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Stereotype threat increases the likelihood that female drivers in a simulator run over jaywalkers

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Abstract

Stereotype threat, or the belief that one may be the target of demeaning stereotypes, leads to performance disruptions in a variety of domains. Two experiments conducted in a driving simulator demonstrate that stereotype threat also disrupts control of an automobile. Women who were reminded of the stereotype that females are poor drivers were more than twice as likely to collide with jaywalking pedestrians than women who were not reminded of this stereotype. Experiment 2 also revealed that the magnitude of this effect was equivalent to that produced by a secondary task, suggesting that stereotype threat might diminish driving performance via a disruptive mental load.

Keywords: Stereotype threat; Stereotypes; Female drivers; Driving behavior; Collision

1. Introduction

Automobile accidents are a serious problem with 42,000 Americans losing their lives each year in motor vehicle crashes (National Safety Council, 2004). Given the prevalence of motor vehicle fatalities and collisions, research has examined various causes of unsafe driving. For example, both in-vehicle distractions (e.g., mobile phone use) and out of vehicle distractions (i.e., environment complexity) have been shown to reduce driving performance (Horberry et al., 2006). A number of individual difference variables have also been shown to impact driving performance (Schwebel et al., 2006). For example, older adults have slower reaction times, as well as decreased visual capacity compared to their younger counterparts, resulting in impaired driving performance (Ho et al., 2001). Furthermore, various personality traits (e.g., sensation-seeking) have also been linked to driving performance (e.g., Jonah, 1997; Schwebel et al., 2006).

Despite the progress made in the study of psychological factors that impact driving safety, research has yet to examine the impact of stereotypes on driving performance. Men are stereotyped to be reckless drivers (Chen et al., 2000) and are well known to be prone to accident involvement (Williams, 2003). Perhaps more pronounced, however, is the negative stereotype of the "female" driver, which is deeply rooted in western culture (Berger, 1986). The consequences of this stereotype are readily observable in daily life; for example, when couples travel together in a vehicle the male usually drives, and the idea that women are poor drivers is a frequent theme of sexist jokes. Stereotypes of women commonly evoke the idea of being a poor driver (Ekehammar et al., 2000), yet research focusing on female drivers is limited (Lonczak et al., 2007). Thus, despite the fact that women have fewer accidents than men (Gebers and Peck, 2003), it nevertheless seems possible that psychological factors may increase the chances that women will be involved in automobile accidents. The goal of the current research is to explore this possibility.

1.1. Stereotype threat

What are the likely consequences for women of the prevalent stereotype that they are poor drivers? Recently, a model of *stereotype threat* (Steele and Aronson, 1995; Steele et al., 2002) has been proposed, which predicts that when people are concerned that they are the target of demeaning stereotypes, their performance can suffer in stereotype-relevant domains. The cen-

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tral tenet of this model is that when a negative stereotype is perceived as potentially self-relevant in a demanding situation (for example when a woman is taking a difficult math test), the target of the stereotype will be distracted by stereotype-relevant thoughts and this will adversely affect performance (Steele and Aronson, 1995).

The impact of stereotypes on behaviors has been the subject of intense study, and a wide variety of studies have now shown that stereotype threat typically impairs the performance of the person being stereotyped (see Steele et al., 2002). Most of the studies have demonstrated that stereotype threat leads to poorer performance on intellectual tasks such as verbal and quantitative tests. For example, when women who have been highly successful in mathematics were reminded of the stereotype that men are better in math, they performed considerably worse on a difficult math test compared to women who did not receive this information (Spencer et al., 1999). It seems that reminding people about group-relevant stereotypes is enough to trigger concerns that disrupt performance, even for the vanguard of the group. This performance-impairing effect of stereotype threat has been replicated across numerous populations and tasks. For example, African Americans' academic pursuits (Steele and Aronson, 1995), poor people's language skills (Croizet and Claire, 1998), and older adults' memory performance (Hess et al., 2003) all suffer when they are reminded about the stereotypes of their group.

