



Better understanding female and male driving offenders' behavior: Psychological resources and vulnerabilities matter!

Marion Karras^{a,*}, Patricia Delhomme^b, Antonia Csillik^c

^a Université Paris Nanterre, Laboratoire CLIPSYD, Nanterre F-92000, France

^b Univ Gustave Eiffel, Université Paris Cité, LaPEA, Versailles F-78000, France

^c Université de Lorraine, APEMAC, équipe EPSAM, Metz F-57000, France

ARTICLE INFO

Keywords:

Driving offenders
Gender
Driving behavior
Psychological resources
Vulnerabilities
Driving anger expression

ABSTRACT

Although driving risk taking appears to be mainly male, an increase in driving violations has been observed in recent years among French female drivers. The main objective of the present study was to explore the driving behaviors, psychological resources, and vulnerabilities of female and male driving offenders participating in a French driver rehabilitation program. The second aim was to examine to what extent females' and males' resources and vulnerabilities predicted their violations, engagement in distracting activities while driving, and prosocial driving behaviors. In the course of 110 rehabilitation programs, 1686 driving offenders (22.4% females) completed a paper-and-pencil questionnaire. Compared to male offenders, females were more likely to have received a higher education, be divorced, or separated, and drive fewer annual kilometers. They also had had fewer demerit points than males in the last three years. They were more empathetic but also more impulsive than their male counterparts and less self-compassionate and mindful. Regression and moderation analyses revealed that, across genders, certain psychological resources such as mindfulness can be considered as protective factors for driving offenders as they tend to decrease dangerous behaviors and increase prosocial ones, while vulnerabilities such as aggressive driving anger expression seem to have the opposite effect. Our results provide a better understanding of driving offenders' behavior and the influence of personal dispositions. They also open new interesting research avenues in the prevention of dangerous behaviors among this high-risk population.

1. Introduction

Male drivers tend to take more risks while driving than female drivers and as a result are more often involved in major traffic crashes (Bachoo et al., 2013; Granié et al., 2021; Guého et al., 2014). In France, among the 2541 people killed on the roads in 2020, 78.3 % were males and males represented 91 % of the drunk drivers involved in a fatal road-traffic crash (ONISR, 2021). In recent years, however, an increase in dangerous driving behaviors has been observed among French female drivers (ONISR, 2020). In France, like in most European countries, drivers' licenses are regulated by the demerit point system (Assailly et al., 2012), and there was in fact a greater increase in the number of demerit points assigned to female drivers compared to those assigned to males between 2010 and 2019 (39.4 % and 19.3 % respectively). Moreover, disqualified drivers' licenses increased by 24.3 % for females while they decreased by 28.8 % for males in the same period. Finally,

only 6 % of drivers arrested for drunk-driving were females in 2000, but they were 11.7 % in 2018 (ONISR, 2020).

A particularity of the French demerit point system, where experienced drivers have twelve points on their licenses that they can lose when they are ticketed for various offences, is that once a year driving offenders can voluntarily participate in a drivers' rehabilitation program to recover up to four points on their driver's licenses. Participation can also be mandatory for young drivers who got at least three demerit points during probation, or for drivers convicted of major driving offenses. Approximately 380,000 driving offenders participated in a rehabilitation program in 2019 (ONISR, 2020). These two-day programs are conducted by two instructors, a psychologist and a specialized driving trainer, and aim at raising awareness of the dangers associated with violating traffic regulations and laws. Although most participants in rehabilitation programs are males, an increase in the number of female driving offenders participating has been noted in recent years:

* Corresponding author at: Paris Nanterre University, Psychology Department, UFR SPSE, 200 avenue de la République, Nanterre Cedex 92001, France.
E-mail address: karras.marion@gmail.com (M. Karras).

10.3 % in Delhomme et al. (2008), 11 % in Nallet et al. (2010), and 15 % in Martha and Delhomme (2014). Driving offenders who take part in these programs have been found to be more impulsive than non-offending drivers, to have more difficulty accepting responsibility for their actions, and to underestimate their risk of being involved in a speed-related crash (Martha & Delhomme, 2014; Nallet et al., 2010; Weber et al., 2014). However, no study has separately explored the individual characteristics of male and female participants.

Driving offenders have a high risk of being involved in a road-traffic crash as they tend to multiply violations of traffic regulation rules such as speeding, drunk-driving, using a mobile phone while driving, or not wearing a seatbelt (Davey et al., 2022). Such violations are among the main factors leading to road fatalities and serious injuries (World Health Organization, 2020). Research on driving offenders showed that they are more likely to be male, younger, less educated, and to drive more annual kilometers than other drivers (Factor, 2018). This may explain why research on female driving offenders is scant. Yet, in view of the above-mentioned figures, it seems crucial to gain a better understanding of who both female and male driving offenders are. Do they engage in the same risky behaviors? Are there differences between female and male offenders' personal dispositions and how these might influence their driving behaviors? Previous research showed that taking into account drivers' psychological resources and vulnerabilities can lead to a better understanding of their driving behaviors, both dangerous and prosocial (Karras et al., 2022; Mirón-Juárez et al., 2020a; Monteiro et al., 2018; Murphy & Matvienko-Sikar, 2019; Olandoski et al., 2019). Dangerous driving behaviors, which include violations and engagement in distracting activities, have been found to increase the risk of road-traffic crashes (Choudhary et al., 2022; Delhomme et al., 2017; de Winter et al., 2015; Feng et al., 2014) whereas prosocial behaviors aim at increasing fluidity and security for all road users (Özkan & Lajunen, 2005).

Previous studies showed that psychological resources can influence driving behaviors. Empathy is the ability of individuals to be sensitive to others' emotional states, often coupled with a concern for their well-being (emotional empathy), and the cognitive capacity to perceive and understand these emotional states (cognitive empathy) (Decety, 2017). Cognitive empathy has been found to predict fewer violations and more prosocial driving while emotional empathy only seemed to increase prosocial driving behaviors (Karras et al., 2020). Dispositional Mindfulness refers to the individual's ability to pay attention to the sensorimotor, cognitive, and emotional stimuli in the present moment without judgment and with acceptance (Brown & Ryan, 2003). In the context of driving safety, mindfulness has been found to negatively predict both violations and use of a mobile phone while driving (Koppel et al., 2018; Moore & Brown, 2019; Murphy & Matvienko-Sikar, 2019). Self-compassion is a form of compassion directed toward oneself (Neff, 2003). To the best of our knowledge, only one published study focused on the links between self-compassion and driving behaviors and found that, although it did not seem to directly predict behaviors, it was nonetheless more prevalent among safer drivers who commit fewer violations and are involved in fewer traffic crashes (Karras et al., 2020).

Self-efficacy refers to the individual's subjective assessment of his or her own ability to succeed in a specific domain (Bandura, 1997). Driving self-efficacy reflects the way drivers perceive their own skills and evaluate their ability to control their vehicles or adapt their behavior to the demands of the environment, as well as their ability to assess risks. This resource has mainly been studied among learning drivers, indicating that driving self-efficacy tends to increase during training (Boccaro et al., 2011) and is a positive predictor of future drivers' safe behaviors (Victoir et al., 2005). Finally, since interactions with the traffic environment and other road users often give rise to anger (Bowen et al., 2020), the ability of some drivers to adaptively process this anger (by thinking of positive ways to handle the situation, accepting that some situations can be frustrating, etc.) can also be considered as a positive resource and has been found to reduce risky driving (Mirón-Juárez et al.,

2020b).

Other drivers, however, experience more difficulty processing negative emotions and tend to express their anger more aggressively (verbally, physically, or through their vehicles). Research showed that aggressive anger expression is positively associated with violations (Olandoski et al., 2019; Villieux & Delhomme, 2010) and the tendency to get distracted from the driving task (Stephens & Sullman, 2014). Other psychological vulnerabilities are also known to increase the likelihood to engage in dangerous behaviors. This is particularly true of impulsiveness, which is the tendency to react without thinking about the consequences of one's own actions (Billieux et al., 2012), and sensation seeking, which is a personality trait that can be defined as the need of an individual to seek new, intense, and varied sensations and experiences (Berdoulat et al., 2018; Bıçaksız & Özkan, 2016b; Olandoski et al., 2019; Song et al., 2021). Finally, among vulnerabilities, primary psychopathic traits can be described as a constellation of personality traits often marked by coldness in interpersonal relationships, a tendency to be manipulative and self-centered, and a difficulty to accept responsibility for one's actions (Sellbom & Drislane, 2020; White, 2014). At a sub-clinical level, these traits can be found in the general population to varying degrees (Armstrong et al., 2020) and, on the road, they are positive predictors of violations and aggressive driving (Burtäverde et al., 2016; Monteiro et al., 2018; Panayiotou, 2015).

Previous research found gender differences regarding emotional empathy (females reporting higher levels than men) but not regarding cognitive empathy, mindfulness, or self-compassion (Kamas & Preston, 2021; Murphy & Matvienko-Sikar, 2019; Neff & Pommier, 2013). Moreover, females tend to be more impulsive (Berdoulat et al., 2018), while males generally report higher levels of sensation seeking and primary psychopathic traits (Anderson et al., 2021; de Winter et al., 2018; Eman et al., 2020). Finally, regarding driving anger expression, results are somewhat inconsistent: some studies found no gender differences in anger expression (Villieux & Delhomme, 2010), others found more aggressive anger expression among males (Deniz et al., 2021) and more adaptive expression among females (Deniz et al., 2021; Olandoski et al., 2019). However, these personal dispositions have never been studied among French driving offenders. The first aim of the present study is therefore to explore the personal characteristics of female and male participants in a drivers' rehabilitation program. The second aim is to investigate the resources and vulnerabilities that predict females' and males' driving behaviors (violations, engagement in distracting activities while driving, and prosocial driving behaviors).

2. Method

This study was conducted in compliance with the ethical standards of the French Society of Psychology and was systematically monitored for compliance with the ethical guidelines of Paris-Nanterre University.

2.1. Procedure

Data collection took place during 110 drivers' rehabilitation programs in seven French regions between April and August 2019. The purpose of the study (to assess psychological factors that could impact driving behaviors) was presented to the driving offenders by one of the instructors during the first day of the program, and participants received a written description of the study. They were informed that the study was designed at Paris-Nanterre University and was independent from the rehabilitation program itself, and that refusal to participate would have no influence on their driver's licenses. Anonymity and confidentiality were ensured. The paper-and-pencil questionnaires took approximately 25 min to complete. Out of the 1853 offending drivers approached in these programs, 167 declined to participate or did not fully complete the questionnaire (91 % participation rate).

Table 1

Demographic characteristics of female and male driving offenders.

