in their patterns of responses about gender stereotypes, we also examined how the ratings were different according to the gender of the participants. Unlike what was found in Pravossoudovitch et al. (2015), male and female participants in our study generally agreed on the attribution of driving behaviours to male or female drivers. The results of the principal

component analysis provided strong support for the dichotomous distribution of gendered stereotypes about driving reactions depicted in our videos. Driving behaviours indicative of incompetent driving were more frequently attributed to women than to men. Moreover, men were more frequently blamed for reckless and aggressive driving behaviours than women.

The findings of this study both validate and add to prior findings about gender-based driving stereotypes. Pravossoudovitch et al. (2015) and Degraeve et al. (2015) gathered some evidence for the terms and concepts related to female and male driving stereotypes. To add to those descriptions of gendered stereotypes about drivers, the study presented in the first article revealed, in well-controlled situations, specific driving actions associated with the reported stereotype contents. This study clarified the ways in which men and women are stereotypically perceived as drastically different drivers.

Although stereotypes about male drivers were not the focus of this thesis, and mostly served as a contrast and backdrop for the research about female drivers, the fact that they exist is also important and suggests that it is also imperative to increase awareness about male driver stereotypes. Male driving stereotypes may not deter men from driving, but believing in those stereotypes may compromise their safety as drivers. When society views reckless driving as a male trait, it can encourage certain men to conform to these stereotypes (Bosson et al., 2009).

### Driving is a Man's Prerogative (Article 2)

The second article explored the intersection of stereotypes about drivers from different gender and age groups. I developed a novel approach to examine the age-old debate about whether driving is a man's prerogative. In the article, we assessed whether participants believed that men are more likely to drive than women in a context in which both could potentially take

the wheel. We also aimed to understand why the participants thought that this would be the case. Was it because men were seen as safer drivers? Did this depend on the drivers' ages?

In general, ageism plagues older persons in various functional domains. Presumptions about ageing persons' cognitive and physical decline are common (Cuddy & Fiske, 2002). In reality, unlike older drivers, who were rated as “dangerous” by the survey participants in a study by Joannis et al. (2012), it is young drivers who are actually more likely to participate in risky driving behaviours, resulting in crashes and infractions (Jonah, 1990; Jonah & Dawson, 1987; Simons-Morton et al., 2019).

Regardless of age, previous research reported that men are viewed as more risk-prone in driving and other activities (Creighton & Oliffe, 2010; Powell, 2003; Styazhkina, 2010). The gender gap in risk-taking behaviour is even more apparent in young people. Men report dangerous driving behaviours more frequently than women, and teen drivers engage in risky driving behaviours more frequently than adult drivers (Rhodes & Pivik, 2011). This combination of youth and masculinity results in young male drivers being the riskiest.

The second article examined how stereotypes about drivers of all age and gender combinations can influence people's decisions about driving even before they get together in a vehicle. One of the populations particularly affected by the social context surrounding driving, gender, and age is the population of older women. Among many other comparisons, the study presented in the second article contrasted stereotypes about different groups of drivers by comparing, among other dyads, the perceived safety of a young male driver with that of a “white-knuckled tiny old lady” (Joannis et al., 2012). In this article, different age and gender combinations were tested to see whether the age of the two members in the dyad affected the perception of who was more likely to take the wheel. The methodology that was used in the

second study is innovative as no other research had directly contrasted stereotypes about different types of drivers, considering their age and gender within the same direct comparison. This methodology is unique in the way that it allows tapping into very specific stereotypes that people may have about drivers from certain age and gender groups, such as older female drivers and young male drivers.

Middle-aged men were found to be the most likely to be behind the wheel in all age and gender combinations, confirming the pattern described in the literature (Berger, 1986; Boutle, 2012; Cohan et al., 2002; Collingwood, 2018; Sibley & Harré, 2009; Terry et al., 2015). Women were not seen as likely to drive. Among all age and gender groups, older women were thought to be the least likely to drive. Indeed, with the exception of older women, young women were found to be less likely to drive when approaching a car with someone from any other demographic group.

The uncovered pattern of results emphasizes the importance of considering the interactive contribution of age and gender when describing the socially shared stereotypes pertaining to car drivers. Despite prior research finding a link between masculinity and risk-taking (Bem, 1981; Coquelet et al., 2019; Granie, 2013; Ozkan & Lajunen, 2005), our findings show that participants do not associate middle-aged men with risky driving. Only young men were associated with risky driving. Young men were not only rated as less safe than middle-aged men, but they were associated with lower safety when compared with virtually every other demographic group, with older women being the sole exception.

From the results of this study, we concluded that driving is still perceived as a man's prerogative, as men of all ages were found to be more likely to drive than women of the same age. We showed that there is still a stereotype according to which middle-aged men are seen as

most likely to drive and are almost always evaluated as the safest drivers when compared with people of other age or gender combinations. Even when a man was rated as a less safe driver in a dyad, as was the case in the comparison of young male and young female drivers, men were rated as more likely to drive. The combination of older age and female gender illustrated a stereotype of older women as the least likely to drive and the least safe drivers. Based on the findings of this study, it is possible to conclude that biases and prejudices against male and female drivers do persist to this day.

Raising awareness about stereotypes associated with male and female drivers, which the research in this thesis attempted to do, can help to address and alleviate the pressures that rigid gender roles associated with driving place on men and women. When people are consciously aware of the stereotypes about male and female drivers, they may be more likely to see how gender roles present a limiting factor in the choices that they make. This may enable individuals to become more adaptable and flexible in their decisions and behaviours.

It would be beneficial for both men and women if men and women were regarded as equally capable drivers. The decision about whether a man or a woman should drive would be based on which of them is in the best physical condition to do so at the time. If a man had a couple of alcoholic beverages and a woman did not, the woman should take the wheel of the car. If a man is too fatigued to drive, he would not continue driving unnecessarily and would instead readily transition to becoming a passenger. Finally, if a man simply does not feel like driving, he would not be required to shoulder the burden of this responsibility. Women would benefit by having more opportunities to practice driving and maintain their driving skills, which would allow them to maintain their mobility well into old age. Everyone would benefit if men and women were treated equally when it comes to driving privileges, rights, and responsibilities.



## Articles 1 and 2: Social Perceptions Toward Drivers – Implications for Mobility

Social variables in general, and driving performance in particular, may have an impact on people's ability to get to their destinations. Studying driving stereotypes is key when it comes to understanding how those assumptions can affect mobility. Women can be affected by negative perceptions about female drivers in a way that is similar to a self-fulfilling prophecy. This is the hypothesized mechanism through which the results of the studies presented in the first two articles can have practical implications. The stereotyping of female drivers as incompetent, unsafe, and unlikely to drive may impact women's self-efficacy in driving. This, in turn, may diminish their willingness to drive, reducing their exposure to driving practice and eventually reducing their mobility. Corollary to that, improving their driving self-efficacy can help improve their mobility into old age and maintain their driving privileges longer.

According to the stereotypes identified in the second article, older women were seen as the least safe drivers. When this observation is combined with the finding that older women were rated as the least likely to drive, it suggests that the cohort of older women is perceived as having a lower ability to safely operate a vehicle as well as a lower likelihood of operating a vehicle when compared with other drivers of different ages or male drivers of the same age. This needs to be considered in light of the fact that drivers who drive more frequently maintain their driving skills and are safer than those who drive less frequently (Koppel et al., 2016; Molnar et al., 2014). This effect may be negligible in younger females because younger females who own a car are more likely to drive even if exposed to the type of social dilemma described in our scenario. However, the impact may definitely be greater in older women, because they are more likely to

let a male family member drive, resulting in fewer driving trips behind the wheel. Women may decide to stop driving earlier than they should because driving becomes more difficult over time due to a lack of practice. Yet older women, who are statistically more likely to outlive their male companions and frequently end up alone in old age, require transportation. Unfortunately, as women age, they may conclude that it is safer to quit driving based on what they repeatedly heard about older female drivers. The social context illustrated in the first two studies does not just affect women's confidence in their driving abilities but also suggests reduced opportunities to practice driving throughout their life based on their social environment. As already indicated, this might ultimately result in diminished driving abilities. A more favourable attitude toward female drivers, which might be achieved by reducing negative perceptions about female drivers, would alleviate the reluctance to drive in this gender group.

### Women Behind the Wheel are Resilient Against Stereotype Threat (Article 3)

Several previous studies have found evidence for the effect of stereotype threat on the driving performance of female drivers. Yeung and von Hippel (2008), Chateignier et al. (2011), and Moe et al. (2015) all found significant effects of gender stereotype threat on female drivers in their studies. Conversely, the pattern of results obtained in the two studies presented in the third article of this thesis did not reveal a conclusive picture in support of the effect of gendered stereotype threat on the driving performance of women.

No reliable differences were found between the stereotype threat group and the neutral group in Experiment 1, even though a variety of scenarios, situations, and variables offered ample opportunities for the detection of such differences if there were any. Similarly, no reliable

differences were found between the enhanced stereotype threat group and the counterstereotype threat group in Experiment 2.

Therefore, none of the predictions that were hypothesized based on the previous literature were supported by the findings. The results obtained in this study differ from the results of the studies that inspired us to undertake this endeavour, such as those by Yeung and von Hippel (2008) and Moe (2015).

Several potential explanations may account for the differences between our findings and those reported in the previous literature in support of the phenomenon of stereotype threat. If the stereotypes about women as bad drivers were no longer relevant in the population that was assessed, the lack of a threat effect would be the expected finding. However, this was shown to be untrue in the first two articles of this thesis as female drivers are still perceived negatively.

Another potential explanation for the absence of the threat effect might have to do with the nature of the recruited sample. The participants in both studies of the third article were young educated female drivers, most of whom were recruited from an introductory psychology course. It is possible that these women were less susceptible to the effect of stereotype threat, a limitation that Picho-Kiroga et al. (2021) believe needs to be checked and accounted for. Indeed, Picho-Kiroga et al. (2021) have postulated that the susceptibility of participants to stereotype threat in a sample is a potential explanation for the inconsistency of findings of gendered stereotype threat effects on women in math (Picho-Kiroga et al., 2021). In our series of experiments, susceptibility to threat was not assessed, and it is impossible to conclude whether or not female participants felt threatened. However, the only two prior driving simulator studies that observed the effect of stereotype threat on women's driving (Moè et al., 2015; Yeung & von Hippel, 2008) did not verify or control for potential moderators that could affect women's

susceptibility to stereotype threat. Nevertheless, they observed large effect sizes. The two studies presented here used a similar but enhanced methodology to the methods used by Yeung and von Hippel (2008) and Moe (2015), with sample sizes that were larger and that had a high potential to find the effect if it existed.

Our results are similar to those of several other recent studies on the topic of stereotype threat (Flore et al., 2018, 2018; Moon & Roeder, 2014; Pennington et al., 2019; Stricker & Ward, 2004; Tsui et al., 2011). Like Pennington et al. (2019), we can now suggest some alternative hypotheses according to which the null findings may be explained by potential moderators of stereotype threat, such as the difficulty of the task, the identification with the domain, or the participants' gender. Another, more likely, explanation is that the effect sizes reported in the previous stereotype threat literature are exaggerated as a consequence of problems with the publication system (Schäfer & Schwarz, 2019; Schimmack, 2020; Zigerell, 2017).

The heterogeneity of the findings of previous studies, with a large number of postulated moderators and mediators that worked for some researchers but not for others, can be seen as an indication that the literature on stereotype threat is skewed as a result of publication bias (Zigerell, 2017), meaning that most peer-reviewed journals refuse to publish findings that do not find differences between groups, thus severely distorting the picture (Schimmack, 2020). The findings of our study are in line with those of Flore et al. (2018) in that a research design that should have detected the effect was unable to do so.

In the past 20 years, we have seen a proliferation of publications hypothesizing potential factors that would explain the mechanism through which the phenomenon of stereotype threat affects the performance of the individuals being stereotyped (Nguyen & Ryan, 2008). For instance, numerous studies looked at the reduction in working memory as a potential explanation

of the threat effect (Schmader & Johns, 2003). Other moderating and mediating factors included identification with the stereotyped group (Schmader, 2002), the domain tested (Smith & Johnson, 2006), the task difficulty (Barber et al., 2020), the level of arousal and its attribution (Ben-Zeev et al., 2005), the presence of other members from the stereotyped groups (Chaney et al., 2018; Sekaquaptewa & Thompson, 2003), and many more (Inzlicht et al., 2006). None of the proposed mediators received unequivocal empirical support (Pennington et al., 2016). For that reason, I would argue that before looking for mechanisms that would explain how a phenomenon works, it is important to determine whether it exists at all.

It is possible that the researchers of the above-mentioned studies have, as they were supposed to do, identified the potential moderators and mediators in advance, hypothesized the results, and later received confirmation for them in the process of empirical testing. It is also possible that at least some of them have generated hypotheses after the results were known (HARKed) (Kerr, 1998; Murphy & Aguinis, 2019), which until recently has been a common practice (Rubin, 2017) and which has even been frequently encouraged by reviewers, editors, and research supervisors (Frias-Navarro et al., 2020; Leung, 2011) in an apparent effort to improve a manuscript. In the not-too-distant past, well-intentioned researchers believed that it was acceptable to examine their data in a variety of ways until they seemingly found an effect and then to postulate retrospectively the potential mechanisms at play (Bishop, 2019; Simmons et al., 2011). This practice, among other similar questionable research practices, resulted in poor reproducibility of many findings in psychological science (Open Science Collaboration, 2015).

### Article 3: Strengths

We developed a methodology that is based on driving simulation research in which we made use of validated driving scenarios. In comparison with previous studies in the domain, our study implemented several improvements that enhanced the replicability and validity of the results. These improvements included automating the data analysis, collecting a large variety of driving indicators variables, exposure to several driving scenarios, larger sample sizes, and an enhanced stereotype threat as the result of improved induction procedures.