Given the prevalence and importance of stereotypes in the academic domain, it is not surprising that most research on stereotype threat has examined performance in academic settings. Nonetheless, stereotype threat is theorized to disrupt performance in other domains, such as the workplace (e.g., Farr, 2003) or the athletic field (Stone et al., 1999). This growing body of research suggests that stereotype threat effects have the potential to be quite broad and may disrupt performance in a variety of everyday activities. For some activities, such as putting a golf ball (Stone et al., 1999), the consequences of stereotype threat might be relatively benign. In contrast, despite their mundane nature, many everyday activities involve decisions with life or death outcomes. Driving an automobile is an example of just such an activity; if stereotype threat can disrupt performance in this domain, poor performance could be disastrous.

The ability to drive an automobile relies on skilled motor movements, coordination, and rapid judgment. People from many different walks of life typically develop sufficient proficiency at driving a car to be granted a license, but at the same time, stereotypes of different types of drivers are common. Women in particular are widely stereotyped to be poor drivers (Berger, 1986; Ekehammar et al., 2000). Research on stereotype threat suggests that stereotypes that women are poor drivers may lead women to perform poorly behind the wheel when the stereotype is made accessible, independent of their actual driving ability.

It is easy to imagine how such increases in accessibility could come about in the course of ordinary driving. For example, consider the case of a driver inadvertently cutting off a truck driver who honks his horn and gesticulates furiously. Although this series of events could cause any driver to experience increased anxiety and thoughts about driving performance, for a female driver this experience could also raise the spectre of being stereotyped in this masculine domain. That is, because women are widely stereotyped to be poor drivers, any difficulty they experience while driving has the potential to activate concerns that others are stereotyping them (see Steele, 1997). Indeed, research has demonstrated that women experience greater driving-related stress compared to men (Simon and Corbett, 1996; Taubmen-Ben-Ari et al., 2004), a finding that might be relevant to the fact that stereotype threat is experienced as stressful for the target of the stereotype (Miller and Kaiser, 2001). This threat of being stereotyped is likely to diminish the capacity to focus on the important task at hand—driving. Given that traffic accidents are a leading cause of death in the United States (Subramanian, 2005), it is important to examine whether stereotype threat could be a contributing factor to automobile collisions.

1.2. Current study

Because people are motivated to disconfirm negative stereotypes about themselves, the experience of stereotype threat can lead people to redouble their efforts in an attempt to disprove the stereotype (Kray et al., 2001; see also von Hippel et al., 2005). As a consequence, when tasks are relatively easy stereotype threat does not appear to induce performance deficits (Spencer et al., 1999), and can even lead to enhanced performance (e.g., O'Brien and Crandall, 2003). Based on these findings, it was predicted in the current research that stereotype threat would motivate drivers to concentrate on essential driving criteria (i.e., speed and lateral position control) in an effort to deny the demeaning stereotype. As a result, little difference was expected on these variables, as stereotype threatened drivers might actually outperform non-threatened drivers in these relatively controllable domains. In contrast, on difficult tasks the evidence overwhelmingly shows that stereotype threat leads to poor performance (Steele et al., 2002), in part because stereotype threat leads to a disruptive mental load that distracts people from the task at hand (Schmader and Johns, 2003). Thus, when confronted with unexpected events (such as a group of jaywalking pedestrians), stereotype threat was expected to result in deficits in performance.

This possibility that different aspects of the driving task might respond differentially to stereotype threat is consistent with research that demonstrates that drivers' responses to multiple performance criteria are flexible, such that performance on some tasks can be enhanced even while other tasks suffer (e.g., Alm and Nilsson, 1994). So long as the overall driving demands are not overwhelming, drivers can choose to focus their resources on specific criteria. For these reasons, it seemed that the best way to capture the negative consequences of stereotype threat was to present drivers with an unexpected event, given the possibility that threatened participants would be extra vigilant on basic driving tasks in their efforts to disconfirm the stereotype of the "female driver" (cf. Kray et al., 2001; von Hippel et al., 2005).