	<i>N</i> = 1686	Female (<i>n</i> = 378)	Male (<i>n</i> = 1308)	<i>df</i>	<i>N</i>	χ^2	<i>p</i>	<i>V</i>
	%	%	%					
<i>Education level</i>				5	1676	35.11	0.000	0.145
Did not complete high school	30.9	19.5 *	34.2					
Completed high school	18.7	20.1	18.3					
Two years of higher education	20.9	21.7	20.7					
Three years and more of higher education	29.5	38.8 *	26.9					
<i>Type of profession</i>				6	1682	50.57	0.000	0.173
Professional drivers	6.1	1.3 *	7.5					
Jobs including numerous car travels	14.0	8.2 *	15.6					
Self-employed	19.6	16.4	20.5					
Students	7.3	10.3 *	6.4					
Retired	7.7	8.5	7.4					
Unemployed	7.5	7.7	7.4					
Other	37.9	47.5 *	35.1					
<i>Marital status</i>				3	1675	39.23	0.000	0.153
Single	35.2	35.6	35.1					
In a relationship/married	50.3	40.6 *	53.0					
Divorced/separated	13.3	22.5 *	10.7					
<i>Km/year</i>				3	1676	74.44	0.000	0.211
Low	27.0	39.4 *	23.4					
Middle low	23.9	30.3 *	22.0					
Middle high	24.2	17.8 *	26.0					
High	25.0	12.5 *	28.6					

* Significant differences between female and male offenders.

2.2. Participants

The final sample consisted of 1686 driving offenders (22.4 % female) ranging from 18 to 87 years-old ($M = 39.95$, $SD = 15.19$). Half of the participants had at least two years of higher education (50.4 %); the others declared having obtained a high school degree (18.7 %) or reported not having completed high school (30.9 %). Most of the drivers (53.4 %) indicated working full-time jobs, 21.7 % were self-employed, 7.6 % were retired, 7.5 % were students, 6.6 % were unemployed, and 3.3 % worked part-time jobs. Finally, most participants were married or living maritally (50.3 %).

Most drivers were participating in a rehabilitation program for the first time (58 %), but for 17.5 % of them it was at least the third program since obtaining their driver's licenses. Participation in the current program was voluntary (81.4 %), mandatory through probationary license (13.8 %) or court-ordered following convictions for major offenses (4.8 %). On average, the participants had had their driver's licenses for 20.12 years ($SD = 15.16$) and drove 34,817 km per year ($SD = 32,496$). They had gotten between 0 and 32 demerit points on their licenses in the three years prior to the study ($M = 7.27$, $SD = 3.44$), and 29 % of them had been involved in at least one road-traffic crash in the same period (damage-only or with injury).

2.3. Measures

2.3.1. Driving behaviors and driving anger expression

Driver Behavior Questionnaire-Transgressions (DBQT, Lawton et al., 1997; French adaptation: Villieux & Delhomme, 2008). The 12 items of the DBQT provided a total violations score (Cronbach's $\alpha = 0.83$), as well as a speed-related violations score (five items, $\alpha = 0.72$), an aggressive violations score (three items, $\alpha = 0.73$), and a "transgressions to maintain progress" score (four items). However, this last score failed to reach acceptable internal consistency ($\alpha = 0.51$) and was removed from statistical analyses.

The first scale of the *Susceptibility to Driver's Distraction Questionnaire* (SDDQ, Feng et al., 2014; French adaptation: Delhomme et al., 2017)

was used to assess drivers' tendency to voluntarily engage in secondary tasks while driving such as texting, taking phone calls, smoking, day-dreaming, etc. (12 items, $\alpha = 0.82$).

Positive Driver Behaviors Scale (PDBS, Özkan & Lajunen, 2005). For the current study, the PDBS was translated into French with the permission of the authors. It comprises 13 items designed to assess how often drivers engage in prosocial driving behaviors ($\alpha = 0.82$).

Driving Anger Expression Inventory-Short Form (DAXI, Stephens & Sullman, 2014; French adaptation: Villieux and Delhomme, 2008; Villieux and Delhomme, 2010) was used to assess how often participants tend to express their driving anger in an aggressive manner (10 items, $\alpha = 0.83$) or in a constructive and adaptive manner (five items, $\alpha = 0.83$).

2.3.2. Psychological resources

Short-French Toronto Empathy Questionnaire (Short-FTEQ, Karras et al., 2020), French adaptation of the Toronto Empathy Questionnaire (TEQ, Spreng et al., 2009) was used to assess emotional empathy (6 items, $\alpha = 0.72$).

Interpersonal Reactivity Index – Perspective Taking (IRI-PT, Davis, 1983; French adaptation: Gilet et al., 2013) was used to assess cognitive empathy with seven items ($\alpha = 0.66$).

Self-Compassion Scale-Short Form (SCS-SF, Raes et al., 2011; French adaptation: Karras et al., 2019) was used to assess self-compassion with 12 items ($\alpha = 0.71$).

Mindful Attention Awareness Scale (MAAS, Brown & Ryan, 2003; French adaptation: Csillik et al., 2010) was used to assess mindfulness as a personal disposition (15 items, $\alpha = 0.83$).

Driving Self-Efficacy Scale (Victoir et al., 2005; French adaptation: Boccara et al., 2011) comprises 12 items ($\alpha = 0.81$) that were used to assess the participants' perception of their own driving abilities.

2.3.3. Psychological vulnerabilities

The first scale of the *Levenson Self-Report Psychopathy Scale* (LSRP, Levenson et al., 1995; French adaptation: Savard et al., 2005, 2014) was used to assess primary psychopathic traits in the current sample (16 items, $\alpha = 0.81$).

Table 2
Driving-related characteristics of female and male driving offenders.

	<i>N</i> = 1686	Female (<i>n</i> = 378)	Male (<i>n</i> = 1308)	<i>df</i>	<i>N</i>	χ^2	<i>p</i>	<i>V</i>
	%	%	%					
<i>Participation in the rehabilitation program</i>				3	1680	16.46	0.001	0.099
Voluntary	81.4	77.2 *	82.6					
Mandatory: Probationary drivers	13.8	19.6 *	12.1					
Mandatory: Court-ordered	4.8	3.2	5.3					
<i>Participation in driver's rehabilitation programs</i>				11	1668	66.93	0.000	0.200
First	58.6	75.6 *	53.7					
Second or third	33.3	22.2 *	36.4					
Fourth to sixth	7.1	2.2 *	8.4					
Seventh to twelfth	1.0	0 *	1.5					
<i>Demerit points in the last 3 years</i>				23	1661	37.23	0.031	0.150
0-4	22.3	30.2 *	19.9					
5-6	26.2	24.6	26.7					
7-10	37.0	35.2	37.6					
11-32	14.5	10.0 *	15.8					
<i>Ticketed offenses in the last 3 years</i>								
Exceeding the speed limit by less than 20 km/h	64.5	62.8	65.0					
Exceeding the speed limit by 20 to 39 km/h	21.2	16.0 *	22.8	1	1676	8.09	0.004	0.069
Exceeding the speed limit by 40 km/h and more	8.8	5.6 *	9.8	1	1676	6.34	0.013	0.062
Using a mobile phone while driving	24.2	23.9	24.3					
Running a red traffic light	23.2	30.3 *	21.2	1	1676	13.75	0.000	0.091
Not complying with a stop sign	6.8	5.3	7.2					
Crossing a white line	5.5	2.1 *	6.5	1	1676	10.56	0.001	0.079
Not wearing a seatbelt	5.4	4.8	5.6					
Right-of-way violation	1.6	1.6	1.5					
Driving while intoxicated with cannabis	2.6	1.6	2.9					
Driving under the influence of alcohol	13.5	9.8 *	14.6	1	1676	5.68	0.017	0.058
<i>Since first obtaining the driver's license:</i>								
License disqualified at least once	10.1	2.7 *	12.3	1	1661	29.39	0.000	0.133
License suspended at least once	30.2	14.0 *	35.0	1	1674	60.80	0.000	0.191
Unlicensed driving	14.8	6.1 *	17.3	1	1657	28.80	0.000	0.132
<i>Crash history:</i>								
Non-fatal crash in the last 3 years	29.0	31.3	28.3					
Fatal crash since obtaining the driver's license	1.9	1.6	2.0					

* Significant differences between female and male offenders.

UPPS-P Impulsive Behavior Scale – Short Form (Billieux et al., 2012). This short impulsiveness scale was derived from the original 59-items UPPS-P scale (Cyders & Smith, 2008; Whiteside & Lynam, 2001). Three four-items subscales of the UPPS-P were used in the current study: positive urgency (the tendency to act impulsively while experiencing positive emotions, $\alpha = 0.70$), negative urgency (the tendency to act impulsively while experiencing negative emotions, $\alpha = 0.75$), and lack of premeditation (the tendency to act without considering the consequences of one's behavior, $\alpha = 0.73$). A total impulsiveness score resulting from the sum of the three subscales was also used in our analyses ($\alpha = 0.81$).

Driving-Related Sensation Seeking Scale (DRSS, Taubman et al., 1996; French adaptation: Delhomme et al., 2009) was used to assess sensation seeking in the specific context of driving (7 items, $\alpha = 0.77$).

Sociodemographic variables were also gathered. They included age, gender, education, marital status, annual kilometers, and years since the driver's license was first obtained. Numbers of road-traffic crashes (both damage-only and with injury), ticketed offenses, and demerit points within the last three years were also recorded. Finally, driving offenders were asked to indicate if they had previously participated in other driver's rehabilitation programs, if they had had their licenses suspended or disqualified, if they had continued to drive during suspension or disqualification (unlicensed driving), and if they had been involved in a fatal crash since first obtaining their driver's licenses.

2.4. Data analysis

Less than 2 % of the data were missing. Cases with missing values were deleted listwise for each specific analysis, and data were analyzed using SPSS 23.0 software. Chi-square test and Student's *t*-test were carried out to assess differences between female and male driving offenders. The normality assumption was checked for all variables: skewness and kurtosis coefficients were all within the recommended interval of $[-2; +2]$ (Gravetter et al., 2020) except for annual kilometers which were therefore divided into four categories: low annual kilometers (150 to 15,500 km per year: 27 % of the sample), middle low (16,000 to 25,000 km: 23.8 % of the sample), middle high (26,000 to 42,000 km: 24.2 % of the sample), and high annual kilometers (45,000 to 450,000 km: 25 % of the sample). These categories were used in all following analyses. Correlations, hierarchical multiple regression analyses and moderation analyses were performed to determine the specific contribution of psychological resources and vulnerabilities to females' and males' violations, voluntary engagement in distracting activities while driving, and prosocial driving behaviors.

3. Results

3.1. Descriptive statistics

Table 1 presents the demographic characteristics of female and male

Table 3
Driving behaviors, personal resources, and vulnerabilities.