We felt that it was necessary to eliminate any subjective bias that may take place in the data analysis process. In the analysis of the data, every single summary variable produced by the simulator was analysed and presented. This way of analysing the data differs dramatically from the way the variables have been examined in previous driving simulator studies of stereotype threat. In one case, significant differences were found only by using an aggregated combination of driving errors, some sort of “a global performance score” (Moè et al., 2015) or “a composite score” (Joanisse et al., 2013). As described by Simmons et al. (2011), combining different variables until finding a precise combination that would seemingly support the original hypothesis is a typical garden path which represents researcher degrees of freedom that would allow to present anything as significant. It is common, although unethical, for researchers to analyse a large swath of variables but present in the publication only those for which they found significant differences between conditions (Simmons et al., 2011). In the third article of this thesis, an opposite approach was used to examine the extent of the threat effect. This approach likely results in a better reflection of the magnitude of the effect under investigation. The variables that are presented in this paper’s experimental results have been automatically

generated by the simulator software and are available for each scenario of each study that uses the STISIM Drive (2021) simulator. This is definitely a step forward in the study of stereotype threat in the context of driving. In contrast, Moe et al. (2015) asked human raters seated on each side of the driver to note down the mistakes that they observed during the five-minute drive. The incredibly large effect obtained in the Moe et al. (2015) study may be partially explained by both the subjective nature of the way the data were collected and the possibilities of subjectively selecting the variables that supported the predictions. Additionally, the discrepancy between the magnitude of their results and the magnitude of the results of other studies in the literature, as well as our study, puts into question whether in the study by Moe et al. (2015) the blinding of the raters to the conditions in which the participants were tested (threat or neutral) was successful. It is conceivable that unbeknownst to the raters and researchers, their behaviour affected both the performance of the participants in the simulator and the process of data collection itself.

The way that the data were analysed in our study also seems to meet the standards currently advocated within social psychology. The potential for replicability and reproducibility has been improved in our study through objective ways of analysing the data according to a pre-determined plan. The data analysis in Study 1 was computationally duplicated in Study 2, thus clearly signalling the absence of *p* hacking, which is currently the focus of attention of many meta-scientists working in the field. As a result, the approaches outlined in the article on stereotype threat are particularly noteworthy in this additional aspect. Future papers that include more than one study should make every effort to ensure that the data analyses of the different studies within the article are identical whenever possible. The use of data analyses that differ from study to study within the same article should be considered with great scepticism, and the authors should provide a full explanation and justification for their decision to do so.

In sum, the methodological choices made in the stereotype threat article are sound, since they adhere to the recent recommendations for improving the quality of this type of research. Although the methods used in the stereotype threat article are neither astonishing nor unusual, they are novel in that no previous research on stereotype threat in driving has been so exhaustive in its search for an effect.

### Article 3: Conclusion – Effects Are Weaker Than Previously Believed

Although some studies have obtained results that looked like evidence for the effect of stereotype threat under a variety of conditions, including the driving of a vehicle (Chateignier et al., 2011; Joannis et al., 2013; Moè et al., 2015; Yeung & von Hippel, 2008), we conclude here that the effect of stereotype threat is non-existent or weak at best. The results of this research suggest that any future studies have a low likelihood of finding this effect. Other researchers have expressed similar opinions in other domains, such as the effect of gender stereotype threat on women's performance in mathematics (Stoet & Geary, 2012).

Retrospectively, it seems that a clearly demarcated debate should have been more apparent in the social psychology literature with regard to the so-called stereotype threat effect. Some researchers still find the existence of this effect convincing (Armstrong et al., 2017; Barber & Mather, 2013; Beasley & Fischer, 2012; R. T. Harrison et al., 2020; Joo & Lee-Won, 2016; King et al., 2019; Rydell & Boucher, 2017; Spencer et al., 1999; Steele, 2011; Villanueva-Moya & Expósito, 2021), yet others doubt its existence or question its strength (Flore et al., 2018; Flore & Wicherts, 2015; Moon & Roeder, 2014; Pennington et al., 2019; Schimmack, 2015a, 2017; Shewach et al., 2019; Stoet & Geary, 2012; Stricker & Ward, 2004; Tsui et al., 2011).



At best, it seems that the evidence supporting the concept of stereotype threat is less robust than initially thought. Curiously enough, vast numbers of papers continue to appear in the literature with stereotype threat as a paradigm under examination, despite the passage of time since the first doubts about it were expressed. The empirical foundations for stereotype threat seemed so solid that the interest in the concept remains high. The original article on stereotype threat by Steele and Aronson (1995) has garnered over 3500 citations to this day. On the other hand, the articles and commentaries that attempt to highlight methodological problems with that research, such as those by Sackett (2004a) and Wicherts (2005), have just 106 and 13 citations, respectively. The prominence and frequency of articles that show the effect, combined with the relative obscurity of the articles that criticize it, is one of the explanations why the research on stereotype threat keeps churning out new publications.

Flore et al. (2018) recently conducted a study about the effects of stereotype threat on the math performance of female high school students, based on a pre-registered methodology. Their high-quality research program with a very large sample size (over 2000 participants) together with a thorough and comprehensive methodology did not find evidence for an overall effect of stereotype threat or for any moderated stereotype threat effect. The authors generously suggested a multitude of alternative explanations that could clarify why their results differ from those in previous studies. Of course, the most parsimonious explanation would be that this effect simply does not exist.

Not only do our results agree with those found by other researchers who find the evidence for the existence of stereotype threat not convincing (Finnigan & Corker, 2016; Flore et al., 2018; Moon & Roeder, 2014; Pennington et al., 2019; Shewach et al., 2019; Stricker & Ward, 2004; Tsui et al., 2011; Zigerell, 2017), but our findings also seem to fit with the pattern

observed in the literature, in which studies with a small sample size and doubtful methodology are able to observe the effect of stereotype threat and studies with a large sample size and high-quality methodology fail to detect the effect (Lewis & Michalak, 2021; Zigerell, 2017).

### Article 3: Implications

The specific topic of psychological models of driving and stereotype threat may be a niche area with seemingly insular findings, but these findings must be seen within the larger scope of social psychology. Even though the study presented here is not without limitations, the failure to replicate the effect of stereotype threat on the simulated driving performance of female drivers suggests that other researchers should think twice before undertaking further studies involving stereotype threat using driving simulation. As already stated, the experiments show that this effect may be elusive even with a strong induction of the stereotype threat and a large sample size. It would not be a surprise if future research also ends up with a lack of significant differences.

In the above section of the thesis, I reviewed and discussed the results presented in the three main articles and finished by placing the findings of the third article in the area of research on stereotype threat against women in the context of driving. Below I expand the scope of the discussion to include stereotype threat in other contexts and stereotype research in general and finish with some remarks about the broad field of social psychology.

### Research Context of the Three Articles Considered Together

The real claim for significance of my thesis is field-based. It may seem grandiose to make a field-based claim based on just one thesis, but I believe that my voice joins the chorus of other

voices that are important to the field as a whole and that have raised similar concerns about research practices and publication bias in the literature on stereotypes. This thesis illustrates an example of how the current system lets down the proper scientific method. Based on some of the findings illustrated in this thesis, it is obvious that one currently cannot confidently rely on previous research in the development of new hypotheses.

### Social Psychology: Research on Stereotypes

Taking a retrospective look at the studies preceding the one presented in the third article (and such studies keep being published) indicates that we should not have been surprised to find null results, with significance chasing (Nickerson, 2000; Ware & Munafò, 2015) and publication bias likely being the main culprits (Schimmack, 2019).

### Questionable Research Practices

With hindsight, the poor replicability of research findings in psychology in general and social psychology in particular could have been foretold, considering the practice of wanton and reckless violations of those assumptions that are built into the most used statistical tests, as well as the prevalence of questionable research practices (John et al., 2012; Schimmack, 2015b), which may constitute a very slowly changing research norm (John et al., 2012). The assumptions most commonly violated include pretending that you have planned your analysis in advance, hypothesizing after results are known (HARKing) (John et al., 2012; Kerr, 1998; Murphy & Aguinis, 2019), and running a large number of comparisons but showing only the results that support the hypothesis and pretending that other results do not exist (cherry-picking) (John et al., 2012; Murphy & Aguinis, 2019; Rubin, 2017). In fact, there have been suggestions in the

literature that the foundational study that spurred the wave of research on stereotype threat – the one by Steele and Aronson (1995) – may include some violations of the statistical assumptions for the tests that were used (Wicherts, 2005), which may have given rise to some misinterpretations of the results (Sackett et al., 2004a, 2004b).

### Publication Bias

In psychology in general, publication bias is one of the culprits for the poor replicability of research, because academic journals prioritize publishing studies that find significant differences between groups and refuse to publish findings that do not find such differences (Chambers, 2015; Ware & Munafò, 2015). The current system is absurd in that it almost exclusively accepts studies for publication that show statistically significant differences between groups. Differences are, arbitrarily, and quite liberally, considered sufficiently significant when the  $p$  value dips below .05. There can be a slew of other research studies that find no differences, but they are not accepted for publication. For every phenomenon, there could have been 100 research projects undertaken, with most of them failing to demonstrate significant group differences and thus not published; however, the only five studies that do demonstrate significant differences would be published. This likely results in a blatant misrepresentation of the truth and makes the picture of the field warped in a way that cannot be reliably straightened out. Thus, for the field to progress, it will be necessary to overcome the problems with the publication bias.

The alarm bells about the state of the field in general were already rung by some researchers, going far back in the past (Barber, 1976; Cohen, 1994). Greenwald (1975) alerted the community to problems with publication bias against the null hypothesis. In his study, which used a mathematical model simulating the research publication process as well as case studies of

erroneous rejections of the null hypothesis in published psychological research, he concluded that the research publication system is dysfunctional and that the discrimination against publishing studies in which the results do not refute the null hypothesis is likely damaging the progress of research (Greenwald, 1975). Thus, the publication process in the field needs to change to obtain a clearer picture of the truth. To this end, studies that find significant differences between groups and studies that do not find significant differences between groups should have an equal likelihood of being published. Both information about finding significant differences and not finding them should be communicated to other researchers, who otherwise keep attempting to replicate the findings and, being unable to do so, put them in the proverbial file drawer (Rosenthal, 1979).

### Outright Scholarly Fraud by Diederik Stapel

Problems with published studies about stereotype threat are not limited to those described above. On top of those, an unfortunate incident of scholarly fraud by Diederik Stapel (Stroebe et al., 2012) currently accounts for approximately 60 retracted publications in the field of social psychology (Marcus et al., 2021). So far, Stapel's retractions amount to a whopping 14 publications in the *Journal of Personality and Social Psychology*, five in the *Journal of Experimental Social Psychology*, eight in the *Personality and Social Psychology Bulletin*, and about 30 others sown far and wide across other journals (Marcus & Oransky, 2021). Stapel's publications based on fabricated data made an impact in the field, with many researchers basing their hypotheses on the reported results of his fabricated studies. Stapel's presumed work generated inspiration for research projects of other scientists, and he has been cited thousands of times. The body of literature on the topic of stereotypes now needs to be cleared not only from

his work but also from the works of other researchers that were based on the supposed findings and many publications by Stapel on the topic of stereotypes that have already been retracted (Oransky & Marcus, 2021). His example also highlights the importance of reproducing original findings, because that would have revealed the lack of credibility of his research earlier. Because Stapel was extremely prolific in publishing fraudulent results, his falsified research contaminated the field of social psychology to an extent that is hard to overestimate, and the whole field requires a significant course correction.

To summarize, as a result of publication bias and other methodological problems, the state of the scientific literature on the topic of stereotypes and stereotype threat has been seriously questioned (Warne, 2020). Based on the literature, the studies presented in this article should have found large differences between experimental conditions. Unfortunately, in previous research, articles that found this effect were published and cited widely, while articles and commentaries that put this effect into question were mostly ignored or not published at all (Stoet & Geary, 2012), biasing the apparent consensus about the strength of the effect and precluding informed planning of research projects. Additionally, articles with clearly fraudulent data, such as those by Stapel, continue to influence the field, since readers tend to believe the findings of an article even after retraction (Greitemeyer, 2014; O'Rear & Radvansky, 2020). This suggests that significant efforts should be undertaken in knowledge translation and dissemination in order to better inform the public and other researchers about the true state of knowledge in the field.

## Future Directions

Even though the specific studies described in this thesis are within a narrow niche of the psychology of driving, the implications are larger and would be interesting to researchers in social psychology. Researchers working in the fields of social psychology and driving psychology should be aware of our results to better orient their own research programmes. I contend that, although some degree of scepticism about past research has always been a component of the research process, the level of scepticism was woefully insufficient. Evaluation of previous research used to imply a moderate amount of scepticism combined with a significant amount of trust in the competence, honesty, and good intentions of other researchers, which, as it has now become apparent, was not warranted. Incompetence and outright fraud can be suspected even in peer-reviewed publications. Given that peer review is often performed by unpaid volunteers, the lack of professionalism and mistakes in approving substandard papers is unsurprising. Thorough and transparent reporting of all the results, the automatic availability of raw data for anyone to double-check, pre-registration, and a basic absence of mathematical mistakes in the analysis and the results should be a given; unfortunately, this is currently not the case. Publications that do not satisfy those criteria should be viewed with a healthy dose of scepticism.

## Summary

The results described in the first two articles presented in this thesis illustrated that gendered driver stereotypes exist and vary according to the stereotyped driver's age. The specific driving behaviours associated with female drivers were not previously documented in the literature; this gap is addressed in the study described in the first article. While previous research

has examined the effects of gender and age on driver stereotypes separately, the combination of these two variables has not been explored. The second article builds upon prior literature by combining gender and age when looking at the contribution of these factors to the stereotypes about drivers. Finally, although stereotypes arguably influence the behaviour of some individuals, the mechanisms by which this occurs remain unknown. In the third article of this thesis, I believe to have shown that there is an increasing likelihood that stereotypes about drivers do not affect the behaviour of stereotyped individuals to the extent that was previously reported. In its small way, this thesis attempts to start correcting previous research that suggested that stereotype threat effects were strong. The results presented in the third article support the most recent research that did not show the stereotype threat effect in other domains.

## Conclusions

My findings confirm what many feel like they know, that is, members of our society share stereotypes about male and female drivers. They also show that very specific driving behaviours are differentially associated with men and women. Additionally, they highlight that it is important to consider age when thinking about stereotypes about male and female drivers, because stereotypes about middle-aged male drivers versus young male drivers, as well as middle-aged women versus old women, are very different.

The findings presented in this thesis also demonstrate that, despite the fact that stereotypes about female drivers exist and are fairly specific, their influence on the behaviour of stereotyped drivers is difficult to discern. Prior research on how stereotypes affect people's performance through the effect of stereotype threat is almost certainly incorrect. Even though stereotypes about female and male drivers are prevalent, which was shown in the first two



studies described in this thesis, it is difficult to detect how they affect driving performance. The two experiments attempting to influence the performance of female drivers in the simulator with the use of the stereotype threat paradigm were not able to detect a difference in driving performance between the participants in the stereotype group and the participants in the control condition. Several recent publications have begun to call into question the effects of stereotype threat, albeit in other domains than the one in which the research for this thesis was conducted. My research broadens the scope of research on stereotype threat to include driving. My findings add to other most recent findings in the literature that describe difficulties in attempting to obtain the effect of stereotype threat. In the words of L. Jussim, the concept of stereotype threat may be “overcooked, overstated, and oversold” (Jussim, 2015).