2. Method

2.1. Participants

The participants were 88 female university students, whose ages ranged from 17 to 42 years with a mean age of 21.7 years. They had held a driver's licence for an average of 3.6 years, and during the month prior to their experimental session, they drove for an average of 8 h per week. Participants received either course credit for an introductory psychology course or AUS$ 15 (US$ ∼12) for participating in this experiment.

2.2. Equipment and procedure

Participants were recruited for a "driving simulation" study and were randomly assigned to the stereotype threat or control condition. They arrived at the laboratory individually and were greeted by the experimenter. The participants were then briefed on the components of the simulator car and shown an instruction video. The video showed an ostensible employee of the Transportation Research Center who explained that the University of New South Wales and the Transportation Research Center were collaborating on this research investigating driving. As the vehicle characteristics of the simulator car were slightly different from a real vehicle (e.g., the steering wheel rotated with less friction) the video first explained that the simulator vehicle characteristics were designed to enhance prediction of successful driving in novel and difficult circumstances.

The simulator was outfitted as an actual automobile, and was composed of a modified Hyundai sedan situated in front of projection screens. Participants had a 135° view (horizontal angle) of the road scene, which was projected on three screens placed in front, to the left, and to the right of the car body. Acoustic signals (e.g., engine sounds) were presented through a speaker in the car body behind the driver's seat. The simulation was fully interactive as the simulator computers converted the drivers' vehicle-control actions into corresponding road scene images (15 frame/s) and acoustic feedback in real time. Lee (2004) has shown a slightly older version of this simulator to be a valid predictor of on-road driving performance. Participants first drove 1.8 km to familiarize themselves with the driving simulator. Participants were given an opportunity to ask questions after completing the practice run, but they were not given any feedback on their performance.

After driving the practice route, the purpose of the experiment was presented to participants via another video-recorded message from the same ostensible employee of the Transportation Research Center. Participants in the stereotype threat condition were told that the study's purpose was to investigate the reason why men are better drivers than women, and that the driving task was designed to ascertain why there is a gender difference in driving capabilities. Participants in the control condition were told that the purpose was to investigate the mental processes involved in driving, and that the driving task was designed to uncover these processes.

The simulated driving route was an 8.8 km rural two-lane highway without intersections. Road signs indicating a speed limit of 80 km/h were regularly displayed. Although there was a constant stream of oncoming vehicles in the opposing lane, no vehicles travelled in the driver's direction. There were 12 left-turning and 12 right-turning curves with 90° angles. These sharp bends had radii ranging from 60 to 100 m and they were separated by mildly curved road segments of radii that ranged from 305 to 488 m. The road remained relatively uneventful until the last road segment, which was a long gentle curve. In the middle of this curve a group of pedestrians suddenly came into view and began walking across the road. The onset of the pedestrians was timed to provide 3.1 s until impact, which could be prevented by rapid application of the brakes.

Pilot testing was used to determine the particulars of the unexpected jaywalking event in the main driving task to ensure it had an appropriate level of difficulty for individual differentiation. Different speed, corner angle, and timing parameters were pretested until a version was identified that achieved a collision rate close to 50%. These parameters were chosen because previous studies have consistently shown that the debilitative effect of stereotype threat is more pronounced with difficult tasks (Steele et al., 2002). In a real driving situation, these timing parameters might enable most people to avoid the pedestrians, or alternatively might lead almost everyone to collide with the pedestrians, depending on a variety of factors. The goal was not to emulate conditions that lead to precise collision rates on the road, but rather to provide a situation where it is difficult to avoid hitting pedestrians in the simulator, thereby testing the effect of stereotype threat.