	Total sample	Female		Male		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i> [<i>SD</i>]	<i>n</i>	<i>M</i> [<i>SD</i>]	<i>n</i>	<i>M</i> [<i>SD</i>]			
Age	39.95 [15.19]	376	40.04 [15.68]	1294	39.92 [15.05]	n.s.		
Driving experience (years)	20.12 [15.16]	373	19.38 [15.43]	1284	20.33 [15.07]	n.s.		
<i>Driving behaviors:</i>								
DBQT-total *	25.96 [7.58]	378	24.74 [6.84]	1303	26.32 [7.75]	3.84	0.000	0.21
DBQT-speed *	12.55 [3.99]	378	11.98 [3.79]	1303	12.72 [4.03]	3.18	0.001	0.19
DBQT-aggressive	6.38 [2.57]	378	6.22 [2.42]	1303	6.42 [2.61]	n.s.		
SDDQ	35.23 [8.43]	378	35.62 [9.15]	1307	35.12 [8.21]	n.s.		
PDBS	60.31 [9.86]	378	60.68 [10.23]	1304	60.21 [9.75]	n.s.		
<i>Resources:</i>								
Short-FTEQ *	23.61 [3.76]	378	24.94 [3.34]	1305	23.23 [3.79]	-7.92	0.000	-0.45
IRI-PT *	33.19 [7.08]	378	34.34 [6.88]	1305	32.85 [7.11]	-3.61	0.000	-0.21
SCS-SF *	37.15 [6.46]	378	35.79 [7.71]	1305	37.55 [5.99]	4.09	0.000	0.27
MAAS *	56.97 [11.74]	378	55.14 [11.61]	1300	57.51 [11.73]	3.47	0.001	0.20
Driving self-efficacy *	45.72 [6.49]	378	44.52 [6.59]	1303	46.07 [6.42]	4.10	0.000	0.24
DAXI-adaptive *	12.68 [3.68]	378	12.34 [3.59]	1308	12.77 [3.70]	2.01	0.045	0.12
<i>Vulnerabilities:</i>								
LSRP *	33.61 [7.25]	377	30.72 [6.66]	1303	34.45 [7.2]	9.00	0.000	0.51
UPPS-total *	27.38 [5.68]	376	28.19 [6.32]	1303	27.15 [5.46]	-2.91	0.004	-0.18
UPPS-negative urgency *	9.35 [2.72]	376	9.59 [2.89]	1303	9.28 [2.67]	-1.97	0.049	-0.12
UPPS-positive urgency *	10.13 [2.46]	376	10.55 [2.65]	1303	10.01 [2.39]	-3.55	0.000	-0.22
UPPS-premeditation	7.91 [2.35]	376	8.06 [2.36]	1303	7.86 [2.35]	n.s.		
DRSS *	18.46 [6.11]	378	16.66 [6.28]	1300	18.99 [5.97]	6.41	0.000	0.38
DAXI-aggressive	16.53 [5.06]	378	16.42 [4.54]	1308	16.56 [5.21]	n.s.		

*significant difference between men and women ($p < .05$).

SD: standard deviation (DBQT: Driving Behaviour Questionnaire-Transgressions; SDDQ: Susceptibility to Driver's Distraction Questionnaire; PDBS: Positive Driver Behavior Scale; Short-FTEQ: French Toronto Empathy Questionnaire-Short Form (emotional empathy); IRI-PT: Interpersonal Reactivity Index-Perspective Taking (cognitive empathy); SCS-SF: Self Compassion Scale-Short Form; MAAS: Mindful Attention Awareness Scale; DAXI: Driving Anger Expression Inventory; LSRP: Levenson Self-Report Psychopathy; UPPS: impulsive behavior scale; DRSS: Driving-Related Sensation Seeking).

driving offenders. Females were more likely to have received higher education than males, to be divorced or separated, and to drive less than 25,000 km per year. This difference in annual kilometers could be explained by the fact that males were more often professional drivers than females or occupied jobs that involved more frequent travels (sales representatives, construction sites supervisors, craftsmen, etc.).

Table 2 presents driving-related variables compared across genders. Females were more often novice drivers legally required to participate in the rehabilitation program, whereas a higher percentage of males participated voluntarily in order to recover license points. For 2.2 % of females and 9.9 % of males, it was at least the third program since obtaining their driver's license. Females had generally gotten fewer demerit points in the three years prior to the study than males. There were no gender differences in ticketed offenses for exceeding the speed limit by less than 20 km/h, using a mobile phone, not complying with a stop sign, not wearing a seatbelt, violating the right-of-way regulation, or driving while intoxicated with cannabis. However, females were sanctioned more often for running a red traffic light whereas males were ticketed more often for exceeding the speed limit by more than 20 km/h, crossing a white line, or drunk-driving.

Males had had their driver's licenses suspended or disqualified more often than females and reported more unlicensed driving. Finally, 31.3 % of females and 28.3 % of males had been involved in at least one non-fatal road-traffic crash in the last three years, and 1.6 % of females and 2 % of males had been involved in at least one fatal crash since first obtaining their driver's licenses. These differences were not significant.

3.2. Driving behaviors, personal resources, and vulnerabilities

Internal consistency coefficients, means, and standard deviations for all continuous variables are reported in Table 3. Student's *t*-test was computed to compare females' and males' scores. There were no

significant differences across genders for age, driving experience, aggressive violations, distracted driving, prosocial driving behaviors, aggressive driving anger expression, and lack of premeditation. However, females reported fewer overall violations and fewer speed-related violations in particular. They scored higher on both empathy scales and were more impulsive than males, especially when confronted with strong positive or negative emotions. They reported lower scores of mindfulness, self-compassion, driving self-efficacy, and adaptive driving anger expression. Finally, female driving offenders had lower primary psychopathic traits and sought fewer sensations while driving.

3.3. Correlation analyses

Correlations between driving behaviors and other study variables are reported in Table 4. As age and driving experience were highly correlated ($r = 0.97, p < .001$), only experience was included in the following analyses. Among both females and males, violations were negatively correlated with driving experience, perspective taking, self-compassion, mindfulness, and adaptive anger expression, and positively correlated with primary psychopathic traits, impulsiveness, driving-related sensation seeking, aggressive anger expression, and annual kilometers. In addition, when violations increased, numbers of demerit points and non-fatal crashes (in the last three years) also increased for both genders. Among male offenders, violations were negatively associated with emotional empathy and positively associated with driving self-efficacy. Engagement in distracting activities was negatively correlated with driving experience, self-compassion, mindfulness, and adaptive anger expression, and positively correlated with impulsiveness, driving-related sensation seeking, aggressive anger expression, annual kilometers, demerit points, and non-fatal crashes for both genders. Among female offenders, engagement in distracting activities was also positively associated with emotional empathy and negatively associated with

Table 4
Correlations between driving behaviors and other study variables among female and male driving offenders.

		Pearson's correlations										Spearman's correlations				
		Driving experience	FTEQ	PT	SCS	MAAS	Self efficacy	DAXad	LSRP	UPPS	DBSS	DAXag	Education level	Km/year	Demerit points	Non-fatal crashes
DBQT	F	-0.29*	-0.06	-0.25*	-0.32*	-0.41*	-0.07	-0.36*	0.29*	0.41*	0.51*	0.71*	-0.03	0.14*	0.12*	0.22*
	M	-0.32*	-0.15*	-0.19*	-0.20*	-0.26*	0.14*	-0.33*	0.29*	0.26*	0.54*	0.71*	0.04	0.12*	0.15*	0.17*
SDDQ	F	-0.36*	0.15*	-0.16*	-0.26*	-0.43*	-0.04	-0.17*	0.06	0.39*	0.30*	0.49*	0.02	0.22*	0.13*	0.22*
	M	-0.35*	0.02	-0.03	-0.10*	-0.28*	0.10*	-0.09*	0.16*	0.17*	0.28*	0.37*	0.05	0.23*	0.17*	0.20*
PDBS	F	0.28*	0.26*	0.38*	0.29*	0.29*	0.15*	0.38*	-0.34*	-0.31*	-0.26*	-0.42*	0.10	-0.03	-0.07	-0.16*
	M	0.31*	0.39*	0.33*	0.17*	0.25*	0.02	0.34*	-0.40*	-0.28*	-0.28*	-0.38*	0.12*	-0.02	0.01	-0.13*

F: female driving offenders; M: male driving offenders.

* $p < .05$ (DBQT: Driving Behaviour Questionnaire-Transgressions; SDDQ: Susceptibility to Driver's Distraction Questionnaire; PDBS: Positive Driver Behavior Scale; FTEQ: French Toronto Empathy Questionnaire-Short Form (emotional empathy); PT: Interpersonal Reactivity Index-Perspective Taking (cognitive empathy); SCS: Self Compassion Scale-Short Form; MAAS: Mindful Attention Awareness Scale; DAXad: Adaptive Driving Anger Expression; LSRP: Levenson Self-Report Psychopathy; UPPS: impulsive behavior scale; DBSS: Driving-Related Sensation Seeking; DAXag: Aggressive Driving Anger Expression).

perspective taking, while among male offenders it was positively associated with driving self-efficacy and primary psychopathic traits. Finally, prosocial driving behaviors were positively correlated with driving experience and all resources, and negatively correlated with all vulnerabilities as well as non-fatal crashes across genders. Among females, these behaviors were positively associated with driving self-efficacy, while among males they were positively associated with education.

3.4. Hierarchical regression analyses

Hierarchical regression analyses were computed with violations, distracting activities, and prosocial behaviors as dependent variables. Only variables significantly correlated with driving behaviors were included in the models. For each analysis, relevant sociodemographic variables were entered in Step 1, psychological resources in Step 2, and vulnerabilities in Step 3 (see Tables 5-7).

Among females, only mindfulness remained a negative predictor of violations in the final step of the model while primary psychopathic traits, sensation seeking, and aggressive anger expression were positive predictors. Among males, only driving experience and mindfulness remained negative predictors of violations in the final step while sensation seeking, and aggressive anger expression were positive predictors. Overall, these models explained 59.1 % of the variance in female driving offenders' violations and 56.6 % of the variance in male offenders' violations.

Females' driving experience and mindfulness negatively predicted distracting activities, while kilometers, emotional empathy, both adaptive and aggressive anger expression, and impulsiveness were positive predictors. Males' driving experience and mindfulness were also negative predictors of distracting activities while kilometers, driving self-efficacy, adaptive and aggressive anger expression were positive predictors. These models explained 42.4 % of the variance in females' engagement in distracting activities while driving, and 28 % of the variance in males' distracting activities.

Finally, among females, driving experience, emotional and cognitive empathy remained positive predictors of prosocial driving behaviors in the final step of the model, while primary psychopathic traits and aggressive anger expression were negative predictors. Among males, driving experience, emotional and cognitive empathy, mindfulness, and adaptive anger expression were positive predictors of prosocial driving behaviors in the final step of the model, while primary psychopathic traits, impulsiveness, and aggressive anger expression were negative predictors. These models explained 37.9 % of the variance in females' prosocial driving and 36.1 % of the variance in males' prosocial driving behaviors.