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## Appendices for Chapter 2



## Appendix A: Recruitment Announcement

### AVIS DE RECHERCHE

Le Laboratoire du Vieillissement Cognitif de l'Université d'Ottawa est à la recherche de personnes en bonne santé physique et mentale, désireuses de participer à une étude scientifique portant sur la conduite automobile. Afin d'y participer, vous devez aussi détenir un permis de conduire valide.

Vous allez visionner des vignettes traitant de scénarios relatifs à la conduite automobile et répondre aux quelques questions pour nous donner vos impressions sur la conduite d'automobile illustrée dans les vignettes. La participation va prendre 45 minutes environ.

### RESEARCH NOTICE

The Laboratory of Cognitive Aging at the University of Ottawa is currently recruiting persons in good mental and physical health, wishing to participate in a scientific study on driving. In order to participate, you need to hold a valid driver's licence.

You will watch brief videos of driving episodes and then answer some questions to give us your impressions about the driving that was illustrated in the videos. Your participation will take about 45 minutes.

## Appendix B: Consent Forms

French Version



**Titre du Projet:** Évaluation des comportements routiers

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillon Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

Je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Mlle Yara Kadulina (étudiante au doctorat et assistante de recherche) de l'équipe de recherche du laboratoire de vieillissement cognitif et de la conduite automobile de l'Université d'Ottawa.

On m'a informé(e) des faits suivants relativement à ma participation dans cette étude. Cette expérience fait partie d'une plus vaste étude portant sur la performance routière. Cette étude vise à mieux comprendre la perception d'automobilistes face à divers comportements routiers. Lors de cette étude, je visionnerai 21 vignettes et je remplirai un questionnaire correspondant. Ma participation sera d'une durée d'environ 45 minutes.

Aucun inconfort ou désagrément ne sont envisagés pendant et suite à ma participation à cette étude. La tâche étant de nature cognitive, il se peut que je ressente une certaine fatigue. Toutefois, si je présente un certain inconfort, je peux prendre une pause ou me retirer en tout temps de l'étude. Si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)).

En participant à cette recherche, j'aurai l'opportunité de contribuer à la recherche scientifique en plus de contribuer à la progression des connaissances relatives à la conduite automobile.

Ma participation est strictement volontaire. Je peux refuser de participer ou me retirer de l'étude en tout temps, et ce, sans craintes de représailles ou d'ennuis. Je peux aussi demander de l'information supplémentaire en tout temps afin d'obtenir une meilleure compréhension de l'étude.

Je comprends qu'une rémunération d'un point de participation, équivalant un pour cent de ma note finale pour un cours d'Introduction à la psychologie, me sera accordée. Je suis assuré par le Dr Gagnon ou Mlle Kadulina et/ou un autre membre de l'équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr, pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr Gagnon, et seuls Dr Gagnon et Mlle Kadulina auront accès aux données, et seront détruites si vous souhaitez vous retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traités globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi, tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Je peux conserver une copie du formulaire de consentement. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut de cette page.

Nous vous remercions à l'avance pour votre participation à cette étude.

En cliquant sur « OUI » en bas, je consens que mes données (anonymisées) seront utilisées pour ce projet de recherche.

ÊTES-VOUS D'ACCORD POUR PARTICIPER?

☐ OUI – Je comprends qu'est-ce qui est requis pour cet étude je consens à y participer.

☐ NON – Je ne veux pas participer.

English Version



**Title of Project:** Evaluation of on-road behaviours

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

#### Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

I, \_\_\_\_\_, agree to participate in the study conducted by Dr. Sylvain Gagnon and Miss Yara Kadulina and the research team of the Laboratory of Cognitive Aging and driving at the University of Ottawa. The nature and purpose of the study were clearly explained to me: I understand that this experiment is part of a larger research program aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours.

In participating in this research, I will have the opportunity to take part in scientific research, while contributing to increase the knowledge that relates to driving. This experiment involves viewing 21 computerized video clips and filling the corresponding questionnaire. This study will take 45 minutes of my time. I will not experience any physical pain, and there are no known risks associated with my participation in this study. Since the task is of a cognitive nature, there is a possibility that I might experience fatigue. Consequently, if at any time I am uncomfortable or too tired to proceed, I may take a break or withdraw completely from the study. If I need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)).

Participation in this research is completely voluntary. The decision to participate or not is entirely mine. Even if I decide to participate, I may still withdraw at any time during the study without any penalty. I can also ask for more information at any time in order to gain a better understanding of the research.

Furthermore, I will be compensated one participation point, equivalent to one percent of my final grade for an introductory psychology course.

I am assured by Dr. Gagnon or Miss Kadulina and other members (or one of their research assistants) that the answers I provide will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study will have access to it (Dr. Gagnon and Miss Kadulina), and will be destroyed if I choose to withdraw from the study. At the end of the retention period, all data will be destroyed. Meanwhile, my data will be used for research purposes only, such as scientific articles or presentations. Results will be reported in pooled format, seeking group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

I may keep a copy of the consent form. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you in advance for your participation in this study.

By clicking YES below, you are consenting for your (anonymised) data to be used in this research project.

DO YOU AGREE TO PARTICIPATE?

☒ YES - I understand the study and what is required of me, and I agree to take part.

☐ NO - I do not agree to take part.



## Appendix C: Questionnaires

## Appendix C: QUESTIONS ASKED

### French Version

Quéstions présentées après chaque vidéoclip.

1.1 Les manœuvres de conduite présentées dans cette vignette sont-elles représentatives d'un conducteur typique du sexe masculin?

| 1                           | 2                      | 3                          | 4                           | 5                     | 6                    | 7                           |
|-----------------------------|------------------------|----------------------------|-----------------------------|-----------------------|----------------------|-----------------------------|
| Pas du tout représentatives | Un peu représentatives | Modérément représentatives | Moyennement représentatives | Assez représentatives | Très représentatives | Extrêmement représentatives |

1.2 Les manœuvres de conduite présentées dans cette vignette sont-elles représentatives d'un conducteur typique du sexe féminin (d'une conductrice)?

| 1                           | 2                      | 3                          | 4                           | 5                     | 6                    | 7                           |
|-----------------------------|------------------------|----------------------------|-----------------------------|-----------------------|----------------------|-----------------------------|
| Pas du tout représentatives | Un peu représentatives | Modérément représentatives | Moyennement représentatives | Assez représentatives | Très représentatives | Extrêmement représentatives |

## Appendix C: QUESTIONS ASKED

### English Version

Questions presented after each video clip.

1.1 Are the driving manoeuvres presented in this clip representative of the typical driver of male gender?

| 1                            | 2                          | 3                            | 4                           | 5                       | 6                      | 7                           |
|------------------------------|----------------------------|------------------------------|-----------------------------|-------------------------|------------------------|-----------------------------|
| Not at all<br>Representative | Somewhat<br>Representative | Moderately<br>Representative | Representative<br>(Average) | Quite<br>Representative | Very<br>Representative | Extremely<br>Representative |

1.2 Are the driving manoeuvres presented in this clip representative of the typical driver of female gender?

| 1                            | 2                          | 3                            | 4                           | 5                       | 6                      | 7                           |
|------------------------------|----------------------------|------------------------------|-----------------------------|-------------------------|------------------------|-----------------------------|
| Not at all<br>Representative | Somewhat<br>Representative | Moderately<br>Representative | Representative<br>(Average) | Quite<br>Representative | Very<br>Representative | Extremely<br>Representative |

## Appendix D: Debriefing

## French Version

### *DEBRIEFING (EN FRANÇAIS)*

- 1) L'objectif réel de l'étude était d'établir s'ils existent toujours les stéréotypes négatifs reliés aux conductrices. Pour atteindre cet objectif, nous ne vous avons pas divulgué le véritable objectif de cette étude. Cet objectif véritable a été fixé étant donné la nécessité de réaliser des études s'interrogeant sur les stéréotypes négatifs envers les conductrices.
- 2) Ainsi, nous sommes principalement intéressés aux réponses que vous nous avez données concernant les comportements routiers typiquement observés chez les conductrices. Nous désirions aussi observer si vous jugiez que d'autres comportements présentés étaient plus typiques de ce groupe, c'est-à-dire qu'ils sont observés plus fréquemment.
- 3) L'objectif réel de l'étude est la seule chose qui a été masquée. Le reste (tâche expérimentale, le laboratoire, les personnes responsables de l'étude et du laboratoire, assistant de recherche) était véridique. De même, les résultats de cette recherche s'inscrivent toujours au sein du mandat de ce laboratoire qui est de mieux comprendre ce qui affecte le comportement et les réactions au volant des conducteurs. Finalement, comme mentionné au début, vos réponses seront traitées de manière totalement confidentielle. Votre anonymat sera conservé en tout temps.
- 4) Cette procédure a été utilisée puisque nous voulions nous assurer de ne pas influencer votre performance. Nous voulions minimiser les risques que vous performiez en fonction du but de l'étude. Cette procédure est couramment utilisée dans les études traitant des stéréotypes. Les données qui seront recueillies à partir de cette étude seront très importantes pour le domaine de la cognition sociale. De fait, il a été noté que les stéréotypes négatifs peuvent affecter de diverses manières les individus qui sont victime de stéréotypes. Il a été démontré que plusieurs caractéristiques d'une personne peuvent susciter des stéréotypes : le genre, le statut socio-économique, l'origine ethnique. Toutefois, aucune étude ne s'est intéressée auparavant à l'existence moderne des stéréotypes à propos des conductrices.
- 5) Si vous vivez certaines difficultés ou un inconfort suite à notre rencontre, nous vous invitons à consulter le Centre des services psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e

étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)). Vous pouvez aussi rejoindre le Responsable de la déontologie en recherche de l'Université d'Ottawa si vous avez des questions ou pour faire part de vos commentaires (550 rue Cumberland, pièce 159, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5841, [ethics@uottawa.ca](mailto:ethics@uottawa.ca) <<mailto:ethics@uottawa.ca>>) pour des questions additionnelles.

- 6) Veuillez noter qu'à la lumière de ces nouvelles informations, vous avez à nouveau le choix de participer à notre recherche ou de vous retirer de celle-ci, et ce, sans craintes de représailles ou autres conséquences négatives. De fait, même si vous faites le choix de vous retirer, vous recevrez la rémunération promise (les points alloués par le SIPR). Vos renseignements seront conservés en lieu sûr, dans le laboratoire de recherche du Dr. Gagnon pour une période maximale de 10 ans et seront détruites si vous choisissez de vous retirer de l'étude, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données. À la fin de la période de rétention, toutes les données seront détruites.

*(Si aucune préoccupation n'est rapportée et que la personne désire toujours participer, il y aura présentation du nouveau formulaire de consentement.)*



## English Version

### *DEBRIEFING (IN ENGLISH)*

- 1) The actual nature and purpose of this study was to identify if negative stereotypes about female drivers still exist. In order to achieve this objective, we did not divulge the real aim of this study. The actual purpose was established based on the need of studies that directly investigate negative stereotypes pertaining to female drivers.
- 2) Therefore, we were mainly interested in the clips demonstrating behaviours that can be thought as typical of female drivers. We also wish to look at other behaviours that you evaluated as typical of female drivers but that can be linked to other age groups (i.e., that are more frequently observed).
- 3) The actual purpose of this study is the only thing that has been concealed. The rest (experimental task, the laboratory, the principal investigators) was true. Additionally, this study is still part of a larger research program aimed at increasing our understanding of variables that have an impact on the behaviours and reactions of drivers. Finally, as stated previously, your answers will remain completely confidential and anonymous.
- 4) This procedure was used to ensure that we did not bias your performance on the simulated task. We wanted to minimize the chances that you would perform according to the purpose of the study. This procedure is often used in stereotype studies. The data that will be collected throughout this study is very important to the social cognition field. In fact, other studies have found that negative stereotypes can have many diverse effects on stigmatized individuals. It was demonstrated that many characteristics (gender, socioeconomical status, ethnic background) can trigger stereotypes. Nevertheless, there is no study that investigated modern presence of female drivers stereotypes.

- 5) If you are having difficulties or feeling uncomfortable, you may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)). Do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 159, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5841, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca), if you have additional questions.
- 6) Also note that based on the aforementioned information, you again have the choice to participate to this research or withdraw your participation without any penalty. In fact, even if you choose to withdraw from this study, you will still be compensated with one participation point for ISPR.
- 7) Your information will be kept safe in the research laboratory of Dr. Gagnon for a maximum period of 10 years and will be destroyed if you choose to withdraw from the study, and only Dr. Gagnon, Yara Kadulina and other research assistants will have access to the data. At the end of the retention period, all data will be destroyed.

*(If no preoccupation related to their participation is reported and if participants still want to participate, the new consent form will be presented to them.)*

## Appendix E: Post-Debriefing Consent Forms

French Version



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Canada's university

**Titre du Project:** Évaluation des stéréotypes reliés aux conductrices.

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement (suite à la révélation de la déception)**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillion Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

On m'a informé(e) des véritables objectifs de l'étude. De fait, cette étude visait à examiner si les stéréotypes négatifs reliés aux conductrices existent toujours. Ma participation permettra de contribuer à la progression de connaissances des variables sociales et contextuelles pouvant avoir un impact sur les effets néfastes des stéréotypes dans notre société. Je comprends que les intentions véritables de l'étude ne pouvaient pas être divulguées à l'avance, puisque ceci aurait pu avoir pour effet d'influencer ma performance. Je comprends que cette expérience fait toujours partie d'une plus vaste étude portant sur la performance routière. Il m'a aussi été indiqué que si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel cps@uottawa.ca).

Suite à la révélation de la déception, j'accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Yara Kadulina (étudiante au doctorat et assistante de recherche) de son équipe de recherche du laboratoire de vieillissement cognitif de l'Université d'Ottawa. J'accepte aussi qu'ils utilisent les résultats obtenus avant la révélation de la duperie.

Ma participation demeure strictement volontaire. Il m'a été expliqué que j'avais à nouveau le choix de participer ou de me retirer de l'étude suite à la divulgation des intentions véritables, et ce, sans craintes de représailles ou d'ennuis. Par ailleurs, on m'a indiqué que si je décidais de me retirer de l'étude, ma rémunération d'un point de participation, équivalant un pour cent de ma note finale pour un cours de la psychologie, me serait toujours accordée.