In both the practice and experimental drives, the participants were required to accomplish two objectives simultaneously: to complete the journey as quickly as possible within the speed limit, and to keep their cars as close to the center of their lane as possible throughout the journey. The participants were informed that their performance was assessed on both criteria, and that the criteria were equally important. Additionally, as with normal driving, the participants needed to obey traffic rules and to avoid hitting any objects or driving off the road.

2.3. Vehicle performance measures

The simulator's computer system recorded speed and lateral position variability of participants' cars every 4.6 m (longitudinal distance) on their route. Speed was calculated as the average speed while lateral position variability was calculated as the average absolute value of the distance between participants' cars and the lane's centerline. The driving performance during the practice run was also recorded for use as a covariate in data analyses. The primary dependent measure was whether participants struck the jaywalking pedestrians.

2.4. Subjective motivation measure

After completing the simulated drive, participants indicated their agreement, on a seven-point scale anchored by *strongly disagree* and *strongly agree*, with the statement, "I was motivated to perform well on the driving task to help show that women are good drivers." This item served as a manipulation check of

the hypothesis that stereotype threatened participants would be motivated to disprove the stereotype (as in von Hippel et al., 2005), and assessed whether any differences that emerged in collision with the pedestrians might have been due to lack of motivation to perform well in the driving task.

3. Results

3.1. Speed and lateral position variability

The performance measures on the sharp bends in the main drive correlated strongly with the corresponding performance measures in the practice drive ($r = .65$, $p < .01$ for speed; $r = .71$, $p < .01$ for lateral position variability), suggesting that the practice-drive measures could be used as covariates in analyses of the experimental performance. To examine the overall effects of stereotype threat on speed and lateral position variability, the two performance indicators were computed across the 24 bends. A one-way ANCOVA was conducted for each performance indicator controlling for the corresponding performance measures on the practice journey. The ANCOVAs revealed that the stereotype threat manipulation did not significantly affect average driving speed ($M = 64.94$ km/h, S.D. = 7.41 km/h for stereotype threat group; $M = 63.66$ km/h, S.D. = 6.74 km/h for control group), $F(1,85) = 0.05$, $p = .82$ or lateral position variability ($M = .47$, S.D. = .12 for stereotype threat group; $M = .44$, S.D. = .10 for control group), $F(1,85) = 1.09$, $p = .30$.

3.2. Unexpected event performance

In the unexpected jaywalking incident, 37 of the 88 participants (42.0%) struck the pedestrians across the two experimental conditions. Consistent with predictions, logistic regression revealed that stereotype threatened participants were more likely to hit the pedestrians (59%) than control participants (25%), wald = 9.99, $p < .01$. A t-test revealed no difference in the speed at which participants in the two conditions were driving (stereotype threat $M = 64.26$ km/h, S.D. = 8.62 km/h; control $M = 61.94$ km/h, S.D. = 8.60 km/h), $t(86) = 1.26$, $p > .20$). Additionally, logistic regression revealed that speed did not predict the probability of collision with the pedestrians (wald = 1.97, $p > .15$) beyond the effect of stereotype threat (wald = 9.04, $p < .01$).

3.3. Subjective motivation

The motivation item revealed that participants were more motivated to show that women are good drivers in the stereotype threat condition ($M = 5.45$, S.D. = 1.59) than in the control condition ($M = 3.61$, S.D. = 1.77), $t(86) = 5.13$, $p < .001$.

4. Discussion

Although speed and lateral position variability were unaffected by the manipulation, women who were threatened by the stereotype that they are poor drivers were more than twice as likely to collide with jaywalking pedestrians than women in the control condition. Importantly, analysis of the motivational item suggested that stereotype threatened women were not simply acquiescing to the stereotype and withdrawing effort, but rather may have been trying harder than control women to prove that the stereotype was not self-descriptive. This evidence of decreased performance despite increased effort is consistent with recent research that suggests that stereotype threat effects may emerge despite, or perhaps even because of, the additional effort engaged in by those who experience stereotype threat (von Hippel et al., 2005).