3.5. Moderation analyses

Regression analyses showed that driving experience predicted violations only among male driving offenders, primary psychopathic traits predicted violations only among females, emotional empathy and impulsiveness predicted the tendency to engage in distracting activities while driving only among females, driving self-efficacy predicted distracting activities only among males, and that mindfulness, adaptive anger expression, and impulsiveness predicted prosocial driving behaviors but only among males. The fact that an independent variable significantly predicts a dependent variable in one sample but not the other does not necessarily mean that the two regression coefficients differ significantly from one population to another. To further explore these differences we conducted moderation analyses on the entire sample using the PROCESS macro in SPSS (Hayes, 2017; model 1) with 5000 bootstrapped samples.

For each moderation model, we entered driving behaviors as dependant variables, gender as the moderator, and the predictor whose influence we wanted to examine as the independent variable. Other

Table 5
Hierarchical regression results for violations (DBQT total score).

	Step 1		Step 2		Step 3	
	β	R ²	β	R ²	β	R ²
Females (n = 370)						
Sociodemographic variables		0.093		0.289		0.591
Driving experience	-0.28***		-0.17***		-0.002	
Km/year	0.10*		0.12**		0.01	
Resources						
Cognitive empathy (IRI-PT)			-0.09		-0.05	
Self-compassion (SCS)			-0.06		0.04	
Mindfulness (MAAS)			-0.27***		-0.13**	
Adaptive driving anger expression (DAXad)			-0.21***		0.02	
Vulnerabilities						
Primary psychopathic traits (LSRP)					0.07*	
Impulsiveness (UPPS)					0.07	
Driving-related sensation seeking (DRSS)					0.23***	
Aggressive driving anger expression (DAXag)					0.53***	
F =	18.915***		24.645***		51.926***	
Males (n = 1254)						
Sociodemographic variables		0.115		0.249		0.566
Driving experience	-0.32***		-0.22***		-0.06**	
Km/year	0.11***		0.10***		0.03	
Resources						
Emotional empathy (FTEQ)			-0.04		0.02	
Cognitive empathy (IRI-PT)			-0.06*		-0.03	
Self-compassion (SCS)			-0.03		0.03	
Mindfulness (MAAS)			-0.21***		-0.08***	
Driving self-efficacy			0.15***		0.02	
Adaptive driving anger expression (DAXad)			-0.21***		0.02	
Vulnerabilities						
Primary psychopathic traits (LSRP)					0.04	
Impulsiveness (UPPS)					0.02	
Driving-related sensation seeking (DRSS)					0.21***	
Aggressive driving anger expression (DAXag)					0.56***	
F =	81.152***		51.634***		134.834***	

* $p < .05$; ** $p < .01$; *** $p < .001$.

sociodemographic variables and personal dispositions were entered as covariates to control their effects. Interaction effects between gender and independent variables for each moderation model are presented in Table 8.

Results of moderation analyses indicate that driving experience is a negative significant predictor of violations across genders while primary psychopathic traits are positive predictors. Emotional empathy is a positive predictor of the tendency to engage in distracting activities for female as well as male offenders while driving self-efficacy is not a significant predictor ($\beta = 0.04$, $t = 1.61$, $p = .11$ in the overall sample of driving offenders). However, it appears that impulsiveness is a positive predictor of this tendency but only among females (see Table 9 and Fig. 1 for more detailed results). Finally, mindfulness and adaptive anger expression are positive predictors of prosocial driving behaviors while impulsiveness is a negative predictor of these positive behaviors regardless of gender.

4. Discussion

In the present exploratory study, we examined the demographic, behavioral, and psychological characteristics of female and male French driving offenders participating in a drivers' rehabilitation program. We also explored the psychological resources and vulnerabilities that predicted their driving behaviors (violations, engagement in distracting activities while driving, and prosocial driving behaviors).

In our sample, female and male driving offenders had the same average age and driving experience. However, females were more likely to have received higher education and to be separated or divorced. Males on the other hand, were more likely to be professional drivers (truck or taxi drivers), or to occupy jobs – such as sales representatives or craftsmen – that require many car trips. This is reflected in part by the higher number of annual kilometers reported by males. The same demographic differences were observed among French driving offenders by Nallet et al. (2010) and in a systematic review on drivers arrested for drunk-driving in the United-Kingdom (McMurrin et al., 2011). Most females in our sample participated in a rehabilitation program for the first time while half of the male participants had enlisted in at least another program since obtaining their drivers' licenses. Moreover, a higher percentage of males had already had their licenses disqualified or suspended at least once, and 17.3 % reported that they had continued to drive during the disqualification or suspension period. Female participants were more likely to have been sanctioned for running a red light while males were more likely to have been ticketed for drunk-driving, crossing a white line, or exceeding the speed limit by more than 20 km per hour. However, there was no difference in the percentages of female and male driving offenders involved in non-fatal crashes in the three years prior to the study, or in fatal crashes since obtaining their drivers' licenses. This is somewhat surprising given that most studies show that male drivers are involved in serious road-traffic crashes more often than females (Cullen et al., 2021; Kumar Yadav & Velaga, 2021;

Table 6

Hierarchical regression results for engagement in distracting activities while driving (SDDQ score).

	Step 1		Step 2		Step 3	
	β	R ²	β	R ²	β	R ²
Females (n = 370)						
Sociodemographic variables		0.158		0.337		0.424
Driving experience	-0.35***		-0.28***		-0.20***	
Km/year	0.16**		0.17***		0.12**	
Resources						
Emotional empathy (FTEQ)			0.17***		0.14**	
Cognitive empathy (IRI-PT)			-0.12*		-0.08	
Self-compassion (SCS)			-0.04		0.04	
Mindfulness (MAAS)			-0.35***		-0.25***	
Adaptive driving anger expression (DAXag)			0.01		0.14**	
Vulnerabilities						
Impulsiveness (UPPS)					0.14**	
Driving-related sensation seeking (DRSS)					0.04	
Aggressive driving anger expression (DAXag)					0.31***	
F =	34.530***		26.237***		26.448***	
Males (n = 1256)						
Sociodemographic variables		0.170		0.239		0.280
Driving experience	-0.35***		-0.31***		-0.26***	
Km/year	0.22***		0.22***		0.20***	
Resources						
Self-compassion (SCS)			0.02		0.04	
Mindfulness (MAAS)			-0.27***		-0.22***	
Driving self-efficacy			0.09***		0.05*	
Adaptive driving anger expression (DAXag)			0.02		0.11***	
Vulnerabilities						
Primary psychopathic traits (LSRP)					0.01	
Impulsiveness (UPPS)					0.02	
Driving-related sensation seeking (DRSS)					0.03	
Aggressive driving anger expression (DAXag)					0.23***	
F =	128.656***		65.207***		32.799***	

* $p < .05$; ** $p < .01$; *** $p < .001$.

Navas et al., 2019). It is also noteworthy that 22.4 % of the present sample were female. This represents a significant increase over previous studies: 10.3 % in Delhomme et al. (2008), 11 % in Nallet et al. (2010), and 15 % in Martha and Delhomme (2014). Together with the increase in demerit points and license disqualifications observed among female drivers in the last decade (ONISR, 2021), this finding highlights the need to better understand female drivers' behavior and the personal factors that underlie it.

There was no difference between females' and males' self-reported aggressive violations (e.g., driving very close to the vehicle in front to force its driver to accelerate or move over), aggressive driving anger expression, engagement in distracting activities while driving, and prosocial driving behaviors. However, males reported more speeding violations and more adaptive anger expression. Other studies also showed that speeding can more commonly be observed among male drivers (Delhomme et al., 2012; Mills et al., 2021; Perez et al., 2021). However, results are somewhat inconsistent regarding other driving behaviors. As in the present study, authors found no gender differences in aggressive driving (Abele et al., 2020; Shen et al., 2018a), aggressive anger expression (Olandoski et al., 2019; Villieux & Delhomme, 2010), distraction (Parnell et al., 2020; Prat et al., 2017; Young et al., 2019), and prosocial driving behaviors (Karras et al., 2020). However, in other studies, male drivers reported more aggressive violations than females (Găianu et al., 2020), expressed their anger more aggressively (Deniz et al., 2021), and engaged in more distracting activities while driving (Feng et al., 2014; Lipovac et al., 2017), while female drivers reported more prosocial driving behaviors (Harris et al., 2014; Shen et al.,

2018b), and expressed their anger just as adaptively (Love et al., 2022; Villieux & Delhomme, 2010) or more adaptively than males (Deniz et al., 2021; Olandoski et al., 2019). These mixed findings might be the result of cultural and methodological differences across studies: different samples (students, general driving population, etc.), and different assessment methods (self-report scales, naturalistic driving observation or simulated driving, etc.). In the present sample however, female driving offenders appear to have more difficulty in finding positive ways to express their driving anger than what is usually observed in other studies.

Differences between female and male driving offenders were more pronounced regarding personal dispositions. Among all resources and vulnerabilities currently assessed, only lack of premeditation, which is a dimension of impulsiveness that refers to the tendency to act without thinking about potential consequences of one's behavior (Billieux et al., 2012), was not significantly different across genders. Females tended to be generally more impulsive than males, especially when confronted with strong emotions, whether positive or negative (positive and negative urgency). They also had higher levels of emotional and cognitive empathy. On the other hand, males had higher levels of self-compassion, mindfulness, and driving self-efficacy, and reported higher primary psychopathic traits and driving-related sensation seeking. Some of these gender differences are consistent with other studies (Anderson et al., 2021; Berdoulat et al., 2018; de Winter et al., 2018; Eman et al., 2020; Monteiro et al., 2018). In the general population, females are often described as more empathetic than males but this difference is usually observed for the emotional component but not the cognitive component

Table 7

Hierarchical regression results for prosocial driving behaviors (PDBS score).

	Step 1		Step 2		Step 3	
	β	R ²	β	R ²	β	R ²
Females (n = 371)						
Sociodemographic variables		0.079		0.320		0.379
Driving experience	0.28***		0.20***		0.13**	
Resources						
Emotional empathy (FTEQ)			0.17***		0.15**	
Cognitive empathy (IRI-PT)			0.23***		0.19***	
Self-compassion (SCS)			0.02		-0.01	
Mindfulness (MAAS)			0.14**		0.07	
Driving self-efficacy			0.03		0.07	
Adaptive driving anger expression (DAXad)			0.19***		0.10	
Vulnerabilities						
Primary psychopathic traits (LSRP)					-0.15**	
Impulsiveness (UPPS)					-0.01	
Driving-related sensation seeking (DRSS)					-0.09	
Aggressive driving anger expression (DAXag)					-0.19**	
F =	31.712***		24.458***		19.956***	
Males (n = 1260)						
Sociodemographic variables		0.105		0.324		0.361
Driving experience	0.31***		0.22***		0.17***	
Education level	0.09**		0.06*		0.04	
Resources						
Emotional empathy (FTEQ)			0.27***		0.22***	
Cognitive empathy (IRI-PT)			0.13***		0.10***	
Self-compassion (SCS)			-0.02		-0.04	
Mindfulness (MAAS)			0.17***		0.11***	
Adaptive driving anger expression (DAXad)			0.18***		0.10***	
Vulnerabilities						
Primary psychopathic traits (LSRP)					-0.11***	
Impulsiveness (UPPS)					-0.06*	
Driving-related sensation seeking (DRSS)					-0.01	
Aggressive driving anger expression (DAXag)					-0.16***	
F =	74.057***		85.590***		64.148***	

* $p < .05$; ** $p < .01$; *** $p < .001$.**Table 8**

Summary of interaction effects for moderation analyses.