J'ai reçu l'assurance par le Dr. Gagnon, Yara Kadulina et/ou autres membres de son équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr. Gagnon, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données, et celles-ci seront détruites si je choisis de me retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traitées globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Je peux conserver une copie du formulaire de consentement. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut.

Merci pour votre participation à cette étude.

En cliquant sur « OUI » en bas, je consens que mes données (anonymisées) seront utilisées pour ce projet de recherche.

ÊTES-VOUS D'ACCORD POUR PARTICIPER?

☐ OUI – Je comprends qu'est-ce qui est requis pour cet étude je consens à y participer.

☐ NON – Je ne veux pas participer.

English Version



**Title of Project:** Evaluation of female driver stereotypes.

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

#### Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

I have been informed of the actual nature and purpose of the study. This study aimed to identify if the negative stereotypes of women drivers still exist. My participation will contribute to the advancement of knowledge that relates to the social and contextual variables that may have an impact on the harmful effects of stereotypes in our society. I understand that the real objectives of this research could not have been explained to me at the beginning of this task, since it could have possibly influenced my performance. I also know that this study is still part of a larger research program aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours. It was also mentioned that if need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)).

After the disclosure of deception, I agree to participate in the study conducted by Dr. Sylvain Gagnon, Yara Kadulina (Ph.D candidate and research assistant), and the research team of the Laboratory of Cognitive Aging at the University of Ottawa. I give them permission to use the data obtained prior to the disclosure of the actual aim of the study.

Participation in this research is still completely voluntary. I understand that, based on the disclosure of the real aim of the research, I again have the choice to participate to this research or withdraw my



participation without any penalty. Furthermore, I understand that I would be compensated one participation point, equivalent to one percent of my final grade for an introductory psychology course, even if I withdrew my participation.

I have been assured by Dr. Gagnon, Yara Kadulina and/or another member of his team that the answers I provided will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study (Dr Gagnon, Yara Kadulina and other research assistants) will have access to it, and the data will be destroyed if I choose to withdraw from this study. At the end of the retention period, all data will be destroyed. Also, my data will be used for research purposes only such as scientific articles or presentations. Results will be reported in pooled format, seeking age group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

I may keep a copy of this consent form. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you for your participation in this study.

By clicking YES below, you are consenting for your (anonymised) data to be used in this research project.

DO YOU AGREE TO PARTICIPATE?

☐ YES - I understand the study and what is required of me, and I agree to take part.

☐ NO - I do not agree to take part

## Appendices for Chapter 3

## Appendix A: Recruitment Announcement

### AVIS DE RECHERCHE

Le Laboratoire du Vieillissement Cognitif de l'Université d'Ottawa est à la recherche de personnes en bonne santé physique et mentale, désireuses de participer à une étude scientifique portant sur la conduite automobile. Afin d'y participer, vous devez aussi détenir un permis de conduire valide.

Vous allez répondre aux quelques questions pour nous donner vos impressions sur la conduite d'automobile des conducteurs variés. La participation va prendre 45 minutes environ.

### RESEARCH NOTICE

The Laboratory of Cognitive Aging at the University of Ottawa is currently recruiting persons in good mental and physical health, wishing to participate in a scientific study on driving. In order to participate, you need to hold a valid driver's licence.

You will answer some questions to give us your impressions about the driving of a variety of drivers. Your participation will take about 45 minutes.

## Appendix B: Consent Forms

French Version



**Titre du Projet:** Évaluation des comportements routiers

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillon Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

Je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Mlle Yara Kadulina (étudiante au doctorat et assistante de recherche) de l'équipe de recherche du laboratoire de vieillissement cognitif et de la conduite automobile de l'Université d'Ottawa.

On m'a informé(e) des faits suivants relativement à ma participation dans cette étude. Cette expérience fait partie d'une plus vaste étude portant sur la performance routière. Lors de cette étude, je remplirai un questionnaire sur la perception d'automobilistes face à divers comportements routiers. Ma participation sera d'une durée d'environ 45 minutes.

Aucun inconfort ou désagrément ne sont envisagés pendant et suite à ma participation à cette étude. La tâche étant de nature cognitive, il se peut que je ressente une certaine fatigue. Toutefois, si je présente un certain inconfort, je peux prendre une pause ou me retirer en tout temps de l'étude. Si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)).

En participant à cette recherche, j'aurai l'opportunité de contribuer à la recherche scientifique en plus de contribuer à la progression des connaissances relatives à la conduite automobile.

Ma participation est strictement volontaire. Je peux refuser de participer ou me retirer de l'étude en tout temps, et ce, sans craintes de représailles ou d'ennuis. Je peux aussi demander de l'information supplémentaire en tout temps afin d'obtenir une meilleure compréhension de l'étude.

Je comprends qu'une rémunération d'un point de participation, équivalant un pour cent de ma note finale pour un cours d'Introduction à la psychologie, me sera accordée. Je suis assuré par le Dr Gagnon ou Mlle Kadulina et/ou un autre membre de l'équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr, pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr Gagnon, et seuls Dr Gagnon et Mlle Kadulina auront accès aux données, et seront détruites si vous souhaitez vous retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traités globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi, tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Je peux conserver une copie du formulaire de consentement. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut de cette page.

Nous vous remercions à l'avance pour votre participation à cette étude.

En cliquant sur « OUI » en bas, je consens que mes données (anonymisées) seront utilisées pour ce projet de recherche.

ÊTES-VOUS D'ACCORD POUR PARTICIPER?

☐ OUI – Je comprends qu'est-ce qui est requis pour cet étude je consens à y participer.

☐ NON – Je ne veux pas participer.

English Version





**Title of Project:** Evaluation of on-road behaviours

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

#### Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

I, \_\_\_\_\_, agree to participate in the study conducted by Dr. Sylvain Gagnon and Miss Yara Kadulina and the research team of the Laboratory of Cognitive Aging and driving at the University of Ottawa. The nature and purpose of the study were clearly explained to me: I understand that this experiment is part of a larger research program aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours.

In participating in this research, I will have the opportunity to take part in scientific research, while contributing to increase the knowledge that relates to driving. This experiment involves filling out questionnaires about driving behaviours. This study will take 45 minutes of my time. I will not experience any physical pain, and there are no known risks associated with my participation in this study. Since the task is of a cognitive nature, there is a possibility that I might experience fatigue. Consequently, if at any time I am uncomfortable or too tired to proceed, I may take a break or withdraw completely from the study. If I need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)).

Participation in this research is completely voluntary. The decision to participate or not is entirely mine. Even if I decide to participate, I may still withdraw at any time during the study without any penalty. I can also ask for more information at any time in order to gain a better understanding of the research.

Furthermore, I will be compensated one participation point, equivalent to one percent of my final grade for an introductory psychology course.

I am assured by Dr. Gagnon or Miss Kadulina and other members (or one of their research assistants) that the answers I provide will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study will have access to it (Dr. Gagnon and Miss Kadulina), and will be destroyed if I choose to withdraw from the study. At the end of the retention period, all data will be destroyed. Meanwhile, my data will be used for research purposes only, such as scientific articles or presentations. Results will be reported in pooled format, seeking group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

I may keep a copy of the consent form. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you in advance for your participation in this study.

By clicking YES below, you are consenting for your (anonymised) data to be used in this research project.

DO YOU AGREE TO PARTICIPATE?

☐ YES - I understand the study and what is required of me, and I agree to take part.

☐ NO - I do not agree to take part.

## Appendix C: Questionnaires

French Version

1. Imaginez deux adultes (dans la quarantaine): un homme et une femme. Ils doivent effectuer un voyage en voiture ensemble.

1a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                     | 2                               | 3                       | 4                            | 5                        | 6                                | 7                      |
|-----------------------|---------------------------------|-------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>l'homme | Très<br>probablement<br>l'homme | Probablement<br>l'homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

1b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                     | 2                               | 3                       | 4                            | 5                        | 6                                | 7                      |
|-----------------------|---------------------------------|-------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>l'homme | Très<br>probablement<br>l'homme | Probablement<br>l'homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

2. Imaginez deux jeunes adultes (en fin d'adolescence, début de la vingtaine): un jeune homme et une jeune femme. Ils doivent effectuer un trajet en voiture ensemble.

2a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                         | 3                                 | 4                            | 5                                 | 6                                         | 7                               |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|-----------------------------------|-------------------------------------------|---------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la jeune<br>femme | Très<br>probablement<br>la jeune<br>femme | Assurément<br>la jeune<br>femme |

2b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                         | 3                                 | 4                            | 5                                 | 6                                         | 7                               |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|-----------------------------------|-------------------------------------------|---------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la jeune<br>femme | Très<br>probablement<br>la jeune<br>femme | Assurément<br>la jeune<br>femme |

3. Imaginez un homme plus âgé et une femme plus âgée (tous deux dans la soixtaine). Ils doivent effectuer un trajet en voiture ensemble.

3a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                             | 2                                   | 3                           | 4                            | 5                                | 6                                        | 7                              |
|-------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------------------------|------------------------------------------|--------------------------------|
| Assurément<br>l'hommes<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Assurément<br>la femme<br>âgée |

3b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                             | 2                                   | 3                           | 4                            | 5                                | 6                                        | 7                              |
|-------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------------------------|------------------------------------------|--------------------------------|
| Assurément<br>l'hommes<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Assurément<br>la femme<br>âgée |

4. Imaginez deux personnes: un homme plus jeune (fin de l'adolescence ou au début de la vingtaine) et une femme plus âgée (dans les 60 ans). Ils doivent effectuer un trajet en voiture ensemble.

4a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                         | 3                                 | 4                            | 5                                        | 6                                             | 7                                   |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|------------------------------------------|-----------------------------------------------|-------------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme la<br>plus âgée | Très<br>probablement<br>la femme plus<br>âgée | Assurément<br>la femme<br>plus âgée |

4b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                         | 3                                 | 4                            | 5                                        | 6                                             | 7                                   |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|------------------------------------------|-----------------------------------------------|-------------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme la<br>plus âgée | Très<br>probablement<br>la femme plus<br>âgée | Assurément<br>la femme<br>plus âgée |



5. Imaginez deux personnes: un homme jeune (dans la fin de l'adolescence ou au début de la vingtaine) et une femme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

5a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                         | 3                                 | 4                            | 5                        | 6                                | 7                      |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

5b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                         | 3                                 | 4                            | 5                        | 6                                | 7                      |
|---------------------------------|-------------------------------------------|-----------------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

6. Imaginez deux personnes: un homme âgé (dans la soixantaine) et une femme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

6a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                            | 2                                   | 3                           | 4                            | 5                        | 6                                | 7                      |
|------------------------------|-------------------------------------|-----------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

6b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                            | 2                                   | 3                           | 4                            | 5                        | 6                                | 7                      |
|------------------------------|-------------------------------------|-----------------------------|------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

7. Imaginez deux personnes: une jeune femme (en fin de son adolescence début de la vingtaine) et une femme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

7a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                              | 3                                      | 4                            | 5                                                  | 6                                                          | 7                                                |
|---------------------------------|------------------------------------------------|----------------------------------------|------------------------------|----------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|
| Assurément<br>la jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Probablement<br>la plus jeune<br>femme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>dans la<br>quarantaine | Très<br>probablement<br>la femme<br>dans la<br>quarantaine | Assurément<br>la femme<br>dans la<br>quarantaine |

7b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                              | 3                                      | 4                            | 5                                                  | 6                                                          | 7                                                |
|---------------------------------|------------------------------------------------|----------------------------------------|------------------------------|----------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|
| Assurément<br>la jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Probablement<br>la plus jeune<br>femme | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>dans la<br>quarantaine | Très<br>probablement<br>la femme<br>dans la<br>quarantaine | Assurément<br>la femme<br>dans la<br>quarantaine |

8. Imaginez deux personnes: une femme âgée (âgée de 60 ans) et une femme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

8a. Laquelle d'entre elles est plus susceptible de prendre le volant? (encerclez)

| 1                              | 2                                        | 3                                | 4                            | 5                                                  | 6                                                          | 7                                                |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|----------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>dans la<br>quarantaine | Très<br>probablement<br>la femme<br>dans la<br>quarantaine | Assurément<br>la femme<br>dans la<br>quarantaine |

8b. Laquelle d'entre elles pensez-vous est un conductrice plus sécuritaire?

| 1                              | 2                                        | 3                                | 4                            | 5                                                  | 6                                                          | 7                                                |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|----------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>la femme<br>dans la<br>quarantaine | Très<br>probablement<br>la femme<br>dans la<br>quarantaine | Assurément<br>la femme<br>dans la<br>quarantaine |

9. Imaginez deux personnes: une femme âgée (âgée de 60 ans) et un homme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

9a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                              | 2                                        | 3                                | 4                            | 5                                                 | 6                                                         | 7                                               |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|---------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>l'homme dans<br>la<br>quarantaine | Très<br>probablement<br>l'homme dans<br>la<br>quarantaine | Assurément<br>l'homme<br>dans la<br>quarantaine |

9b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                              | 2                                        | 3                                | 4                            | 5                                                 | 6                                                         | 7                                               |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|---------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>l'homme dans<br>la<br>quarantaine | Très<br>probablement<br>l'homme dans<br>la<br>quarantaine | Assurément<br>l'homme<br>dans la<br>quarantaine |

10. Imaginez deux personnes: une femme âgée (âgée de 60 ans) et une jeune femme (en fin de son adolescence début 20 s). Ils doivent effectuer un trajet en voiture ensemble.

10a. Laquelle d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                              | 2                                        | 3                                | 4                            | 5                                      | 6                                              | 7                               |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |

10b. Laquelle d'entre eux pensez-vous est une conductrice plus sécuritaire?

| 1                              | 2                                        | 3                                | 4                            | 5                                      | 6                                              | 7                               |
|--------------------------------|------------------------------------------|----------------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>la femme<br>âgée | Très<br>probablement<br>la femme<br>âgée | Probablement<br>la femme<br>âgée | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |

11. Imaginez deux personnes: un homme âgé (dans la soixantaine) et une jeune femme (en fin d'adolescence début de la vingtaine). Ils doivent effectuer un trajet en voiture ensemble.