Experiment 1 provides evidence that stereotype threat can disrupt driving performance, but it does not provide any evidence about how stereotype threat leads to these performance deficits. To address the cause of this effect, Experiment 2 concurrently examined the role of disruptive mental load. Recent research has demonstrated that stereotype threat leads to performance decrements due to reductions in working memory capacity (Croizet et al., 2004; Schmader and Johns, 2003). These findings suggest that stereotype threat is distracting to participants, thereby causing deficits in working memory and a concomitant decrease in attention to the driving task. Such a possibility would be consistent with other research on the negative consequences of driver distraction (Horberry et al., 2006). If stereotype threat is causing performance decrements by reducing working memory capacity, then a manipulation of divided attention should have an effect commensurate to that of stereotype threat on the probability of colliding with the pedestrians. The goal of Experiment 2 was to test this possibility.

5. Experiment 2 methodology

5.1. Participants

Participants were 80 female university students, whose ages ranged from 18 to 50 years with a mean age of 23.2 years. They had held a driver's licence for an average of 4.3 years, and during the month prior to their experimental session, they drove for an average of 7.4 h per week. Participants received either course credit for an introductory psychology course or AUS$ 10 (US$ ~7) for participating in this experiment.

5.2. Procedure

With the exceptions discussed below, the procedure was identical to Experiment 1. To enhance generalizability, in this experiment the simulated driving route was an 8.4 km four-lane road with a constant stream of vehicles travelling in the driver's direction. Due to this change in traffic conditions, the speed limit was lowered to 70 km/h. The road comprised mild curves of a 762 m radius. In the drivers' direction, all the vehicles were either parked on the roadside or moving slowly (around 30 km/h). Thus, during both the practice and main driving journeys, the drivers regularly passed slow moving vehicles in their lane. These vehicles compelled the drivers to change lanes (to overtake those front vehicles), and thereby presented the drivers with the challenge of (a) controlling their speed while overtaking and (b) staying centered when moving to a new lane. The

vehicles to be overtaken all came into view at a substantial distance ahead to allow drivers ample time (approximately 10 s) to change lanes without necessitating any vehicle slowing. These events were programmed so that after the first 700 m the drivers had to change lanes (to overtake another vehicle) approximately every 210 m throughout the journey.

For both the practice and experimental drives, the participants' objective was to complete the journey as quickly as they could and at the same time try their best to remain within the speed limit (70 km/h) and stay in the center of their lane. As with normal driving, they were required to obey traffic rules and to avoid hitting objects or driving off the road. Additionally, they worked on a concurrent task (discussed in Section 5.3 below) when it was presented.

As in Experiment 1, the drivers did not come across any pedestrians or incidents that required rapid brake application on the practice journey or for the first 60% of the main driving route, until they encountered a group of unexpected jaywalkers. As participants neared the point at which the jaywalking pedestrians emerge, one of the lanes was blocked to control the driver's lane and to ensure that no vehicles could pass the participant.

5.3. Grammatical reasoning task

This experiment also included a concurrent, grammatical reasoning task (Baddeley, 1968) on alternating segments of the driving route. Due to the addition of the concurrent task, the practice drive for Study 2 was lengthened to 4.5 km so that participants could familiarize themselves with the concurrent task during half of the practice route. Participants were told that this secondary task was used to simulate real driving situations in which drivers often engage in conversations while driving. The concurrent task involved grammatical reasoning, such that participants heard a series of audio-recorded sentences regarding the order of two letters, followed immediately by the stated letters. After hearing each sentence participants judged whether the stated letter order was true or false. For example, a sample item was "B precedes A. AB.", and the correct answer for this item is *false*. This task has been used to simulate mental load while driving (e.g., Brown et al., 1969). Engagement in this task was staggered across segments of the main journey (approximately 960 m each), such that half the participants were involved in the concurrent task on segments 2, 4, 6 and 8 and half the participants were involved in the concurrent task on segments 3, 5, 7 and 9. As a consequence, when participants encountered the jaywalking pedestrians during segment 6 of the journey, half were engaged in the concurrent task and half were not. These manipulations resulted in a 2 (stereotype threat vs. control) by 2 (full vs. divided attention) between subjects design.