	β	t	p
Dependent variable: violations			
<i>Interaction results:</i>			
Gender x driving experience	0.06	1.43	0.15
Gender x primary psychopathic traits (LSRP)	0.05	1.06	0.29
Dependent variable: Engagement in distracting activities			
<i>Interaction results:</i>			
Gender x emotional empathy (FTEQ)	0.05	0.97	0.33
Gender x driving self-efficacy	-0.07	-1.46	0.15
Gender x impulsiveness (UPPS)	0.19	4.26	0.000
Dependent variable: Prosocial driving behaviors			
<i>Interaction results:</i>			
Gender x mindfulness (MAAS)	0.03	0.64	0.52
Gender x adaptive anger expression (DAXad)	0.07	1.34	0.18
Gender x impulsiveness (UPPS)	-0.03	-0.71	0.48

of empathy (Jonason & Krause, 2013; Kamas & Preston, 2021; Karras et al., 2020). Our results also differ from those of other studies that found equal levels of self-compassion and dispositional mindfulness across genders among community samples and drivers in general (Koppel et al., 2018; López et al., 2018; Murphy & Matvienko-Sikar, 2019; Neff &

Pommier, 2013). It appears that, among French driving offenders, gender differences are not always consistent with what is usually observed in the general population.

It appears that, in the present sample, females reported fewer resources related to emotional regulation (particularly impatience, frustration, or anger) and, maybe as a result, were more easily distracted while driving. The present study is the first to investigate these gender differences and more research is needed to determine whether these are inherent to driving offenders or only relate to the present sample. Moreover, future studies should include comparisons with a control sample of non-offending female drivers and other variables could be considered to complete the present findings. For example, recent studies indicated that female drivers arrested for alcohol- or drug-impaired driving tend to have lower income than males and are more often divorced with children (McMurrin et al., 2011), they are also more likely to have mental health issues and alcohol use disorders (Armstrong et al., 2019; Webster et al., 2019; Armstrong et al., 2020). Thus, social, situational, and medical determinants of female driving offending could be assessed in future research.

Hierarchical regression analyses and moderation analyses were computed to further investigate the extent to which personal resources and vulnerabilities contribute to the behaviors of female and male driving offenders. In the overall sample, violations were negatively predicted by mindfulness and positively predicted by driving-related sensation seeking, aggressive driving anger expression, and primary

Table 9

Moderation analysis for engagement in distracting activities while driving (SDDQ score).

	β	t	R^2	F
$N = 1623$				
Control variables				
Driving experience	-0.24***	-10.7		
Km/year	0.16***	8.34		
Emotional empathy (FTEQ)	0.11***	4.45		
Cognitive empathy (IRI-PT)	-0.02	-0.73		
Self-compassion (SCS)	0.04	1.68		
Mindfulness (MAAS)	-0.23***	-9.35		
Driving self-efficacy	0.04	1.78		
Adaptive driving anger expression (DAXad)	0.10***	4.24		
Primary psychopathic traits (LSRP)	0.01	0.58		
Driving-related sensation seeking (DRSS)	0.03	1.36		
Aggressive driving anger expression (DAXag)	0.25***	9.49		
Independent variables				
Gender	0.06	1.21		
Impulsiveness (UPPS)	0.003	0.12		
Interaction				
Gender X Impulsiveness	0.19***	4.26		
Model summary			0.319	53.71***

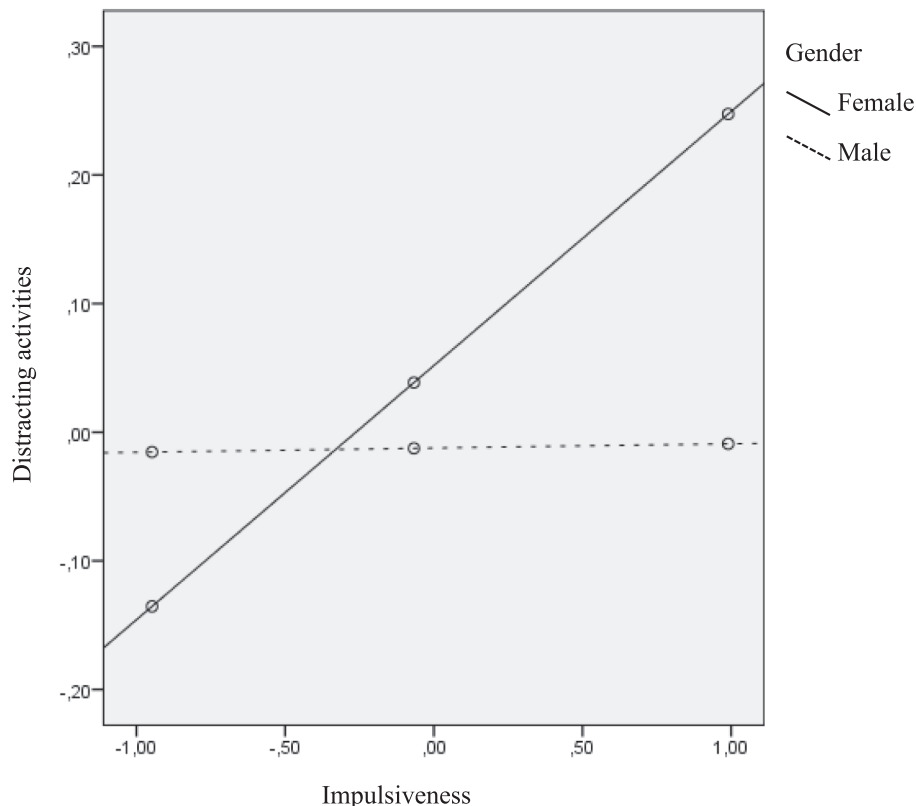
* $p < .05$; ** $p < .01$; *** $p < .001$.

psychopathic traits. The tendency to engage in distracting activities while driving was negatively predicted by driving experience and mindfulness across genders, and positively predicted by annual

kilometers, emotional empathy, and both aggressive and adaptive driving anger expression. Female offenders' and impulsiveness also increased this tendency. Finally, prosocial driving behaviors were positively predicted by driving experience, both emotional and cognitive empathy, mindfulness, and adaptive anger expression, and negatively predicted by primary psychopathic traits, impulsiveness, and aggressive driving anger expression across genders.

In light of these results, aggressive expression of driving anger appears to be an important vulnerability factor for both female and male driving offenders as it increases risky driving behaviors and decreases positive behaviors, which is consistent with other research results (Mirón-Juárez et al., 2020; Stephens & Sullman, 2014; Villieux & Delhomme, 2010). On the contrary, mindfulness seems to be a protective factor as it decreases dangerous behaviors and increases prosocial behaviors. A growing body of research points out the positive influence of mindfulness on driving behaviors. Negative associations were found with violations (Murphy & Matvienko-Sikar, 2019), texting while driving (Moore & Brown, 2019), aggressive driving (Stephens et al., 2018), and overall engagement in distracting activities (Young et al., 2019). Mindfulness has also been found to help reduce stress manifestations in daily activities (Hicks et al., 2020; Pascoe et al., 2017); hence it is possible that it also enables drivers to manage the many stressful and frustrating situations they encounter while driving.

Empathy also appears to be a positive resource for both female and male driving offenders. Although it does not predict risky behaviors, it is associated with an increase in prosocial driving behaviors across genders. These results are consistent with those found in the general population of drivers by Karras et al. (2020). Being sensitive to other people's well-being and being able to cognitively project themselves in other people's experiences might enable drivers to adopt positive behaviors that facilitate interactions with other road users and increase their safety. On the other hand, lack of empathy and consideration for others are often considered core characteristics of primary psychopathic traits (Jonason & Kroll, 2015; Salekin et al., 2014) which might explain

**Fig. 1.** Gender moderating effect between impulsiveness and engagement in distracting activities while driving.

why these traits were found to decrease prosocial driving behaviors. In the present study, they were also associated with an increase in violations which is consistent with other studies' results (Monteiro et al., 2018; Panayiotou, 2015).

Impulsiveness and sensation seeking are two other well-known vulnerability factors in the literature on driving behaviors. They have been found to increase violations (Bıçaksız and Özkan, 2016a,b; de Winter et al., 2018), speeding (Sârbescu & Rusu, 2021), aggressive driving (Berdoulat et al., 2018), distracted driving (Chen et al., 2016), and drunk-driving (Navas et al., 2019). However, the results of the present study are not as clear-cut as might have been expected. Although driving-related sensation seeking was associated with more violations across genders, impulsiveness only predicted more engagement in distracting activities among females, and fewer prosocial behaviors among both females and males. Thus, impulsiveness might not affect driving behaviors in the same way among female and male driving offenders. While this could be explained in part by the fact that females and males scored differently on the various components of impulsiveness, further research is needed to better understand the influence of this multidimensional disposition on driving behaviors across genders.

Finally, the present study yielded surprising results as adaptive driving anger expression and emotional empathy predicted an increase in the tendency to engage in distracting activities. On the one hand, driving can be frustrating and interactions with other road users can elicit fear, anxiety or anger, especially when others' behavior is perceived as a potential threat to one's own safety (Bowen et al., 2020). Adaptive anger expression is the individual's ability to positively manage these difficult situations and maintain a safe behavior (Defenbacher et al., 2002). Engaging in distracting activities while driving could be a way, for some drivers, to manage their anger or mentally extract themselves from frustrating situations. On the other hand, it can be difficult to explain how being sensitive to other people's well-being might increase the tendency to engage in distracting activities while driving. However, negative associations have been found between emotional empathy and attentional control in a previous study (Goodhew & Edwards, 2021), and individuals prone to cognitive failures (e.g. daydreaming when they should be focusing on a specific task) have been found to have higher levels of emotional empathy than individuals less prone to such failures (Goodhew & Edwards, 2022). The present study is the first to suggest that adaptive anger expression and emotional empathy could, in some cases, have detrimental effects on driving and more research is needed to confirm and further explore these surprising results.