11a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                            | 2                                   | 3                           | 4                            | 5                                      | 6                                              | 7                               |
|------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |

11b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                            | 2                                   | 3                           | 4                            | 5                                      | 6                                              | 7                               |
|------------------------------|-------------------------------------|-----------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |

12a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                     | 2                               | 3                       | 4                            | 5                                      | 6                                              | 7                               |
|-----------------------|---------------------------------|-------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>l'homme | Très<br>probablement<br>l'homme | Probablement<br>l'homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |

12b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                     | 2                               | 3                       | 4                            | 5                                      | 6                                              | 7                               |
|-----------------------|---------------------------------|-------------------------|------------------------------|----------------------------------------|------------------------------------------------|---------------------------------|
| Assurément<br>l'homme | Très<br>probablement<br>l'homme | Probablement<br>l'homme | Soit l'un<br>soit<br>l'autre | Probablement<br>la plus jeune<br>femme | Très<br>probablement<br>la plus jeune<br>femme | Assurément<br>la jeune<br>femme |



13. Imaginez deux personnes: un homme âgé (dans la soixantaine) et un homme dans la quarantaine (un adulte). Ils doivent effectuer un trajet en voiture ensemble.

13a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                            | 2                                   | 3                           | 4                               | 5                                                 | 6                                                         | 7                                               |
|------------------------------|-------------------------------------|-----------------------------|---------------------------------|---------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>l'homme dans<br>la<br>quarantaine | Très<br>probablement<br>l'homme dans<br>la<br>quarantaine | Assurément<br>l'homme<br>dans la<br>quarantaine |

13b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                            | 2                                   | 3                           | 4                               | 5                                                 | 6                                                         | 7                                               |
|------------------------------|-------------------------------------|-----------------------------|---------------------------------|---------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------|
| Assurément<br>l'homme<br>âgé | Très<br>probablement<br>l'homme âgé | Probablement<br>l'homme âgé | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>l'homme dans<br>la<br>quarantaine | Très<br>probablement<br>l'homme dans<br>la<br>quarantaine | Assurément<br>l'homme<br>dans la<br>quarantaine |

14. Imaginez deux hommes: un jeune homme (fin de l'adolescence ou au début de la vingtaine) et un homme âgé (dans la soixantaine). Ils doivent effectuer un trajet en voiture ensemble.

14a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                         | 3                                 | 4                               | 5                           | 6                                   | 7                            |
|---------------------------------|-------------------------------------------|-----------------------------------|---------------------------------|-----------------------------|-------------------------------------|------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>l'homme âgé | Très<br>probablement<br>l'homme âgé | Assurément<br>l'homme<br>âgé |

14b.

Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                         | 3                                 | 4                               | 5                           | 6                                   | 7                            |
|---------------------------------|-------------------------------------------|-----------------------------------|---------------------------------|-----------------------------|-------------------------------------|------------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>l'homme âgé | Très<br>probablement<br>l'homme âgé | Assurément<br>l'homme<br>âgé |

15. Imaginez deux personnes: un homme jeune (dans la fin de l'adolescence ou au début de la vingtaine) et une femme adulte (dans la quarantaine). Ils doivent effectuer un trajet en voiture ensemble.

15a. Lequel d'entre eux est plus susceptible de prendre le volant? (encerclez)

| 1                               | 2                                         | 3                                 | 4                               | 5                        | 6                                | 7                      |
|---------------------------------|-------------------------------------------|-----------------------------------|---------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

15b. Lequel d'entre eux pensez-vous est un conducteur plus sécuritaire?

| 1                               | 2                                         | 3                                 | 4                               | 5                        | 6                                | 7                      |
|---------------------------------|-------------------------------------------|-----------------------------------|---------------------------------|--------------------------|----------------------------------|------------------------|
| Assurément<br>le jeune<br>homme | Très<br>probablement<br>le jeune<br>homme | Probablement<br>le jeune<br>homme | Soit<br>l'un<br>soit<br>l'autre | Probablement<br>la femme | Très<br>probablement<br>la femme | Assurément<br>la femme |

English Version

1. Imagine **two adults (in their forties): a man and a woman**. They have to take a car trip together.

1a. Which one of them is more likely to take the wheel? (Circle one)

| 1                 | 2                   | 3                | 4                            | 5                  | 6                     | 7                   |
|-------------------|---------------------|------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the man | Most likely the man | Probably the man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

1b. Which one of them do you think is a safer driver?

| 1                 | 2                   | 3                | 4                            | 5                  | 6                     | 7                   |
|-------------------|---------------------|------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the man | Most likely the man | Probably the man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

2. Imagine **two young adults (in their late teens, early twenties): a young man and a young woman.** They have to take a car trip together.

2a. Which one of them is more likely to take the wheel? (Circle one)

| 1                       | 2                         | 3                      | 4                            | 5                        | 6                           | 7                         |
|-------------------------|---------------------------|------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the young man | Most likely the young man | Probably the young man | Either one is equally likely | Probably the young woman | Most likely the young woman | Certainly the young woman |

2b. Which one of them do you think is a safer driver?

| 1                       | 2                         | 3                      | 4                            | 5                        | 6                           | 7                         |
|-------------------------|---------------------------|------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the young man | Most likely the young man | Probably the young man | Either one is equally likely | Probably the young woman | Most likely the young woman | Certainly the young woman |

3. Imagine **an old couple: an older man and an older woman (both in their 60-s)**. They have to take a car trip together.

3a. Which one of them is more likely to take the wheel? (Circle one)

| 1                       | 2                         | 3                      | 4                            | 5                        | 6                           | 7                         |
|-------------------------|---------------------------|------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the older woman | Most likely the older woman | Certainly the older woman |

3b. Which one of them do you think is a safer driver?

| 1                       | 2                         | 3                      | 4                            | 5                        | 6                           | 7                         |
|-------------------------|---------------------------|------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the older woman | Most likely the older woman | Certainly the older woman |

4. Imagine **two people: a younger man (in his late teens or early 20s) and an older woman (in her 60-s)**. They have to take a car trip together.

4a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                        | 6                           | 7                         |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the older woman | Most likely the older woman | Certainly the older woman |

4b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                        | 6                           | 7                         |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------|-----------------------------|---------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the older woman | Most likely the older woman | Certainly the older woman |



5. Imagine **two people: a younger man (in his late teens or early 20s) and an adult woman (in her 40-s)**. They have to take a car trip together.

5a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                  | 6                     | 7                   |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

5b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                  | 6                     | 7                   |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

6. Imagine **two people: an old man (in his 60s) and an adult woman (in her 40-s)**. They have to take a car trip together.

6a. Which one of them is more likely to take the wheel? (Circle one)

| 1                     | 2                       | 3                    | 4                            | 5                  | 6                     | 7                   |
|-----------------------|-------------------------|----------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the old man | Most likely the old man | Probably the old man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

6b. Which one of them do you think is a safer driver?

| 1                     | 2                       | 3                    | 4                            | 5                  | 6                     | 7                   |
|-----------------------|-------------------------|----------------------|------------------------------|--------------------|-----------------------|---------------------|
| Certainly the old man | Most likely the old man | Probably the old man | Either one is equally likely | Probably the woman | Most likely the woman | Certainly the woman |

7. Imagine **two people: a young woman (in her late teens early 20s) and a woman in her 40-s**. They have to take a car trip together.

7a. Which one of them is more likely to take the wheel? (Circle one)

| 1                           | 2                             | 3                          | 4                            | 5                              | 6                                 | 7                               |
|-----------------------------|-------------------------------|----------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the younger woman | Most likely the younger woman | Probably the younger woman | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

7b. Which one of them do you think is a safer driver?

| 1                           | 2                             | 3                          | 4                            | 5                              | 6                                 | 7                               |
|-----------------------------|-------------------------------|----------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the younger woman | Most likely the younger woman | Probably the younger woman | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

8. Imagine **two people: an older woman (in her 60s) and an adult woman (in her 40-s)**. They have to take a car trip together.

8a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                              | 6                                 | 7                               |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

8b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                              | 6                                 | 7                               |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

9. Imagine **two people: an older woman (in her 60s) and a man in his 40-s**. They have to take a car trip together.

9a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                            | 6                               | 7                             |
|---------------------------|-----------------------------|--------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the man in his 40-s | Most likely the man in his 40-s | Certainly the man in his 40-s |

9b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                            | 6                               | 7                             |
|---------------------------|-----------------------------|--------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the man in his 40-s | Most likely the man in his 40-s | Certainly the man in his 40-s |

10. Imagine **two people: an older woman (in her 60s) and a young woman (in her late teens early 20-s)**. They have to take a car trip together.

10a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                          | 6                             | 7                           |
|---------------------------|-----------------------------|--------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |

10b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                          | 6                             | 7                           |
|---------------------------|-----------------------------|--------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the older woman | Most likely the older woman | Probably the older woman | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |

11. Imagine **two people: an older man (in his 60s) and a young woman (in her late teens early 20s)**. They have to take a car trip together.

11a. Which one of them is more likely to take the wheel? (Circle one)

| 1                       | 2                         | 3                      | 4                            | 5                          | 6                             | 7                           |
|-------------------------|---------------------------|------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |

11b. Which one of them do you think is a safer driver?

| 1                       | 2                         | 3                      | 4                            | 5                          | 6                             | 7                           |
|-------------------------|---------------------------|------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |

12. Imagine **two people: a man in his 40s and a young woman (in her late teens early 20s)**. They have to take a car trip together.

12a. Which one of them is more likely to take the wheel? (Circle one)

| 1                            | 2                              | 3                           | 4                            | 5                          | 6                             | 7                           |
|------------------------------|--------------------------------|-----------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the man in his 40s | Most likely the man in his 40s | Probably the man in his 40s | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |

12b. Which one of them do you think is a safer driver?

| 1                            | 2                              | 3                           | 4                            | 5                          | 6                             | 7                           |
|------------------------------|--------------------------------|-----------------------------|------------------------------|----------------------------|-------------------------------|-----------------------------|
| Certainly the man in his 40s | Most likely the man in his 40s | Probably the man in his 40s | Either one is equally likely | Probably the younger woman | Most likely the younger woman | Certainly the younger woman |



13. Imagine **two people: an older man (in his late 60-s) and a man in his 40-s (an adult)**. They have to take a car trip together.

13a. Which one of them is more likely to take the wheel? (Circle one)

| 1                       | 2                         | 3                      | 4                            | 5                            | 6                               | 7                             |
|-------------------------|---------------------------|------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the man in his 40-s | Most likely the man in his 40-s | Certainly the man in his 40-s |

13b. Which one of them do you think is a safer driver?

| 1                       | 2                         | 3                      | 4                            | 5                            | 6                               | 7                             |
|-------------------------|---------------------------|------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the older man | Most likely the older man | Probably the older man | Either one is equally likely | Probably the man in his 40-s | Most likely the man in his 40-s | Certainly the man in his 40-s |

14. Imagine **two men: a young man (late teens or early twenties) and an older man (in his 60-s)**. They have to take a car trip together.

14a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                            | 6                               | 7                             |
|---------------------------|-----------------------------|--------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the man in his 60-s | Most likely the man in his 60-s | Certainly the man in his 60-s |

14b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                            | 6                               | 7                             |
|---------------------------|-----------------------------|--------------------------|------------------------------|------------------------------|---------------------------------|-------------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the man in his 60-s | Most likely the man in his 60-s | Certainly the man in his 60-s |

15. Imagine **two people: a younger man (in his late teens or early 20s) and a woman in her 40-s**. They have to take a car trip together.

15a. Which one of them is more likely to take the wheel? (Circle one)

| 1                         | 2                           | 3                        | 4                            | 5                              | 6                                 | 7                               |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

15b. Which one of them do you think is a safer driver?

| 1                         | 2                           | 3                        | 4                            | 5                              | 6                                 | 7                               |
|---------------------------|-----------------------------|--------------------------|------------------------------|--------------------------------|-----------------------------------|---------------------------------|
| Certainly the younger man | Most likely the younger man | Probably the younger man | Either one is equally likely | Probably the woman in her 40-s | Most likely the woman in her 40-s | Certainly the woman in her 40-s |

## Appendix D: Debriefing

## French Version

### *DEBRIEFING (EN FRANÇAIS)*

- 1) L'objectif réel de l'étude était d'établir s'ils existent toujours les stéréotypes négatifs reliés aux conductrices. Pour atteindre cet objectif, nous ne vous avons pas divulgué le véritable objectif de cette étude. Cet objectif véritable a été fixé étant donné la nécessité de réaliser des études s'interrogeant sur les stéréotypes négatifs envers les conductrices.
- 2) Ainsi, nous sommes principalement intéressés aux réponses que vous nous avez données concernant les comportements routiers typiquement observés chez les conductrices. Nous désirions aussi observer si vous jugiez que d'autres comportements présentés étaient plus typiques de ce groupe, c'est-à-dire qu'ils sont observés plus fréquemment.
- 3) L'objectif réel de l'étude est la seule chose qui a été masquée. Le reste (tâche expérimentale, le laboratoire, les personnes responsables de l'étude et du laboratoire, assistant de recherche) était véridique. De même, les résultats de cette recherche s'inscrivent toujours au sein du mandat de ce laboratoire qui est de mieux comprendre ce qui affecte le comportement et les réactions au volant des conducteurs. Finalement, comme mentionné au début, vos réponses seront traitées de manière totalement confidentielle. Votre anonymat sera conservé en tout temps.
- 4) Cette procédure a été utilisée puisque nous voulions nous assurer de ne pas influencer votre performance. Nous voulions minimiser les risques que vous performiez en fonction du but de l'étude. Cette procédure est couramment utilisée dans les études traitant des stéréotypes. Les données qui seront recueillies à partir de cette étude seront très importantes pour le domaine de la cognition sociale. De fait, il a été noté que les stéréotypes négatifs peuvent affecter de

diverses manières les individus qui sont victime de stéréotypes. Il a été démontré que plusieurs caractéristiques d'une personne peuvent susciter des stéréotypes : le genre, le statut socio-économique, l'origine ethnique. Toutefois, aucune étude ne s'est intéressée auparavant à l'existence moderne des stéréotypes à propos des conductrices.

- 5) Si vous vivez certaines difficultés ou un inconfort suite à notre rencontre, nous vous invitons à consulter le Centre des services psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)). Vous pouvez aussi rejoindre le Responsable de la déontologie en recherche de l'Université d'Ottawa si vous avez des questions ou pour faire part de vos commentaires (550 rue Cumberland, pièce 159, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5841, [ethics@uottawa.ca](mailto:ethics@uottawa.ca) <<mailto:ethics@uottawa.ca>>) pour des questions additionnelles.
- 6) Veuillez noter qu'à la lumière de ces nouvelles informations, vous avez à nouveau le choix de participer à notre recherche ou de vous retirer de celle-ci, et ce, sans craintes de représailles ou autres conséquences négatives. De fait, même si vous faites le choix de vous retirer, vous recevrez la rémunération promise (les points alloués par le SIPR). Vos renseignements seront conservés en lieu sûr, dans le laboratoire de recherche du Dr. Gagnon pour une période maximale de 10 ans et seront détruites si vous choisissez de vous retirer de l'étude, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données. À la fin de la période de rétention, toutes les données seront détruites.