5.4. Vehicle control performance

Due to the changed road conditions in this experiment, vehicle control performance was measured slightly differently. Consistent with Experiment 1, lateral position variability was calculated as the average distance (absolute value) between participants' cars and the center of the lane. When drivers changed lanes, their car-position data within a longitudinal distance of 18 m before and after the lane crossover point were not included in computations of the dependent measures (to allow the drivers sufficient distance to move to the center of the new lane). However, drivers needed to stay in their new lane for at least 36 m for the movement to be considered lane changing. If drivers moved briefly to the adjacent lane and then moved back to the original one (within a longitudinal distance of 36 m), the movement was regarded as a deviation from the original lane's center and was counted towards the lateral position variability measure. Speed variability measured the average difference (absolute value) between the car's speed and the 70-km/h speed limit. Speed-limit adherence measured the proportion of the journey for which the car's speed was more than 10% faster than the 70-km/h speed limit.

6. Results

6.1. Reasoning task performance

When participants worked on the reasoning task while driving, they answered an average of 60% (S.D. = 18%) of the items correctly. The accuracy rate was significantly better than the 50% rate expected for random answering, $t(79) = 4.90$, $p < .01$, indicating that participants made an effort to perform well on the task while driving. Consistent with this inference, there was no significant difference between participants' performance on the reasoning task while driving ($M = 60\%$, S.D. = 18%) and their performance on the reasoning-task practice blocks administered before the driving tasks began ($M = 60\%$, S.D. = 20%), $F(1,79) = 0.15$, $p = .70$.

6.2. Speed and lateral position variability

To test the hypothesised effect of stereotype threat on driving performance, a one-way ANCOVA was conducted on each of the performance indicators, controlling for participants' performance on the corresponding indicators during the practice drive. The ANCOVA on lateral position variability revealed that the threatened group showed a marginally significant increase in performance ($M = .40$, S.D. = .09) over the control group ($M = .43$, S.D. = .09), $F(1,77) = 3.78$, $p = .06$, partial $\eta^2 = 0.05$. Stereotype threat did not show a significant effect on the other two vehicle-control-performance indicators of speed variability ($M = 6.71$, S.D. = 3.02 for stereotype threat condition; $M = 6.57$, S.D. = 2.35 for control condition), $F(1,77) = 0.12$, $p = .73$, or speed-limit adherence ($M = 37.27\%$, S.D. = 25.29% for stereotype threat condition; $M = 34.17\%$, S.D. = 19.30% for control condition), $F(1,77) = 1.02$, $p = .32$.

6.3. Unexpected event performance

Across all experimental conditions, 34 of the 80 participants (42.5%) hit the pedestrians in the unexpected jaywalking event. Consistent with Experiment 1, logistic regression revealed that participants with full attention available were more likely to collide with the pedestrians when they were under stereotype

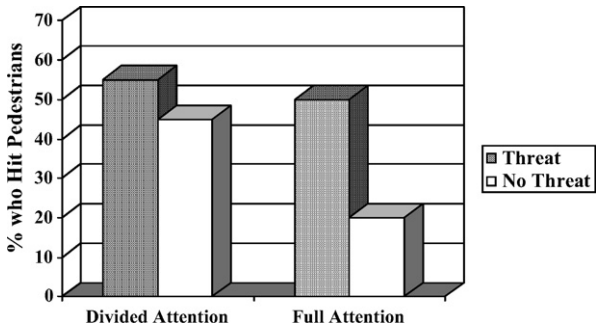

Fig. 1. Percentage of participants who struck the pedestrians in each condition.

threat than when they were not, wald = 3.75, $p = .05$ (see Fig. 1). Participants with divided attention showed no effect of stereotype threat on the probability of colliding with the pedestrians (wald = .40, $p > .50$), and more importantly, they did not differ from stereotype threatened participants who had full attention available, wald = .00, $p > .95$. As in Experiment 1, the inclusion of speed did not influence any of these analyses, nor did speed differ by stereotype threat or divided attention conditions (all p's > .15).