4.1. Limitations and future research

One limitation of this study is its cross-sectional design that does not allow to understand the causal relationships between variables. Concerns could also be raised regarding the use of self-report scales. However, anonymity and confidentiality were emphasized during the data collection phase and previous studies have shown that scales assessing driving behaviors are not sensitive to social desirable responding (Lajunen & Summala, 2003; Sullman & Taylor, 2010). The psychological resources and vulnerabilities measured in this study were selected after a review of the literature, as previous research showed that they can influence driving behaviors. Further studies could include other variables such as risk perception (Choudhary et al., 2022), time management (Cœugnet et al., 2013), substance abuse disorders (Webster et al., 2019, 2020), mental health disorders (Liang & Yang, 2022), criminal history (Robertson et al., 2019), etc., to provide a better understanding of driving behaviors. Finally, a growing body of literature points out that differences in driving behavior may have less to do with biological sex than with gender role (Albentosa et al., 2018; Deniz et al., 2021; Granié et al., 2021; Krahé, 2018; Öztürk et al., 2021) as masculinity and femininity seem to rely differently on violations, prosocial behaviors and driving anger expression. Thus, future research on driving

offenders could also include measures of gender self-concept and perceived norms associated with gender to better grasp influencing personal factors.

Another limit of this study is the small number of female driving offenders compared to males. This is an inherent limitation of the driving offenders population, as males generally tend to violate traffic regulation rules more often than females, but one that should be considered in future research. The lack of a control group is also noteworthy. To gain a better understanding of the specificity of female offenders, future studies could include a sample of female drivers who never participated in a rehabilitation program or never got demerit points.

5. Conclusion

The present work was the first exploratory study to examine the driving behaviors, personal resources, and vulnerabilities of female and male French driving offenders participating in a driver's rehabilitation program. Despite the absolute gender differences in risk taking and dangerous driving behaviors, there are indications that females are offending more often than before, and that personal dispositions play a role in the way they behave on the road. Female driving offenders appear to be better educated than males, are more likely to be divorced or separated, and tend to drive less. They appear to be more empathetic than males but less self-compassionate and mindful in their daily activities. They also tend to be more impulsive, especially when experiencing strong emotions.

Furthermore, this study highlighted the predictive power of some personal dispositions in the driving behaviors of both genders. Aggressive driving anger expression appeared to be predictive of more dangerous behaviors and fewer prosocial driving behaviors while mindfulness reduced violations and engagement in distracting activities while driving, and empathy (both cognitive and emotional) increased prosocial driving behaviors. These findings provide interesting new paths to be explored regarding the evolution of drivers' rehabilitation programs. New intervention methods introducing anger management techniques and mindfulness exercises could be tested during these programs. Moreover, instructors in charge of leading these sessions (psychologists and specialized driving instructors) could be trained to assess and recognize these important personal resources and vulnerabilities within a group of driving offenders and be able to adapt their interventions accordingly.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

References

- Abele, L., Hausteine, S., Möller, M., Zettler, I., 2020. Links between observed and self-reported driving anger, observed and self-reported aggressive driving, and personality traits. *Accident Analysis & Prevention* 140, 105516. <https://doi.org/10.1016/j.aap.2020.105516>.
- Albentosa, J., Stephens, A.N., Sullman, M.J.M., 2018. Driver anger in France: The relationships between sex, gender roles, trait and state driving anger and appraisals made while driving. *Transportation Research Part f: Traffic Psychology and Behaviour* 52, 127–137. <https://doi.org/10.1016/j.trf.2017.11.019>.
- Anderson, N.E., Widdows, M., Maurer, J.M., Kiehl, K.A., 2021. Clarifying fearlessness in psychopathy: An examination of thrill-seeking and physical risk-taking. *Journal of Psychopathology & Behavioral Assessment* 43 (1), 21–32. <https://doi.org/10.1007/s10862-020-09847-y>.
- Armstrong, T.A., Boisvert, D., Wells, J., Lewis, R.H., Cooke, E., Woeckner, M., 2020. Assessing potential overlap between self-control and psychopathy: A consideration