*(Si aucune préoccupation n'est rapportée et que la personne désire toujours participer, il y aura présentation du nouveau formulaire de consentement.)*

## English Version

### *DEBRIEFING (IN ENGLISH)*

- 1) The actual nature and purpose of this study was to identify if negative stereotypes about female drivers still exist. In order to achieve this objective, we did not divulge the real aim of this study. The actual purpose was established based on the need of studies that directly investigate negative stereotypes pertaining to female drivers.
- 2) Therefore, we were mainly interested in the clips demonstrating behaviours that can be thought as typical of female drivers. We also wish to look at other behaviours that you evaluated as typical of female drivers but that can be linked to other age groups (i.e., that are more frequently observed).
- 3) The actual purpose of this study is the only thing that has been concealed. The rest (experimental task, the laboratory, the principal investigators) was true. Additionally, this study is still part of a larger research program aimed at increasing our understanding of variables that have an impact on the behaviours and reactions of drivers. Finally, as stated previously, your answers will remain completely confidential and anonymous.
- 4) This procedure was used to ensure that we did not bias your performance on the simulated task. We wanted to minimize the chances that you would perform according to the purpose of the study. This procedure is often used in stereotype studies. The data that will be collected throughout this study is very important to the social cognition field. In fact, other studies have found that negative stereotypes can have many diverse effects on stigmatized individuals. It was demonstrated that many characteristics (gender, socioeconomical status, ethnic background) can trigger stereotypes. Nevertheless, there is no study that investigated modern presence of female drivers stereotypes.

- 5) If you are having difficulties or feeling uncomfortable, you may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)). Do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 159, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5841, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca), if you have additional questions.
- 8) Also note that based on the aforementioned information, you again have the choice to participate to this research or withdraw your participation without any penalty. In fact, even if you choose to withdraw from this study, you will still be compensated with one participation point for ISPR.
- 9) Your information will be kept safe in the research laboratory of Dr. Gagnon for a maximum period of 10 years and will be destroyed if you choose to withdraw from the study, and only Dr. Gagnon, Yara Kadulina and other research assistants will have access to the data. At the end of the retention period, all data will be destroyed.

*(If no preoccupation related to their participation is reported and if participants still want to participate, the new consent form will be presented to them.)*



## Appendix E: Post-Debriefing Consent Forms

French Version



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**Titre du Project:** Évaluation des stéréotypes reliés aux conductrices.

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement (suite à la révélation de la déception)**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillion Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

On m'a informé(e) des véritables objectifs de l'étude. De fait, cette étude visait à examiner si les stéréotypes négatifs reliés aux conductrices existent toujours. Ma participation permettra de contribuer à la progression de connaissances des variables sociales et contextuelles pouvant avoir un impact sur les effets néfastes des stéréotypes dans notre société. Je comprends que les intentions véritables de l'étude ne pouvaient pas être divulguées à l'avance, puisque ceci aurait pu avoir pour effet d'influencer ma performance. Je comprends que cette expérience fait toujours partie d'une plus vaste étude portant sur la performance routière. Il m'a aussi été indiqué que si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel cps@uottawa.ca).

Suite à la révélation de la déception, j'accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Yara Kadulina (étudiante au doctorat et assistante de recherche) de son équipe de recherche du laboratoire de vieillissement cognitif de l'Université d'Ottawa. J'accepte aussi qu'ils utilisent les résultats obtenus avant la révélation de la duperie.

Ma participation demeure strictement volontaire. Il m'a été expliqué que j'avais à nouveau le choix de participer ou de me retirer de l'étude suite à la divulgation des intentions véritables, et ce, sans craintes de représailles ou d'ennuis. Par ailleurs, on m'a indiqué que si je décidais de me retirer de l'étude, ma

rémunération d'un point de participation, équivalant un pour cent de ma note finale pour un cours de la psychologie, me serait toujours accordée.

J'ai reçu l'assurance par le Dr. Gagnon, Yara Kadulina et/ou autres membres de son équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr. Gagnon, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données, et celles-ci seront détruites si je choisis de me retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traitées globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Je peux conserver une copie du formulaire de consentement. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut.

Merci pour votre participation à cette étude.

En cliquant sur « OUI » en bas, je consens que mes données (anonymisées) seront utilisées pour ce projet de recherche.

ÊTES-VOUS D'ACCORD POUR PARTICIPER?

☐ OUI – Je comprends qu'est-ce qui est requis pour cet étude je consens à y participer.

☐ NON – Je ne veux pas participer.

English Version



**Title of Project:** Evaluation of female driver stereotypes.

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

I have been informed of the actual nature and purpose of the study. This study aimed to identify if the negative stereotypes of women drivers still exist. My participation will contribute to the advancement of knowledge that relates to the social and contextual variables that may have an impact on the harmful effects of stereotypes in our society. I understand that the real objectives of this research could not have been explained to me at the beginning of this task, since it could have possibly influenced my performance. I also know that this study is still part of a larger research program aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours. It was also mentioned that if need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)).

After the disclosure of deception, I agree to participate in the study conducted by Dr. Sylvain Gagnon, Yara Kadulina (Ph.D candidate and research assistant), and the research team of the Laboratory of Cognitive Aging at the University of Ottawa. I give them permission to use the data obtained prior to the disclosure of the actual aim of the study.

Participation in this research is still completely voluntary. I understand that, based on the disclosure of the real aim of the research, I again have the choice to participate to this research or withdraw my participation without any penalty. Furthermore, I understand that I would be compensated one participation point, equivalent to one percent of my final grade for an introductory psychology course, even if I withdrew my participation.

I have been assured by Dr. Gagnon, Yara Kadulina and/or another member of his team that the answers I provided will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study (Dr Gagnon, Yara Kadulina and other research assistants) will have access to it, and the data will be destroyed if I choose to withdraw from this study. At the end of the retention period, all data will be destroyed. Also, my data will be used for research purposes only such as scientific articles or presentations. Results will be reported in pooled format, seeking age group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

I may keep a copy of this consent form. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you for your participation in this study.

By clicking YES below, you are consenting for your (anonymised) data to be used in this research project.

DO YOU AGREE TO PARTICIPATE?

☒ YES - I understand the study and what is required of me, and I agree to take part.

☐ NO - I do not agree to take part.

## Appendices for Chapter 4



## Appendix A: Recruitment Announcement



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### AVIS DE RECHERCHE



Le Laboratoire du Vieillissement Cognitif de l'Université d'Ottawa est à la recherche de **personnes âgées de 18 à 25 ans ou de 65 ans et plus**, en bonne santé physique et mentale, désireuses de participer à une étude scientifique portant sur la conduite automobile. Afin d'y participer, vous devez aussi détenir un permis de conduire valide. Une compensation monétaire peut s'appliquer. Pour plus d'informations, contactez-nous au 613-562-5800 x 2271.

### RESEARCH NOTICE

The Laboratory of Cognitive Aging at the University of Ottawa is currently recruiting **persons 18 to 25 years old or 65 years and older**, in good mental and physical health, wishing to participate in a scientific study on driving. In order to participate, you also need to hold a valid driver's licence. A monetary compensation may apply. For more information, contact us at 613-562-5800 x 2271.



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## Appendix B: Consent Forms

French Version



**Titre du Projet:** Comprendre les réactions au volant en contexte de simulation

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

#### **Formulaire de consentement**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillon Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

Je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Mlle Yara Kadulina (étudiante au doctorat et assistante de recherche) de l'équipe de recherche du laboratoire de vieillissement cognitif et de la conduite automobile de l'Université d'Ottawa.

On m'a informé(e) des faits suivants relativement à ma participation dans cette étude. Cette expérience fait partie d'une plus vaste étude portant sur les comportements routiers tant chez les jeunes conducteurs que les personnes âgées. Cette étude vise à mieux comprendre les réactions au volant par l'intermédiaire des performances sous des conditions de conduite simulée. En participant à cette recherche, j'aurai l'opportunité de contribuer à la recherche scientifique en plus de contribuer à la progression des connaissances relatives à la conduite automobile. Ma participation comprend une seule rencontre d'une durée de 90-100 minutes. Je remplirai d'abord questionnaires. Par la suite, on examinera mes réactions au volant dans un parcours routier via un simulateur de conduite automobile.

Les risques d'inconfort ou de désagrément pendant et suite à ma participation à cette étude sont minimes. Toutefois, la tâche étant de nature cognitive, il se peut que je ressente une certaine fatigue. Par ailleurs, malgré son niveau élevé de réalisme, les tests sur simulateur peuvent engendrer des nausées et maux de tête. Cependant, une investigation continue de mon état sera effectuée afin d'assurer mon bien-être et une pause sera prévue après 35 minutes d'expérimentation. D'autres pauses peuvent être ajoutées au

besoin. Par ailleurs, si je présente un certain inconfort, je peux me retirer en tout temps de l'étude. Je peux aussi être reconduit à la maison suite à la tâche de simulation, si je ne me sens pas en mesure de le faire. Si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel cps@uottawa.ca).

Ma participation est strictement volontaire. Je peux refuser de participer ou me retirer de l'étude en tout temps, et ce, sans craintes de représailles ou d'ennuis. Je peux aussi demander de l'information supplémentaire en tout temps afin d'obtenir une meilleure compréhension de l'étude. Je comprends qu'une rémunération de 20 \$ me sera donnée lors de cette étude. De plus, la gratuité du stationnement m'est assurée par les responsables de l'étude. J'ai reçu l'assurance par le Dr Gagnon ou Mlle Kadulina et/ou un autre membre de l'équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr, pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr Gagnon, et seuls Dr Gagnon et Mlle Kadulina auront accès aux données, et seront détruites si vous souhaitez vous retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traités globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi, tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, ethics@uottawa.ca.

Il y a deux copies du formulaire de consentement, dont une que je peux conserver. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut de cette page.

Nous vous remercions à l'avance pour votre participation à cette étude.

**Section à remplir par le participant :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

**Section à remplir par le responsable de recherche :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_



**Titre du Projet:** Comprendre les réactions au volant en contexte de simulation

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillion Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

Je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Mlle Yara Kadulina (étudiante au doctorat et assistante de recherche) de l'équipe de recherche du laboratoire de vieillissement cognitif et de la conduite automobile de l'Université d'Ottawa.

On m'a informé(e) des faits suivants relativement à ma participation dans cette étude. Cette expérience fait partie d'une plus vaste étude portant sur les comportements routiers tant chez les jeunes conducteurs que les personnes âgées. Cette étude vise à mieux comprendre les réactions au volant par l'intermédiaire des performances sous des conditions de conduite simulée. En participant à cette recherche, j'aurai l'opportunité de contribuer à la recherche scientifique en plus de contribuer à la progression des connaissances relatives à la conduite automobile. Ma participation comprend une seule rencontre d'une durée de 90-100 minutes. Je remplirai d'abord questionnaires. Par la suite, on examinera mes réactions au volant dans un parcours routier via un simulateur de conduite automobile.

Les risques d'inconfort ou de désagrément pendant et suite à ma participation à cette étude sont minimes. Toutefois, la tâche étant de nature cognitive, il se peut que je ressente une certaine fatigue. Par ailleurs, malgré son niveau élevé de réalisme, les tests sur simulateur peuvent engendrer des nausées et maux de tête. Cependant, une investigation continue de mon état sera effectuée afin d'assurer mon bien-être et une pause sera prévue après 35 minutes d'expérimentation. D'autres pauses peuvent être ajoutées au besoin. Par ailleurs, si je présente un certain inconfort, je peux me retirer en tout temps de l'étude. Je peux aussi être reconduit à la maison suite à la tâche de simulation, si je ne me sens pas en mesure de le

faire. Si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel cps@uottawa.ca).

Ma participation est strictement volontaire. Je peux refuser de participer ou me retirer de l'étude en tout temps, et ce, sans craintes de représailles ou d'ennuis. Je peux aussi demander de l'information supplémentaire en tout temps afin d'obtenir une meilleure compréhension de l'étude. Je comprends qu'en tant que participant(e) recruté(e) à partir du Système Intégré de participation à la recherche de l'Université d'Ottawa (SIPR), je recevrai deux points de participation, l'équivalent de deux pour cent de la note finale au cours d'introduction à la psychologie auquel je suis inscrit. De plus, la gratuité du stationnement m'est assurée par les responsables de l'étude. J'ai reçu l'assurance par le Dr Gagnon ou Mlle Kadulina et/ou un autre membre de l'équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr, pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr Gagnon, et seuls Dr Gagnon et Mlle Kadulina auront accès aux données, et seront détruites si vous vous retirez de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traités globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi, tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, ethics@uottawa.ca.

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Nous vous remercions à l'avance pour votre participation à cette étude.

**Section à remplir par le participant :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

**Section à remplir par le responsable de recherche :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_



English Version



**Title of Project:** Understanding driving reactions in a driving simulator

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

#### **Consent Form**

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: [sgagnon@uottawa.ca](mailto:sgagnon@uottawa.ca).

I, \_\_\_\_\_, agree to participate in the study conducted by Dr. Sylvain Gagnon and Miss Yara Kadulina and the research team of the Laboratory of Cognitive Aging and driving at the University of Ottawa. The nature and purpose of the study were clearly explained to me: I understand that this experiment is part of a larger research program aimed at increasing our understanding of driving behavior. This study seeks to better understand this by observing their behavior under simulated driving conditions. In participating in this research, I will have the opportunity to take part in scientific research, while contributing to increase the knowledge that relates to driving. This experiment involves two parts and will last approximately 90-100 minutes in total. The first part will be devoted to filling questionnaires while the second part will involve driving on a road circuit in a driving simulator.

The risks of discomfort during and after my participation in this study are minimal. However, since the task is of a cognitive nature, there is a possibility that I might experience fatigue. Furthermore, while the simulator is as close to reality as possible, it can engender nausea and headaches. Consequently, there will be a break after 35 minutes of testing. At all times, my state will be continuously monitored to insure my well-being. Additional breaks can be taken. If at any time I am uncomfortable or too tired to proceed, I may withdraw completely from the study. If I need to, I can be given a ride home after the simulator session. If I need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)).