6.4. Subjective motivation

As in Experiment 1, the motivation item revealed that participants were more motivated to show that women are good drivers in the stereotype threat condition ($M = 5.28$, S.D. = 1.62) than in the control condition ($M = 4.28$, S.D. = 1.95), $t(78) = 2.49$, $p < .05$.

7. Discussion

The results of Experiment 2 suggest that reduced working memory capacity is the likely mechanism through which stereotype threat exerts its impact on driving performance. Stereotype threatened participants who encountered jaywalking pedestrians with full attention available collided with the pedestrians at a rate that matched that of participants who were concurrently engaging in a grammatical reasoning task. Although the equivalence of these effect sizes does not provide direct evidence that the stereotype threat effect is brought about by a reduction in working memory, the results are consistent with that account. In combination with previous research demonstrating the impact of stereotype threat on working memory capacity (Croizet et al., 2004; Schmader and Johns, 2003), the current results can be interpreted as preliminary evidence that stereotype threat increases collisions with pedestrians because female drivers are distracted by their concerns of being stereotyped. Examination of other possible mediating mechanisms, such as generalized arousal or stress, represents a potentially worthwhile avenue for future research.

In Experiment 2 but not Experiment 1, stereotype threatened drivers out-performed control drivers on lane-tracking performance. These discrepant findings across the two experiments might be due to the varying road conditions and instructions. Because the control of speed and lateral position was more difficult on the sharp bends of Experiment 1 than in the mild curves in Experiment 2, the facilitating effects of stereotype threat on simple tasks might have been more likely to emerge in Experiment 2 than in Experiment 1. The fact that no similar facilitative effect emerged in speed control suggests that future research is required to assess whether this effect of stereotype threat on lane-tracking is a reliable one.

8. General discussion

These experiments are the first to demonstrate the performance decrements of stereotype threat behind the wheel. Two experiments, with varying road conditions, revealed that driving instructions that evoked stereotype threat more than doubled the likelihood that female drivers would collide with jaywalking pedestrians in a driving simulator. The current findings provide evidence for the potential performance decrements caused by stereotype threat for female drivers in emergency situations.

Despite the dramatic nature of the increase in collision documented in this experiment, it is important to keep in mind that the goal was to create a situation that led to substantial collision rates in an effort to assess whether stereotype threat enhances the likelihood of collision. If baseline collision rates were very low in the no-threat condition, then it seems unlikely that stereotype threat would lead to a significant increase in collision likelihood. Indeed, Steele et al. (2002) have shown that stereotype threat only impacts performance when the task at hand is very difficult. Thus, the current experiment created a situation in which avoiding collision with the jaywalking pedestrians was very difficult to achieve. For this reason, the collision rates documented in this experiment are not intended to reflect pedestrian injury rates per kilometre driven.

Additionally, it should also be noted that validation studies comparing simulated driving to on-road driving have shown greater performance decrements in the simulator than on the road (Reed and Green, 1999). It is therefore likely that stereotype threat effects in actual driving would not be as substantial as those documented in the simulator, even if a situation emerged in which it was equivalently difficult to avoid collision. The current experiments were not designed to achieve absolute validity (i.e., identical rates of collision on the road and in the simulator), but rather the intention was to achieve relative validity (Blaauw, 1982), whereby the relationship between stereotype threat and an increased likelihood of collision documented in the simulator should also emerge on the road, if perhaps to a lesser degree.

Despite the fact that the use of a driving simulator might have magnified the effect of stereotype threat, it remains clear from the current findings that stereotype threat can increase the chance that female drivers will be involved in a collision. At first blush, this finding may seem at odds with actuarial and other evidence showing that women get in fewer accidents than men. While the actuarial data highlight that women are "safe" drivers, the current study nevertheless demonstrates that there are important risk factors for female drivers. Thus, despite the lower collision rates of women compared to men, stereotype threat may nevertheless be a factor increasing women's collision rates above what they would otherwise be.