- of the Grasmick self-control scale and the Levenson self-report psychopathy scale. *Journal of Criminal Justice* 70, 101725. <https://doi.org/10.1016/j.jcrimjus.2020.101725>.
- Armstrong, K.A., Freeman, J.E., Davey, J.D., Kelly, R.L., 2019. Drink driving engagement in women: An exploration of context, hazardous alcohol use, and behaviour. *PLoS ONE* 14 (9), 1–18. <https://doi.org/10.1371/journal.pone.0222195>.
- Assailly, J.-P., Authried, N., Dabrowska-Loranc, M., Farrugia, B., Goldenbeld, C., Kallberg, V.-P., Klipp, S., Möller, M., Munnely, M., Vlakveld, W., 2012. Identification of the essential features for an effective Demerit Point System (MOVE/SUB/2010/D3/300-1/S12.569987-BestPoint). SWOV Institute for Road Safety Research.
- Bachoo, S., Bhagwanjee, A., Govender, K., 2013. The influence of anger, impulsivity, sensation seeking and driver attitudes on risky driving behaviour among post-graduate university students in Durban, South Africa. *Accident Analysis & Prevention* 55, 67–76. <https://doi.org/10.1016/j.aap.2013.02.021>.
- Bandura, A. (1997). Self-efficacy: The exercise of control (p. ix, 604). W H Freeman/Times Books/Henry Holt & Co.
- Berdoulat, E., Rochaix, D., Poulet, C., Harrati, S., Vavassori, D., 2018. Étude des liens entre conduite automobile agressive et transgressive et impulsivité : Compréhension empirique et clinique à l'aide du modèle UPPS de l'impulsivité. *Pratiques Psychologiques* 24 (2), 227–238. <https://doi.org/10.1016/j.prps.2017.05.002>.
- Bıçaksız, P., Özkan, T., 2016a. Developing the Impulsive Driver Behavior Scale. *Transportation Research Part F: Traffic Psychology and Behaviour* 43, 339–356. <https://doi.org/10.1016/j.trf.2016.09.005>.
- Bıçaksız, P., Özkan, T., 2016b. Impulsivity and driver behaviors, offences and accident involvement: A systematic review. *Transportation Research Part F: Traffic Psychology and Behaviour* 38, 194–223. <https://doi.org/10.1016/j.trf.2015.06.001>.
- Billieux, J., Rochat, L., Ceschi, G., Carré, A., Offerlin-Meyer, I., Defeldre, A.-C., Khazaal, Y., Besche-Richard, C., Van der Linden, M., 2012. Validation of a short French version of the UPPS-P Impulsive Behavior Scale. *Comprehensive Psychiatry* 53 (5), 609–615. <https://doi.org/10.1016/j.comppsy.2011.09.001>.
- Boccaro, V., Delhomme, P., Vidal-Gomel, C., Rogalski, J., 2011. Time course of driving-skill self-assessments during French driver training. *Accident Analysis & Prevention* 43 (1), 241–246. <https://doi.org/10.1016/j.aap.2010.08.016>.
- Bowen, L., Budden, S.L., Smith, A.P., 2020. Factors underpinning unsafe driving: A systematic literature review of car drivers. *Transportation Research Part F: Traffic Psychology and Behaviour* 72, 184–210. <https://doi.org/10.1016/j.trf.2020.04.008>.
- Brown, K.W., Ryan, R.M., 2003. The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology* 84 (4), 822–848. <https://doi.org/10.1037/0022-3514.84.4.822>.
- Burtäverde, V., Chraïf, M., Aniței, M., Mihăilă, T., 2016. The incremental validity of the dark triad in predicting driving aggression. *Accident Analysis & Prevention* 96, 1–11. <https://doi.org/10.1016/j.aap.2016.07.027>.
- Chen, H.-Y.-W., Donmez, B., Hoekstra-Atwood, L., Marulanda, S., 2016. Self-reported engagement in driver distraction: An application of the Theory of Planned Behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour* 38, 151–163. <https://doi.org/10.1016/j.trf.2016.02.003>.
- Choudhary, P., Gupta, A., Velaga, N.R., 2022. Perceived risk vs actual driving performance during distracted driving: A comparative analysis of phone use and other secondary distractions. *Transportation Research Part F: Traffic Psychology and Behaviour* 86, 296–315. <https://doi.org/10.1016/j.trf.2022.03.001>.
- Cœugnet, S., Naveteur, J., Antoine, P., Anceaux, F., 2013. Time pressure and driving : Work, emotions and risks. *Transportation Research Part F: Traffic Psychology and Behaviour* 20, 39–51. <https://doi.org/10.1016/j.trf.2013.05.002>.
- Csillik, A., Mahr, S., Meyer, T., 2010. The Mindful Attention Awareness Scale (MAAS) French validation: Convergent and divergent validity [Affiche]. *Quatrième Congrès International de la Théorie de l'Autodétermination, Gand, Belgique*.
- Cullen, P., Möller, H., Woodward, M., Senserrick, T., Boufous, S., Rogers, K., Brown, J., Ivers, R., 2021. Are there sex differences in crash and crash-related injury between men and women? A 13-year cohort study of young drivers in Australia. *SSM - Population Health* 14, 100816. <https://doi.org/10.1016/j.ssmph.2021.100816>.
- Cyders, M.A., Smith, G.T., 2008. Emotion-based dispositions to rash action : Positive and negative urgency. *Psychological Bulletin* 134 (6), 807–828. <https://doi.org/10.1037/a0013341>.
- Davey, B., Parkes, A., Freeman, J., Mills, L., Davey, J., 2022. Versatile, but not focused, traffic offenders are more likely to be at fault for a fatal crash. *Journal of Safety Research* 81, 143–152. <https://doi.org/10.1016/j.jsr.2022.02.006>.
- de Winter, J.C.F., Dodou, D., Stanton, N.A., 2015. A quarter of a century of the DBQ: Some supplementary notes on its validity with regards to accidents. *Ergonomics* 58 (10), 1745–1769. <https://doi.org/10.1080/00140139.2015.1030460>.
- de Winter, J. C. F., Dreger, F. A., Huang, W., Miller, A., Soccolich, S., Ghanipour Machiani, S., & Engström, J. (2018). The relationship between the Driver Behavior Questionnaire, Sensation Seeking Scale, and recorded crashes: A brief comment on Martinussen et al. (2017) and new data from SHRP2. *Accident Analysis and Prevention*, 118, 54–56. <https://doi.org/10.1016/j.aap.2018.05.016>.
- Decety, J., 2017. EMPATHIE. *Encyclopædia Universalis*. <http://www.universalis-edu.com/faraway.parisnantes.fr/encyclopedie/empathie/>.
- Deffenbacher, J.L., Lynch, R.S., Otting, E.R., Swaim, R.C., 2002. The Driving Anger Expression Inventory: A measure of how people express their anger on the road. *Behaviour Research and Therapy* 40 (6), 717–737. [https://doi.org/10.1016/S0005-7967\(01\)00063-8](https://doi.org/10.1016/S0005-7967(01)00063-8).
- Delhomme, P., Grenier, K., Kreel, V., 2008. Replication and extension: The effect of the commitment to comply with speed limits in rehabilitation training courses for traffic regulation offenders in France. *Transportation Research Part F: Traffic Psychology and Behaviour* 11, 192–206. <https://doi.org/10.1016/j.trf.2007.10.002>.
- Delhomme, P., Verhiac, J.-F., Martha, C., 2009. Are drivers' comparative risk judgments about speeding realistic? *Journal of Safety Research* 40 (5), 333–339. <https://doi.org/10.1016/j.jsr.2009.09.003>.
- Delhomme, P., Chaurand, N., Paron, F., 2012. Personality predictors of speeding in young drivers : Anger vs. sensation seeking. *Transportation Research Part F: Traffic Psychology and Behaviour* 15 (6), 654–666. <https://doi.org/10.1016/j.trf.2012.06.006>.
- Delhomme, P., Palat, B., Saint Pierre, G., 2017. *MassE de Données de Conduite pour modélisation d'un feed-back incitant à la conduite plus éco-compatible selon les déplacements des automobilistes*. *Projet MEDOC Financé Par Fondation MAIF [rapport Final De Recherche Ifstar]*. Fondation MAIF.
- Deniz, P., Lajunen, T., Özkan, T., Gaygısız, E., 2021. Masculinity, femininity, and angry drivers: Masculinity and femininity as moderators between driver anger and anger expression style among young drivers. *Accident Analysis & Prevention* 161, 106347. <https://doi.org/10.1016/j.aap.2021.106347>.
- Eman, S., Nicolson, R.I., Blades, M., Jha, R.P., 2020. The role of gender, empathy, sensation seeking, and callousness in physically aggressive and non-aggressive antisocial behaviours among students. *International E-Journal of Criminal Sciences* 15, 7. <https://dialnet.unirioja.es/servlet/articulo?codigo=7711963>.
- Factor, R., 2018. An empirical analysis of the characteristics of drivers who are ticketed for traffic offences. *Transportation Research Part F: Traffic Psychology and Behaviour* 53, 1–13. <https://doi.org/10.1016/j.trf.2017.12.001>.
- Feng, J., Marulanda, S., Donmez, B., 2014. Susceptibility to driver distraction questionnaire: Development and relation to relevant self-reported measures. *Transportation Research Record: Journal of the Transportation Research Board* 2434, 26–34. <https://doi.org/10.3141/2434-04>.
- Găianu, P.-A., Giosan, C., Sărbescu, P., 2020. From trait anger to aggressive violations in road traffic. *Transportation Research Part F: Traffic Psychology and Behaviour* 70, 15–24. <https://doi.org/10.1016/j.trf.2020.02.006>.
- Goodhew, S.C., Edwards, M., 2021. Attentional control both helps and harms empathy. *Cognition* 206, 104505. <https://doi.org/10.1016/j.cognition.2020.104505>.
- Goodhew, S.C., Edwards, M., 2022. The relationship between cognitive failures and empathy. *Personality and Individual Differences* 186 (8), 111384. <https://doi.org/10.1016/j.paid.2021.111384>.
- Granié, M.-A., Thévenet, C., Varet, F., Evennou, M., Oulid-Azouz, N., Lyon, C., Meesmann, U., Robertson, R., Torfs, K., Vanlaar, W., Woods-Fry, H., Van den Bergh, W., 2021. Effect of culture on gender differences in risky driver behavior through comparative analysis of 32 countries. *Transportation Research Record* 2675 (3), 274–287. <https://doi.org/10.1177/0361198120970525>.
- Gravetter, F.J., Wallnau, L.B., Forzano, L.A.-B., Witnauer, J.E., 2020. *Essentials of Statistics for the Behavioral Sciences*, (10th ed.). Cengage Learning.
- Guého, L., Granié, M.-A., Abric, J.-C., 2014. French validation of a new version of the Driver Behavior Questionnaire (DBQ) for drivers of all ages and level of experiences. *Accident Analysis and Prevention* 63 (2), 41–48. <https://doi.org/10.1016/j.aap.2013.10.024>.
- Harris, P.B., Houston, J.M., Vazquez, J.A., Smither, J.A., Harms, A., Dahlke, J.A., Sachau, D.A., 2014. The Prosocial and Aggressive Driving Inventory (PADi): A self-report measure of safe and unsafe driving behaviors. *Accident Analysis & Prevention* 72, 1–8. <https://doi.org/10.1016/j.aap.2014.05.023>.
- Hayes, A.F., 2017. *Introduction to Mediation, Moderation, and Conditional Process Analysis, Second Edition*. Guilford Publications, A Regression-Based Approach.
- Hicks, A., Siwik, C., Phillips, K., Zimmaro, L.A., Salmon, P., Burke, N., Albert, C., Fields, O., Dorsel, D., Sephton, S.E., 2020. Dispositional mindfulness is associated with lower basal sympathetic arousal and less psychological stress. *International Journal of Stress Management* 27 (1), 88–92. <https://doi.org/10.1037/str0000124>.
- Jonason, P.K., Krause, L., 2013. The emotional deficits associated with the Dark Triad traits: Cognitive empathy, affective empathy, and alexithymia. *Personality and Individual Differences* 55 (5), 532–537. <https://doi.org/10.1016/j.paid.2013.04.027>.
- Jonason, P.K., Kroll, C.H., 2015. A multidimensional view of the relationship between empathy and the dark triad. *Journal of Individual Differences* 36 (3), 150–156. <https://doi.org/10.1027/1614-0001/a000166>.
- Kamas, L., Preston, A., 2021. Empathy, gender, and prosocial behavior. *Journal of Behavioral and Experimental Economics* 92, 1–12. <https://doi.org/10.1016/j.soec.2020.101654>.
- Karras, M., Delhomme, P., Csillik, A., 2022. French drivers' behavior: Do psychological resources and vulnerabilities matter? *Journal of Safety Research* 80, 235–242. <https://doi.org/10.1016/j.jsr.2021.12.005>.
- Karras, M., Csillik, A., Delhomme, P., & Fenouillet, F. (2019). Empathy and Self-compassion in French Drivers's Behaviors [Oral Communication]. *Second Positive Psychology Conference*, Metz, France.
- Karras, M., Csillik, A., Delhomme, P., & Fenouillet, F. (2020). L'empathie est-elle une ressource protectrice sur la route ? *Sciences & Bonheur*, 5, 62–81. hal-03165173.
- Koppel, S., Stephens, A.N., Young, K.L., Hua, P., Chambers, R., Hased, C., 2018. What is the relationship between self-reported aberrant driving behaviors, mindfulness, and self-reported crashes and infringements? *Traffic Injury Prevention* 19 (5), 480–487. <https://doi.org/10.1080/15389588.2018.1440083>.
- Krahé, B., 2018. Gendered self-concept and the aggressive expression of driving anger: Positive femininity buffers negative masculinity. *Sex Roles* 79 (1–2), 98–108. <https://doi.org/10.1007/s1199-017-0853-9>.
- Kumar Yadav, A., Velaga, N.R., 2021. A comprehensive systematic review of the laboratory-based research investigating the influence of alcohol on driving behaviour. *Transportation Research Part F: Traffic Psychology and Behaviour* 81, 557–585. <https://doi.org/10.1016/j.trf.2021.07.010>.
- Lajunen, T., Summala, H., 2003. Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses.