Participation in this research is completely voluntary. The decision to participate or not is entirely mine. Even if I decide to participate, I may still withdraw at any time during the study without any penalty. I can also ask for more information at any time in order to gain a better understanding of the research. Furthermore, I will be compensated 20 \$ for my participation and my parking fees will be covered by the researchers. I have been assured by Dr. Gagnon or Miss Kadulina and other members (or one of their research assistants) that the answers I provide will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study will have access to it (Dr. Gagnon and Miss Kadulina), and will be destroyed if you choose to withdraw from the study. At the end of the retention period, all data will be destroyed. Meanwhile, my data will be used for research purposes only such as scientific articles or presentations. Results will be reported in pooled format, seeking group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

There are two copies of the consent form, one of which I may keep. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you in advance for your assistance in this study.

**Section to be completed by the participant:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Section to be completed by the researcher:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_



**Title of Project:** Understanding driving reactions in a driving simulator

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

#### Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: sgagnon@uottawa.ca.

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The risks of discomfort during and after my participation in this study are minimal. However, since the task is of a cognitive nature, there is a possibility that I might experience fatigue. Furthermore, while the simulator is as close to reality as possible, it can engender nausea and headaches. Consequently, there will be a break after 35 minutes of testing. At all times, my state will be continuously monitored to insure my well-being. Additional breaks can be taken. If at any time I am uncomfortable or too tired to proceed, I may withdraw completely from the study. If I need to, I can be given a ride home after the

simulator session. If I need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: cps@uottawa.ca).

Participation in this research is completely voluntary. The decision to participate or not is entirely mine. Even if I decide to participate, I may still withdraw at any time during the study without any penalty. I can also ask for more information at any time in order to gain a better understanding of the research. Furthermore, I understand that as a participant recruited from the Integrated System of Participation in Research at the University of Ottawa (ISPR), I will receive two participation points, equivalent to two percent of the final grade in the introductory course of psychology in which I am enrolled. I have been assured by Dr. Gagnon or Miss Kadulina and other members (or one of their research assistants) that the answers I provide will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study will have access to it (Dr. Gagnon and Miss Kadulina), and will be destroyed if you choose to withdraw from the study. At the end of the retention period, all data will be destroyed. Meanwhile, my data will be used for research purposes only such as scientific articles or presentations. Results will be reported in pooled format, seeking group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: ethics@uottawa.ca.

There are two copies of the consent form, one of which I may keep. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you in advance for your assistance in this study.

**Section to be completed by the participant:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Section to be completed by the researcher:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

## Appendix C: Scripts of Induction for Conditions

### Scripts for Stereotype Threat Condition

*French Version***Condition de menace de stéréotype**

Bonjour,

Merci d'avoir accepté de prendre part à cette étude.

Comme vous le savez, la conduite automobile est une activité pratiquée par une proportion extrêmement importante d'hommes et femmes. En ce qui a trait aux femmes, on entend souvent dire que celles-ci sont moins performantes, voire moins compétentes que les hommes. Les résultats d'études récentes confirment, entre autres, que le temps de réaction des femmes est ralenti en comparaison à ce qui est observé chez les conducteurs masculins. D'après ces études, les hommes auraient également de meilleures habiletés spatiales.

L'expérience à laquelle vous êtes sur le point de participer s'insère dans un projet plus vaste portant sur les réactions des femmes au volant. Nous avons développé des parcours complexes de conduite simulée qui nous permettront d'identifier avec plus de précision les facteurs qui expliquent les différences observées entre les femmes et les hommes. Par ailleurs, nous évaluerons si les réactions des participants se comparent à ce que l'on observe sur les routes sous des conditions similaires.

À partir de maintenant, c'est l'expérimentateur ou l'expérimentatrice qui se chargera de toutes les étapes relatives à la conduite sur simulateur. Vous serez d'abord initié aux différentes composantes du simulateur. Par la suite, vous complèterez 6 parcours de simulation dont deux de ceux-ci ont pour fonction de vous familiariser avec la conduite sur simulateur. Suite à la simulation, nous vous inviterons à remplir quelques questionnaires. Je vous invite à suivre la lettre toutes les consignes qui vous seront données pendant la simulation. Il est très important de conduire comme si vous étiez au volant d'une voiture. Je vous remercie à l'avance de votre participation.



*English Version*

### **Stereotype Threat Condition**

Hello,

Thank you for agreeing to participate in this study.

As you know, driving a car is an activity that is practiced by a very considerable proportion of men and women. When it concerns women, we often hear that they are less efficient, that is, less competent than men drivers. Results of recent studies confirm, among others, that women have slower reaction time in comparison to what was observed in male drivers. According to those studies, men also have better spatial abilities.

The experiment in which you are about to participate is part of a larger project that looks at the reactions of men and women drivers. We have developed several difficult routes of driving simulation that allow us to identify with precision the factors that explain the differences observed between women and men. We will also evaluate if participants' reactions are comparable to those observed on the roads in similar conditions.

From this moment on, the experimenter will be in charge of all the steps relative to driving in the simulator. You will first become familiar with the different parts of the simulator. Following that, we will complete 6 routes in the simulator, among which 2 will help you to become familiar with driving in the simulator. Following the simulation, we will invite you to fill out several questionnaires. I suggest that you follow precisely the instructions that will be given to you during the simulation. It is very important to drive the way you would normally drive behind the wheel of a car. I thank you in advance for your participation.

### Scripts for Neutral Condition

*French Version***Condition Neutre**

Bonjour,

Merci d'avoir accepté de prendre part à cette étude.

Comme vous le savez, la conduite automobile est une activité pratiquée par une proportion extrêmement importante de la population Canadienne. La mobilité des citoyens canadiens repose largement sur la conduite automobile. Elle combine indépendance, autonomie et flexibilité, ce que peu d'autres moyens de transport peuvent offrir.

L'expérience à laquelle vous êtes sur le point de participer s'insère dans un projet plus vaste portant sur les réactions des conducteurs en contexte de simulation. Nous avons développé des parcours de conduite simulé qui nous permettent d'étudier une panoplie de réactions au volant. Dans cette étude, nous évaluerons si les réactions des participants se comparent à ce que l'on observe sur les routes sous des conditions similaires.

À partir de maintenant, c'est l'expérimentateur ou l'expérimentatrice qui se chargera de toutes les étapes relatives à la conduite sur simulateur. Vous serez d'abord initié aux différentes composantes du simulateur. Par la suite, vous complèterez 6 parcours de simulation dont deux de ceux-ci ont pour fonction de vous familiariser avec la conduite sur simulateur. Suite à la simulation, nous vous inviterons à remplir quelques questionnaires. Je vous invite à suivre à la lettre toutes les consignes qui vous seront données pendant la simulation. Il est très important de conduire comme si vous étiez au volant d'une voiture. Je vous remercie à l'avance de votre participation.

*English Version***Neutral Condition**

Hello,

Thank you for agreeing to participate in this study.

As you know, driving a car is an activity that is practiced by a very considerable proportion of the Canadian population. Mobility of Canadian residents relies largely on driving. It combines independence, autonomy and flexibility, and this is something that few other means of transport can offer.

The experiment in which you are about to participate is a part of a larger project that looks at the reactions of the drivers in the context of simulation. We have developed several difficult routes of driving simulation that allow us to study a plethora of driving reactions at the wheel. In this study, we evaluate if participants' reactions are comparable to those observed on the roads in similar conditions.

From this moment on, the experimenter will be in charge of all the steps relative to driving in the simulator. You will first become familiar with the different parts of the simulator. Following that, we will complete 6 routes in the simulator, among which 2 will help you to become familiar with driving in the simulator. Following the simulation, we will invite you to fill out several questionnaires. I suggest that you follow precisely the instructions that will be given to you during the simulation. It is very important to drive the way you would normally drive behind the wheel of a car. I thank you in advance for your participation.

### Scripts for Counterstereotype Condition

*French Version***Condition Contre-Stéréotype.**

Bonjour,

Merci d'avoir accepté de prendre part à cette étude.

Comme vous le savez, la conduite automobile est une activité pratiquée par une proportion extrêmement importante d'hommes et femmes. En ce qui a trait aux femmes, celles-ci sont reconnues comme étant les plus compétentes au volant. Moins d'infractions au code de la route sont commises par les femmes et celles-ci sont moins à risque d'être impliquées dans un accident dont elles en sont la cause. Les femmes jouissent des primes d'assurance automobile les plus basses.

L'expérience à laquelle vous êtes sur le point de participer s'insère dans un projet plus vaste portant sur les comportements appropriés des conductrices. Nous avons développé des parcours de conduite simulée qui nous permettront de mettre en valeur les réactions des conductrices. Par ailleurs, nous évaluerons si les réactions des participantes se comparent à ce que l'on observe sur les routes sous des conditions similaires.

À partir de maintenant, c'est l'expérimentateur ou l'expérimentatrice qui se chargera de toutes les étapes relatives à la conduite sur simulateur. Vous serez d'abord initié aux différentes composantes du simulateur. Par la suite, vous complèterez 6 parcours de simulation dont deux de ceux-ci ont pour fonction de vous familiariser avec la conduite sur simulateur. Suite à la simulation, nous vous inviterons à remplir quelques questionnaires. Je vous invite à suivre la lettre toutes les consignes qui vous seront données pendant la simulation. Il est très important de conduire comme si vous étiez au volant d'une voiture. Je vous remercie à l'avance de votre participation.

*English Version***Counterstereotype Condition**

Hello,

Thank you for agreeing to participate in this study.

As you know, driving a car is an activity that is practiced by a very considerable proportion of men and women. When it concerns women, they are known to be more competent drivers. Women get fewer fines for traffic violations, and they are less at risk to be involved in an accident at their fault. Car insurance premiums are less expensive for women than men.

The experiment in which you are about to participate is a part of a larger project that looks at the appropriate behaviours of woman drivers. We have developed several difficult routes of driving simulation that allow us to highlight reactions of women drivers. We will also evaluate if participants' reactions are comparable to what we observe on the roads in similar conditions.

From this moment on, the experimenter will be in charge of all the steps relative to driving in the simulator. You will first become familiar with the different parts of the simulator. Following that, we will complete 6 routes in the simulator, among which 2 will help you to become familiar with driving in the simulator. Following the simulation, we will invite you to fill out several questionnaires. I suggest that you follow precisely the instructions that will be given to you during the simulation. It is very important to drive the way you would normally drive behind the wheel of a car. I thank you in advance for your participation.

## Appendix D: Debriefing



## French Version

### *DEBRIEFING (EN FRANÇAIS)*

- 1) L'objectif réel de l'étude était d'établir si les stéréotypes négatifs reliés aux conducteurs âgés, aux jeunes conducteurs masculins ou aux jeunes conductrices, ont un impact sur leur performance au volant en contexte de simulation. Pour atteindre cet objectif, nous ne vous avons pas divulgué le véritable objectif de cette étude. Cet objectif véritable a été fixé puisqu'aucune étude ne s'est directement attardée aux stéréotypes négatifs reliés à la conduite automobile.
- 2) Il est à noter que si vous étiez inclus dans la condition stéréotype, nous vous avons indiqué que les autres conducteurs étaient meilleurs que les conducteurs de votre groupe d'appartenance ou commettaient moins d'accidents que les conducteurs de votre groupe d'appartenance. Cette information est fabriquée. De fait, nous savons que la majorité des conducteurs en bonne santé sont des conducteurs sécuritaires et performants. Or, nous désirions mieux comprendre si de telles informations (qui peuvent être véhiculées dans les médias ou par des proches) ont un impact sur la performance au volant. Ainsi, nous sommes principalement intéressés à votre score total sur le trajet simulé. Nous allons comparer les résultats des gens ayant été soumis aux stéréotypes aux gens n'ayant pas reçu cette information.
- 3) L'objectif réel de l'étude est la seule chose qui a été masquée. Le reste (tâche expérimentale, le laboratoire, les personnes responsables de l'étude et du laboratoire, assistant de recherche) était véridique. De même, les résultats de cette recherche s'inscrivent toujours au sein du mandat de ce laboratoire qui est de mieux comprendre ce qui affecte le comportement et les réactions au volant des conducteurs. Finalement, comme mentionné au début, vos réponses seront traitées de manière totalement confidentielle. Votre anonymat sera conservé en tout temps.
- 4) Cette procédure a été utilisée puisque nous voulions nous assurer de ne pas influencer votre performance. Nous voulions minimiser les risques que vous performiez en fonction du but de l'étude. Cette procédure est couramment utilisée dans les études traitant des stéréotypes. Les données qui seront recueillies à partir de cette étude seront très importantes pour le domaine de la gériatrie. De fait, il a été noté que les stéréotypes négatifs peuvent affecter de diverses manières les individus qui sont victimes de stéréotypes. Il a été démontré que plusieurs caractéristiques d'une personne peuvent susciter des stéréotypes : le genre, le statut socio-

économique, l'origine ethnique. Pour ce qui est des personnes âgées, nous savons que les résultats à des tests de mémoire peuvent être sensibles aux stéréotypes véhiculés. Toutefois, aucune étude ne s'est intéressée auparavant aux conducteurs âgés.

- 5) Est-ce que vous avez des questions ou craintes par rapport à ce que je viens de vous indiquer ? Est-ce que vous avez besoin davantage d'informations à ce sujet ou au niveau de la procédure que nous avons employée? Lors de la tâche expérimentale, est-ce que vous vous doutiez que les objectifs de la recherche avaient été masqués ? Comment vous sentez-vous par rapport aux informations que je viens de vous présenter ?

Si vous vivez certaines difficultés ou un inconfort suite à notre rencontre, nous vous invitons à consulter le Centre des services psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)). Vous pouvez aussi rejoindre le Responsable de la déontologie en recherche de l'Université d'Ottawa si vous avez des questions ou pour faire part de vos commentaires (550 rue Cumberland, pièce 159, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5841, [ethics@uottawa.ca](mailto:ethics@uottawa.ca) <<mailto:ethics@uottawa.ca>>) pour des questions additionnelles.

- 6) Veuillez noter qu'à la lumière de ces nouvelles informations, vous avez à nouveau le choix de participer à notre recherche ou de vous retirer de celle-ci, et ce, sans craintes de représailles ou autres conséquences négatives. De fait, même si vous faites le choix de vous retirer, vous recevrez la rémunération promise (ou les points alloués par le SIPR) et vos frais de transport seront couverts (pour les membres de la communauté). Vos renseignements seront conservés en lieu sûr, dans le laboratoire de recherche du Dr. Gagnon pour une période maximale de 10 ans et seront détruites si vous choisissez de vous retirer de l'étude, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données. À la fin de la période de rétention, toutes les données seront détruites.

- 7) Est-ce que vous avez des questions par rapport à votre consentement à participer à notre étude ?

Si aucune préoccupation n'est rapportée et que la personne désire toujours participer, il y aura présentation du nouveau formulaire de consentement.