Although collision rates were the main area of focus in this study, stereotype threat while driving is likely to manifest itself in ways other than collisions. Parallel parking, reversing, and driving in heavy city traffic are all likely to make women more sensitive or susceptible to stereotype threat. Although we explicitly reminded participants about the stereotype of female drivers, negative stereotypes of female drivers can become accessible to women in these situations in a more naturalistic manner. Many women have experienced the anxiety of trying to parallel-park on a busy street while an impatient driver in another vehicle shakes his head at her "incompetence." The stereotype threat literature suggests that this scenario is not equally unnerving for men and women. Knowledge of a self-relevant stereotype creates an interpretative framework for such events, whereby performance frustration results in a cascading series of interpretations that further undermine performance on the task at hand (Steele, 1997). Additionally, simply viewing other women who behave stereotypically can activate stereotype threat (Davies et al., 2005). Thus, it seems likely that subtle reminders of stereotypes of women drivers would have a similar impact on women while they are driving, although this remains an important question for future research.

The stereotype threat literature has highlighted the importance of domain identification for stereotype threat effects to emerge (Steele et al., 2002). The more an individual identifies with the stereotyped domain, the more vulnerable she is to the threat posed by a stereotype denigrating her ability in that domain. Given the strength of the current findings, which emerged without preselecting participants on their identification with driving, it is possible that driving represents a case in which high levels of identification are not a pre-condition for stereotype threat effects to emerge. Identification with the task of driving may be less important because driving provides people a sense of freedom and independence (Lee, 2004). Additionally, safe driving is critically important for everyone. Thus, even if our female participants do not define driving as self-relevant, successful driving is critical to safety and transportation. It is also possible, however, that the current participants were domain identified. After all, these women chose to take part in an experiment that was advertised as concerning driving skills. Future research might examine more fully the possible moderating role of domain identification in driving and stereotype threat.

The current research provides evidence for the impact of stereotype threat on the performance of female drivers, but it does not address the consequences of these manipulations for male drivers. It is arguable that the presence of male control groups in experiments such as the current ones is largely unnecessary, as a substantial literature now documents that people who are informed of their stereotypic superiority tend to perform slightly better when the stereotype is made salient than when it is denied (Walton and Cohen, 2003). Nevertheless, it is also becoming increasingly apparent that most people are subjected to denigrating stereotypes of one type or another, depending on the nature of the comparison group or the task description (e.g., Aronson et al., 1999; Stone et al., 1999). In the case of driving, although women are stereotyped to be poor drivers, young men are stereotyped to be reckless drivers, and indeed they are more likely than young women to be involved in fatal motor vehicle collisions (Chen et al., 2000). Thus, it would seem like a worthwhile avenue for future research to assess whether males would show a conceptually similar pattern of findings if the stereotype of their recklessness were highlighted prior to their driving performance. On the one hand, it is possible that such a stereotype could easily be countered by simply driving more slowly. Alternatively, perhaps the stereotype is not experienced by males as particularly demeaning, as young males might be proud of their reckless reputation. Either way, it remains possible that with proper framing and task demands, stereotype threat might lead to poorer driving performance among males, in a manner conceptually similar to that found with females in the current experiments.

Finally, it should be noted that the potential severity of the consequences of the present findings suggests that future research might profitably consider strategies for ameliorating stereotype threat behind the wheel. The stereotype threat literature has begun to document acute and chronic techniques for minimizing the negative consequences of stereotype threat (Ben-Zeev et al., 2005; Ford et al., 2004; Johns et al., 2005; Marx et al., 2005), but it is unclear how well these techniques would translate to driving. If stereotype threat really does lead to increased collision rates, the answer to this question would seem well worth knowing.

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