- Transportation Research Part f: Traffic Psychology and Behaviour 6 (2), 97–107. [https://doi.org/10.1016/S1369-8478\(03\)00008-1](https://doi.org/10.1016/S1369-8478(03)00008-1).
- Lawton, R., Parker, D., Manstead, A.S.R., Stradling, S.G., 1997. The role of affect in predicting social behaviors: The case of road traffic violations. *Journal of Applied Social Psychology* 27 (14), 1258–1276. <https://doi.org/10.1111/j.1559-1816.1997.tb01805.x>.
- Levenson, M.R., Kiehl, K.A., Fitzpatrick, C.M., 1995. Assessing psychopathic attributes in a noninstitutionalized population. *Journal of Personality and Social Psychology* 68 (1), 151.
- Liang, O.S., Yang, C.C., 2022. Mental health conditions and unsafe driving behaviors: A naturalistic driving study on ADHD and depression. *Journal of Safety Research* 82, 233–240. <https://doi.org/10.1016/j.jsr.2022.05.014>.
- Lipovac, K., Đerić, M., Tešić, M., Andrić, Z., Marić, B., 2017. Mobile phone use while driving-literary review. *Transportation Research Part f: Traffic Psychology and Behaviour* 47, 132–142. <https://doi.org/10.1016/j.trf.2017.04.015>.
- López, A., Sanderman, R., Ranchor, A.V., Schroevers, M.J., 2018. Compassion for others and self-compassion: Levels, correlates, and relationship with psychological well-being. *Mindfulness* 9 (1), 325–331. <https://doi.org/10.1007/s12671-017-0777-z>.
- Love, S., Kannis-Dymand, L., Davey, J., Freeman, J., 2022. Metacognition, rumination and road rage: An examination of driver anger progression and expression in Australia. *Transportation Research Part f: Traffic Psychology and Behaviour* 84, 21–32. <https://doi.org/10.1016/j.trf.2021.11.015>.
- Martha, C., Delhomme, P., 2014. Are absolute and comparative judgements about road traffic-risks inherent in speeding realistic? A study among French traffic regulation offenders. *Transportation Research Part f: Traffic Psychology and Behaviour* 26, 126–137. <https://doi.org/10.1016/j.trf.2014.06.013>.
- McMurrin, M., Riemsma, R., Manning, N., Misso, K., Kleijnen, J., 2011. Interventions for alcohol-related offending by women: A systematic review. *Clinical Psychology Review* 31 (6), 909–922. <https://doi.org/10.1016/j.cpr.2011.04.005>.
- Mills, L., Freeman, J., Truelove, V., Davey, J., Delhomme, P., 2021. Comparative judgements of crash risk and driving ability for speeding behaviours. *Journal of Safety Research* 79, 68–75. <https://doi.org/10.1016/j.jsr.2021.08.006>.
- Mirón-Juárez, C.A., García-Hernández, C., Ochoa-Ávila, E., Díaz-Grijalva, G.R., 2020. Approaching to a structural model of impulsivity and driving anger as predictors of risk behaviors in young drivers. *Transportation Research Part f: Traffic Psychology and Behaviour* 72, 71–80. <https://doi.org/10.1016/j.trf.2020.05.006>.
- Monteiro, R. P., Coelho, G. L. de H., Hanel, P. H. P., Pimentel, C. E., & Gouveia, V. V. (2018). Personality, dangerous driving, and involvement in accidents: Testing a contextual mediated model. *Transportation Research Part F: Traffic Psychology and Behaviour*, 58, 106–114. <https://doi.org/10.1016/j.trf.2018.06.009>.
- Moore, M.M., Brown, P.M., 2019. The association of self-regulation, habit, and mindfulness with texting while driving. *Accident Analysis & Prevention* 123, 20–28. <https://doi.org/10.1016/j.aap.2018.10.013>.
- Murphy, G., Matvienko-Sikar, K., 2019. Trait mindfulness & self-reported driving behaviour. *Personality and Individual Differences* 147, 250–255. <https://doi.org/10.1016/j.paid.2019.05.002>.
- Nallet, N., Bernard, M., Gadebeku, B., Supernant, K., Chiron, M., 2010. Who takes driving licence point recovery courses in France? Comparison between course-takers and ordinary drivers. *Transportation Research Part f: Traffic Psychology and Behaviour* 13 (2), 92–105. <https://doi.org/10.1016/j.trf.2009.11.005>.
- Navas, J.F., Martín-Pérez, C., Petrova, D., Verdejo-García, A., Cano, M., Sagripanti-Mazuquín, O., Perandres-Gómez, A., López-Martín, A., Cordovilla-Guardia, S., Megías, A., Perales, J.C., Vilar-López, R., 2019. Sex differences in the association between impulsivity and driving under the influence of alcohol in young adults: The specific role of sensation seeking. *Accident Analysis & Prevention* 124, 174–179. <https://doi.org/10.1016/j.aap.2018.12.024>.
- Neff, K.D., 2003. The development and validation of a scale to measure self-compassion. *Self and Identity* 2, 223–250. <https://doi.org/10.1080/15298860390209035>.
- Neff, K.D., Pommier, E., 2013. The relationship between self-compassion and other-focused concerns among college undergraduates, community adults, and practicing meditators. *Self and Identity* 12 (2), 160–176. <https://doi.org/10.1080/15298868.2011.649546>.
- Olandoski, G., Bianchi, A., Delhomme, P., 2019. Brazilian adaptation of the driving anger expression inventory: Testing its psychometrics properties and links between anger behavior, risky behavior, sensation seeking, and hostility in a sample of Brazilian undergraduate students. *Journal of Safety Research* 70, 233–241. <https://doi.org/10.1016/j.jsr.2019.07.008>.
- ONISR. (2020). Bilan 2019 des infractions et du permis à points. Observatoire National Interministériel de la Sécurité Routière. <https://www.onisr.securite-routiere.gouv.fr/etat-de-l-insecurite-routiere/bilans-annuels-infractions-et-permis-a-points/bilan-2019-des-infractions-et-du-permis-a-points>.
- ONISR. (2021). 2020 Road Safety Annual Report | French road safety observatory. <https://www.onisr.securite-routiere.gouv.fr/en/road-safety-performance/annual-road-safety-reports/2020-road-safety-annual-report>.
- Özkan, T., Lajunen, T., 2005. A new addition to DBQ: positive driver behaviours scale. *Transportation Research Part f: Traffic Psychology and Behaviour* 8 (4–5), 355–368. <https://doi.org/10.1016/j.trf.2005.04.018>.
- Öztürk, İ., Özkan, Ö., Öz, B., 2021. Investigating sex, masculinity and femininity in relation to impulsive driving and driving anger expression. *Transportation Research Part f: Traffic Psychology and Behaviour* 81, 14–26. <https://doi.org/10.1016/j.trf.2021.05.009>.
- Panayiotou, G., 2015. The bold and the fearless among us: Elevated psychopathic traits and levels of anxiety and fear are associated with specific aberrant driving behaviors. *Accident Analysis & Prevention* 79, 117–125. <https://doi.org/10.1016/j.aap.2015.03.007>.
- Parnell, K.J., Rand, J., Plant, K.L., 2020. A diary study of distracted driving behaviours. *Transportation Research Part f: Traffic Psychology and Behaviour* 74, 1–14. <https://doi.org/10.1016/j.trf.2020.08.003>.
- Pascoe, M.C., Thompson, D.R., Jenkins, Z.M., Ski, C.F., 2017. Mindfulness mediates the physiological markers of stress: Systematic review and meta-analysis. *Journal of Psychiatric Research* 95, 156–178. <https://doi.org/10.1016/j.jpsychires.2017.08.004>.
- Perez, M.A., Sears, E., Valente, J.T., Huang, W., Sudweeks, J., 2021. Factors modifying the likelihood of speeding behaviors based on naturalistic driving data. *Accident Analysis & Prevention* 159, 106267. <https://doi.org/10.1016/j.aap.2021.106267>.
- Prat, F., Gras, M.E., Planes, M., Font-Mayolas, S., Sullman, M.J.M., 2017. Driving distractions: An insight gained from roadside interviews on their prevalence and factors associated with driver distraction. *Transportation Research Part f: Traffic Psychology and Behaviour* 45, 194–207. <https://doi.org/10.1016/j.trf.2016.12.001>.
- Raes, F., Pommier, E., Neff, K.D., Van Gucht, D., 2011. Construction and validation of a short form of the Self-Compassion Scale. *Clinical Psychology and Psychotherapy* 18, 250–255. <https://doi.org/10.1002/cpp.702>.
- Robertson, A. A., Zhou, Q. M., Tatch, A., & Walsh, M. (2019). Gender-Specific Predictors of Recidivism Among DUI Offenders. *Journal of Studies on Alcohol and Drugs*, 80(6), 641–650. <https://doi.org/10.15288/jsad.2019.80.641>.
- Salekin, R.T., Chen, D.R., Sellbom, M., Lester, W.S., MacDougall, E., 2014. Examining the factor structure and convergent and discriminant validity of the Levenson Self-Report Psychopathy Scale: Is the two-factor model the best fitting model? *Personality Disorders: Theory, Research, and Treatment* 5 (3), 289–304. <https://doi.org/10.1037/per0000073>.
- Sârbescu, P., Rusu, A., 2021. Personality predictors of speeding: Anger-Aggression and Impulsive-Sensation Seeking. A systematic review and meta-analysis. *Journal of Safety Research* 77, 86–98. <https://doi.org/10.1016/j.jsr.2021.02.004>.
- Sellbom, M., Drislane, L.E., 2020. The classification of psychopathy. *Aggression and Violent Behavior* 59 (2), 101473. <https://doi.org/10.1016/j.avb.2020.101473>.
- Shen, B., Ge, Y., Qu, W., Sun, X., Zhang, K., 2018a. The different effects of personality on prosocial and aggressive driving behaviour in a Chinese sample. *Transportation Research Part f: Traffic Psychology and Behaviour* 56, 268–279. <https://doi.org/10.1016/j.trf.2018.04.019>.
- Shen, B., Qu, W., Ge, Y., Sun, X., Zhang, K., 2018b. The relationship between personalities and self-report positive driving behavior in a Chinese sample. *PLoS ONE* 13 (1), e0190746.
- Song, X., Yin, Y., Cao, H., Zhao, S., Li, M., Yi, B., 2021. The mediating effect of driver characteristics on risky driving behaviors moderated by gender, and the classification model of driver's driving risk. *Accident Analysis & Prevention* 153, 106038. <https://doi.org/10.1016/j.aap.2021.106038>.
- Stephens, A.N., Koppel, S., Young, K.L., Chambers, R., Hasted, C., 2018. Associations between self-reported mindfulness, driving anger and aggressive driving. *Transportation Research Part f: Traffic Psychology and Behaviour* 56, 149–155. <https://doi.org/10.1016/j.trf.2018.04.011>.
- Stephens, A.N., Sullman, M.J., 2014. Development of a short form of the driving anger expression inventory. *Accident Analysis & Prevention* 72, 169–176.
- Sullman, M.J.M., Taylor, J.E., 2010. Social desirability and self-reported driving behaviours: Should we be worried? *Transportation Research Part f: Traffic Psychology and Behaviour* 13 (3), 215–221. <https://doi.org/10.1016/j.trf.2010.04.004>.
- Taubman, O., Mikulincer, M., & Iram, A. (1996). The cognitive, motivational and emotional system of driving. Department of Casualties and Road Safety of the Israeli Army.
- Victoir, A., Eertmans, A., Van den Bergh, O., Van den Broucke, S., 2005. Learning to drive safely: Social-cognitive responses are predictive of performance rated by novice drivers and their instructors. *Transportation Research Part f: Traffic Psychology and Behaviour* 8 (1), 59–74. <https://doi.org/10.1016/j.trf.2005.01.002>.
- Villieux, A., Delhomme, P., 2008. Colère éprouvée au volant et différentes manières de l'exprimer : Quels liens avec des transgressions de conduite déclarées ? *Le Travail Humain* 71 (4), 359–384. <https://doi.org/10.3917/bupsy.494.0115>.
- Villieux, A., Delhomme, P., 2010. Driving anger and its expressions: Further evidence of validity and reliability for the Driving Anger Expression Inventory French Adaptation. *Journal of Safety Research* 41, 417–422. <https://doi.org/10.1016/j.jsr.2010.08.003>.
- Weber, L., Inesse, L., Marjorie, M., & Arnaud, M. (2014). Etude sur les réitérants de stages : Description des conducteurs qui reviennent en stages « permis à points ». (No 2200657614). INSERR-Institut National de Sécurité Routière et de Recherches. <https://www.inserr.fr/documents/etude-sur-les-reiterants-de-stages-description-des-conducteurs-qui-reviennent-en-stages>.
- Webster, J.M., Staton, M., Dickson, M.F., 2019. Brief report: Sex differences in substance use, mental health, and impaired driving among rural DUI offenders. *The American Journal on Addictions* 28 (5), 405–408. <https://doi.org/10.1111/ajad.12920>.
- Webster, J.M., Tillson, M., Dickson, M.F., Staton, M., 2020. Impaired driving among rural female drug-involved offenders. *Traffic Injury Prevention* 21 (8), 513–520. <https://doi.org/10.1080/15389588.2020.1810244>.
- White, B.A., 2014. Who cares when nobody is watching? Psychopathic traits and empathy in prosocial behaviors. *Personality and Individual Differences* 56, 116–121. <https://doi.org/10.1016/j.paid.2013.08.033>.

- Whiteside, S.P., Lynam, D.R., 2001. The Five Factor Model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences* 30 (4), 669–689. [https://doi.org/10.1016/S0191-8869\(00\)00064-7](https://doi.org/10.1016/S0191-8869(00)00064-7).
- World Health Organization. (2020, février). Road traffic injuries. <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>.
- Young, K.L., Koppel, S., Stephens, A.N., Osborne, R., Chambers, R., Hasted, C., 2019. Mindfulness predicts driver engagement in distracting activities. *Mindfulness* 10 (5), 913–922. <https://doi.org/10.1007/s12671-018-1060-7>.