## English Version

- *DEBRIEFING (IN ENGLISH)*

- The actual nature and purpose of this study was to identify if negative older driver stereotypes or the negative stereotypes pertaining to female or young male drivers could impact on their performance on a driving simulator. In order to achieve this objective, we did not divulge the real aim of this study. The actual purpose was established based on a lack of studies that directly investigate the effect of negative stereotypes on driving.
- If you were assigned to the stereotype condition, you were told that the drivers of the other sex or from other age groups were either better drivers or tended to be less involved in crashes. This information was fabricated. We know that most healthy drivers are safe and competent. Nevertheless, we wanted to understand if this type of information (that can be mentioned by the media or close ones) can have an impact on the on-road performance of older adults. Therefore, we were mainly interested in your global score on the simulated task. We will compare the score of people in the stereotype condition with the score obtained by participants who did not receive this information.
- The actual purpose of this study is the only thing that has been concealed. The rest (experimental task, the laboratory, the principal investigators) was true. Additionally, this study is still part of a larger research program aimed at increasing our understanding of variables that have an impact on the behaviours and reactions of drivers. Finally, as stated previously, your answers will remain completely confidential and anonymous.
- This procedure was used to ensure that we did not bias your performance on the simulated task. We wanted to minimize the chances that you would perform according to the purpose of the study. This procedure is often used in stereotype studies. The data that will be collected throughout this study is very important to the gerontology field. In fact, other studies have found that negative stereotypes can have many diverse effects on stigmatized individuals. It was demonstrated that many characteristics (gender, socioeconomical status, ethnic background) can trigger stereotypes. In regards to older adults, it has been demonstrated that the results on memory tests can be affected by the mentioned stereotypes. Nevertheless, there is no study that investigated older drivers.
- Do you have any questions or concerns about what was just mentioned to you? Do you need additional information about this topic or the procedure used? During this experimental task, did you think that the real objectives of this study could have been concealed? How do you feel about the information that was presented to you?
  - If you are having difficulties or feeling uncomfortable after our meetings, you may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone:

(613) 562-5289, email: [cps@uottawa.ca](mailto:cps@uottawa.ca)). Do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 159, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5841, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca), if you have additional questions.

- Also note that based on the aforementioned information, you again have the choice to participate to this research or withdraw your participation without any penalty. In fact, even if you choose to withdraw from this study, you will still be compensated and your parking expenses will be covered (if participants from the community). Your information will be kept safe in the research laboratory of Dr. Gagnon for a maximum period of 10 years and will be destroyed if you choose to withdraw from the study, and only Dr. Gagnon, Yara Kadulina and other research assistants will have access to the data. At the end of the retention period, all data will be destroyed.
- Do you have any other question in regards to your consent in participating in this study?
- If no preoccupation related to their participation is reported and if participants still want to participate, the new consent form will be presented to them.

## Appendix E: Post-Debriefing Consent Forms

### French Version



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**Titre du Projet: Identification des médiateurs de l'effet de la menace du stéréotype dans le domaine de la conduite automobile chez les jeunes conducteurs et chez les conducteurs âgés.**

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement (suite à la révélation de la déception)**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillon Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

Suite à la révélation de la déception, je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Yara Kadulina (étudiante au doctorat et assistante de recherche) de son équipe de recherche du laboratoire de vieillissement cognitif de l'Université d'Ottawa. J'accepte aussi qu'ils utilisent les résultats obtenus avant la révélation de la duperie.

On m'a informé(e) des véritables objectifs de l'étude. De fait, cette étude visait à examiner si les stéréotypes négatifs reliés aux jeunes conducteurs ou aux conducteurs âgés ont un impact sur leur performance au volant en contexte de simulation. Ma participation permettra de contribuer à la progression de connaissances des variables sociales et contextuelles pouvant avoir un impact sur les effets néfastes des stéréotypes dans notre société. Je comprends que les intentions véritables de l'étude ne pouvaient pas être divulguées à l'avance, puisque ceci aurait pu avoir pour effet d'influencer ma performance. Je comprends que cette expérience fait toujours partie d'une plus vaste étude portant sur

la performance routière. Il m'a aussi été indiqué que si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel cps@uottawa.ca).

Ma participation demeure strictement volontaire. Il m'a été expliqué que j'avais à nouveau le choix de participer ou de me retirer de l'étude suite à la divulgation des intentions véritables, et ce, sans craintes de représailles ou d'ennuis. On m'a indiqué que ma rémunération de 20 \$ et les frais de déplacement me seraient toujours accordés si je me retirais de l'étude. J'ai reçu l'assurance par le Dr. Gagnon, Yara Kadulina et/ou autres membres de son équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr. Gagnon, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données, et celles-ci seront détruites si je choisis de me retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traitées globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, ethics@uottawa.ca.

Il y a deux copies du formulaire de consentement, dont une que je peux conserver. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr. Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut de cette page.

Merci pour votre participation à cette étude.

**Section à remplir par le participant :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

**Section à remplir par le responsable de recherche :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_



**Titre du Projet:** Identification des médiateurs de l'effet de la menace du stéréotype dans le domaine de la conduite automobile chez les jeunes conducteurs et chez les conducteurs âgés.

**Chercheur Principal:** Sylvain Gagnon, PhD

Université d'Ottawa

(613) 562-5800 Poste 4305

**Formulaire de consentement (suite à la révélation de la déception)**

Responsable de la recherche: Sylvain Gagnon, Ph.D., École de Psychologie, Laboratoire de vieillissement cognitif, Pavillon Vanier, 136 rue Jean-Jacques Lussier, pièce 3042, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, Tél.: (613) 562-5800, ext. 2515, Courriel: sgagnon@uottawa.ca.

Suite à la révélation de la déception, je, \_\_\_\_\_, accepte de participer à la recherche menée sous la direction du Dr. Sylvain Gagnon et Yara Kadulina (étudiante au doctorat et assistante de recherche) de son équipe de recherche du laboratoire de vieillissement cognitif de l'Université d'Ottawa. J'accepte aussi qu'ils utilisent les résultats obtenus avant la révélation de la duperie.

On m'a informé(e) des véritables objectifs de l'étude. De fait, cette étude visait à examiner si les stéréotypes négatifs reliés aux jeunes conducteurs ou aux conducteurs âgés ont un impact sur leur performance au volant en contexte de simulation. Ma participation permettra de contribuer à la



progression de connaissances des variables sociales et contextuelles pouvant avoir un impact sur les effets néfastes des stéréotypes dans notre société. Je comprends que les intentions véritables de l'étude ne pouvaient pas être divulguées à l'avance, puisque ceci aurait pu avoir pour effet d'influencer ma performance. Je comprends que cette expérience fait toujours partie d'une plus vaste étude portant sur la performance routière. Il m'a aussi été indiqué que si j'en ressens le besoin, je peux contacter le Centre des Services Psychologiques de l'Université d'Ottawa (11 rue Marie-Curie, 6e étage, téléphone : (613) 562-5289, courriel [cps@uottawa.ca](mailto:cps@uottawa.ca)).

Ma participation demeure strictement volontaire. Il m'a été expliqué que j'avais à nouveau le choix de participer ou de me retirer de l'étude suite à la divulgation des intentions véritables, et ce, sans craintes de représailles ou d'ennuis. On m'a indiqué que je recevrais deux points de participation, l'équivalent de deux pour cent de la note finale au cours d'introduction à la psychologie auquel je suis inscrit, et les frais de déplacement me seraient toujours accordés si je me retirais de l'étude. J'ai reçu l'assurance par le Dr. Gagnon, Yara Kadulina et/ou autres membres de son équipe de recherche que l'anonymat et la confidentialité seront respectés. Ces renseignements seront conservés en lieu sûr pour une période maximale de 10 ans, dans le laboratoire de recherche du Dr. Gagnon, et seuls Dr. Gagnon, Yara Kadulina et autres assistants de recherche auront accès aux données, et celles-ci seront détruites si je choisis de me retirer de l'étude. À la fin de la période de rétention, toutes les données seront détruites. De plus, mes résultats seront traités globalement afin d'éviter mon identification. Ainsi, la différence entre les groupes sera examinée et non les différences entre chacun des individus. On m'a aussi assuré que les résultats de cette étude seront utilisés seulement à des fins de recherche scientifique (i.e., présentations et articles).

Cette étude est approuvée par le comité d'éthique de la Recherche en Sciences Sociales et Humanités de l'Université d'Ottawa. Tous les projets de recherche impliquant les humains ou les animaux doivent recevoir l'approbation du comité d'éthique afin d'assurer que les directives d'éthique (incluant les droits en tant que participant(e)) soient respectées. Ainsi tout renseignement sur mes droits comme participant ou toute plainte concernant la conduite éthique de ce projet de recherche peuvent être soumises au Responsable de la déontologie en recherche, 550 rue Cumberland, pièce 154, Université d'Ottawa, Ottawa (Ontario), K1N 6N5, (613) 562-5387, [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Il y a deux copies du formulaire de consentement, dont une que je peux conserver. Si je veux une copie du rapport final de l'étude ou si j'ai des questions au sujet de la conduite de ce projet de recherche, je peux communiquer avec le Dr. Gagnon au numéro de téléphone ou à l'adresse courriel citée au haut de cette page.

Merci pour votre participation à cette étude.

**Section à remplir par le participant :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

**Section à remplir par le responsable de recherche :**

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

English Version



**Title of Project: Identification of the underlying mediators of stereotype threat in car driving in young and older drivers.**

**Primary Investigator:** Sylvain Gagnon, PhD

University of Ottawa

(613) 562-5800 Ext. 4305

Consent Form

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: sgagnon@uottawa.ca.

After the disclosure of deception, I, \_\_\_\_\_, agree to participate in the study conducted by Dr. Sylvain Gagnon, Yara Kadulina (Ph.D candidate and research assistant), and the research team of the Laboratory of Cognitive Aging at the University of Ottawa. I give them permission to use the data obtained prior to the disclosure of the actual aim of the study.

I have been informed of the actual nature and purpose of the study. This study aimed at identifying if negative driver stereotypes could impact on the simulated on-road performance. My participation will contribute to the advancement of knowledge that relates to the social and contextual variables that may have an impact on the harmful effects of stereotypes in our society. I understand that the real objectives of this research could not have been explained to me at the beginning of this task, since it could have possibly influenced my performance. I also know that this study is still part of a larger research program

aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours. It was also mentioned that if need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: cps@uottawa.ca).

Participation in this research is still completely voluntary. It was explained that, based on the disclosure of the real aim of the research, I again had the choice to participate to this research or withdraw my participation without any penalty. It was explained that I would be compensated 20\$ for my participation and travel expenses, even if I withdrew my participation. I have been assured by Dr. Gagnon, Yara Kadulina and/or another member of his team that the answers I provided will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study (Dr Gagnon, Yara Kadulina and other research assistants) will have access to it, and the data will be destroyed if I choose to withdraw from this study. At the end of the retention period, all data will be destroyed. Also, my data will be used for research purposes only, such as scientific articles or presentations. Results will be reported in pooled format, seeking group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: ethics@uottawa.ca.

There are two copies of the consent form, one of which I may keep. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you for your assistance in this study.

**Section to be completed by the participant:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Section to be completed by the researcher:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_



**Title of Project: Identification of the underlying mediators of stereotype threat in car driving in young and older drivers.**

**Primary Investigator:** Sylvain Gagnon, PhD  
University of Ottawa  
(613) 562-5800 Ext. 4305

**Consent Form**

Primary investigator: Sylvain Gagnon, Ph.D., School of Psychology, Cognition Laboratory, Vanier Hall, 136 Jean-Jacques Lussier, Room 3042, University of Ottawa, Ottawa, Ontario, K1N 6N5, Tel.: (613) 562-5800, ext. 2515, E-mail: sgagnon@uottawa.ca.

After the disclosure of deception, I, \_\_\_\_\_, agree to participate in the study conducted by Dr. Sylvain Gagnon, Yara Kadulina (Ph.D candidate and research assistant), and his research team of the Laboratory of Cognitive Aging at the University of Ottawa. I give them permission to use the data obtained prior to the disclosure of the actual aim of the study.

I have been informed of the actual nature and purpose of the study. This study aimed at identifying if negative older driver stereotypes could impact on the simulated on-road performance of younger or older adults. My participation will contribute to the advancement of knowledge that relates to the social and contextual variables that may have an impact on the harmful effects of stereotypes in our society. I understand that the real objectives of this research could not have been explained to me at the beginning of this task, since it could have possibly influenced my performance. I also know that this study is still part of a larger research program aimed at increasing our understanding of perceptions held by drivers in regards to various driving behaviours. It was also mentioned that if need it, I may seek help at the Centre for Psychological Services (11 Marie-Curie St., 6<sup>th</sup> floor, telephone: (613) 562-5289, email: cps@uottawa.ca).

Participation in this research is still completely voluntary. It was explained that, based on the disclosure of the real aim of the research, I again had the choice to participate to this research or withdraw my participation without any penalty. It was explained that I would receive my two participation points, equivalent to two percent of my final grade in the introductory course of psychology in which I am enrolled, and that I will receive my travel expenses, even if I withdrew my participation from this study. I have been assured by Dr. Gagnon, Yara Kadulina and/or another member of his team that the answers I provided will remain completely confidential and anonymous. All the data will be kept safely in the research laboratory for a maximum period of 10 years and only the researchers involved in this study (Dr Gagnon, Yara Kadulina and other research assistants) will have access to it, and the data will be destroyed if I choose to withdraw from this study. At the end of the retention period, all data will be destroyed. Also, my data will be used for research purposes only such as scientific articles or presentations. Results will be reported in pooled format, seeking age group differences and not individual differences, in order to protect my identity.

This study has been approved by the University of Ottawa's Social Sciences and Humanities ethics board. All research projects involving humans or animals must be approved by the appropriate research ethics board in order to ensure that ethical guidelines (including your rights as a research participant) are followed. Should you have any questions or comments regarding the ethics of this study, please do not hesitate to contact the Protocol Officer for Ethics in Research, Tabaret Hall, 550 Cumberland Street, Room 154, University of Ottawa, Ottawa, ON K1N 6N5, Tel.: (613) 562-5387, E-mail: [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

There are two copies of the consent form, one of which I may keep. If I wish to receive a copy of the final report of this study or have any questions about the conduct of the research project, I may contact Dr. Gagnon by mail, telephone, or e-mail at the addresses listed above.

Thank you for your assistance in this study.

**Section to be completed by the participant:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Section to be completed by the researcher:**

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

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